INSTITUTE *for* ADVANCED STUDY

REPORT

FOR THE ACADEMIC YEAR

2004 – 2005

PRINCETON · NEW JERSEY

INSTITUTE
for ADVANCED STUDY

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Extract from the letter addressed by the Institute's Founders, Louis Bamberger and Caroline Bamberger Fuld, to the Board of Trustees, dated June 4, 1930.

Newark, New Jersey.

> *It is fundamental in our purpose, and our express desire, that in the appointments to the staff and faculty, as well as in the admission of workers and students, no account shall be taken, directly or indirectly, of race, religion, or sex. We feel strongly that the spirit characteristic of America at its noblest, above all the pursuit of higher learning, cannot admit of any conditions as to personnel other than those designed to promote the objects for which this institution is established, and particularly with no regard whatever to accidents of race, creed, or sex.*

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INSTITUTE FOR ADVANCED STUDY
BACKGROUND AND PURPOSE

The Institute for Advanced Study was founded in 1930 with a major gift from New Jersey businessman and philanthropist Louis Bamberger and his sister, Caroline Bamberger Fuld, who wished to use their fortunes to make a significant and lasting contribution to society. They sought the advice of educator Abraham Flexner, who developed the concept of the Institute as a community of scholars whose primary purpose would be the pursuit of advanced learning and scholarly exploration. The Institute for Advanced Study has remained committed to its founding principle for seventy-five years and its record of definitive scholarship and scientific achievement is unsurpassed.

The Institute fills a unique role in postgraduate education and scientific and scholarly research. As "the university to universities," in the words of Trustee Vartan Gregorian, the Institute serves all colleges and universities by providing a place where scholars can hone their skills and do their best work, thereby adding substantially to their ability to contribute as both teachers and scholars to the academic institutions where they base their careers. For young scholars just entering the academic world, an opportunity to work at the Institute can set the direction for lifelong research interests and thereby determine professional careers. The Institute provides more mature scholars with the opportunity to take new directions in their research or to complete a major piece of work away from the many obligations of working life at a university. At a time when pure research and scholarly activities are undervalued, the opportunities that the Institute provides have never been more needed.

The Institute's foremost objective is the advancement of knowledge and the deepening of understanding across a broad range of the humanities, sciences, and social sciences. One of the Institute's unique strengths is its permanent Faculty of 26 eminent scholars whose broad interests and extensive ties to the larger academic world are reflected in their own work and also in the guidance and direction they provide to the Institute's visiting Members. The Faculty defines the major themes and questions that become the focus of each School's seminars and other activities, and the Faculty selects and works closely with visiting Members. Small in number and organized in four Schools (Historical Studies, Mathematics, Natural Sciences, and Social Science), the Faculty and Members can interact with one another without any departmental and disciplinary barriers.

Each year the Institute awards fellowships to some 190 visiting Members from about one hundred universities and research institutions throughout the world. The Institute's more than 5,000 former Members hold positions of intellectual and scientific leadership in the United States and abroad. Some twenty-one Nobel laureates, and thirty-two out of forty-four Fields Medalists have been Institute Faculty or Members. Many winners of the Wolf or MacArthur prizes have also been affiliated with the Institute.

The Institute does not receive income from tuition or fees. Resources for operations come from endowment income, grants from private foundations and government agencies, and gifts from corporations and individuals.

CLIFF MOORE

"It seemed to me that the time was ripe for the creation in America of an institute in the field of general scholarship and science ... not a graduate school, training men in the known and to some extent in methods of research, but an institute where everyone — faculty and members — took for granted what was known and published, and in their individual ways endeavored to advance the frontiers of knowledge."

— Abraham Flexner, Founding Director (1930–39) of the Institute, Memorandum to the Board of Trustees of the Institute for Advanced Study, September 26, 1931

Looking toward Simonyi Hall with new sculpture by Elyn Zimmerman installed by the Institute Pond, a gift of Robert B. Menschel

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JAMES STEPHENS
Computer Manager, School of Natural Sciences

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Manager, Databases and Integration

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(in order of service)

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(current Faculty and Faculty Emeriti are in bold)

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DINAH KAZAKOFF

"The active community that existed at the Institute during the year was an extraordinary resource. Thanks in large part to the regular teas and seminars, there was a good deal of interaction among the Members and I was happy to take advantage of the opportunity to discuss my ideas with and learn from the others."

— Member, School of Social Science

Afternoon tea in the Common Room, Fuld Hall

REPORT OF THE CHAIRMAN 2004-05

In 2005, the Institute for Advanced Study is celebrating the 75th anniversary of its founding. In 1930, Louis Bamberger and his sister, Caroline Bamberger Fuld, took the generous and bold step of creating an international institution for research and education at the postdoctoral level. This year, Director Peter Goddard and the Faculty planned a most informative series of celebratory weekends and other events to share highlights of the history of the Institute, lead lively discussions related to fields of scientific and scholarly exploration, and allow those of us who have not had the advantage of scholarly time at the Institute to hear accounts of this institution's impact on the lives of Members who are selected for this privilege.

On Founders Day, May 20, a sculpture, given by Trustee Robert B. Menschel and created by Elyn Zimmerman, was dedicated in recognition of the achievements in science and scholarship of the Institute for Advanced Study. Three curved granite slabs seem to float amid the tall trees on the southern bank of the Institute pond and each bears a quotation from a key figure in the Institute's history.

> Abraham Flexner, Founding Director, 1930-39: *Those who have moved the world have usually been those who have followed the will-o-the-wisp of their own intellectual and spiritual curiosity.*
>
> Albert Einstein, Professor, 1933-55: *All our science, measured against reality, is primitive and childlike – and yet it is the most precious thing we have.*
>
> George F. Kennan, Professor, 1956-2005: *True scholars often work in loneliness, compelled to find reward in the awareness that they have made valuable, even beautiful, contributions to the cumulative structure of human knowledge, whether anyone knows it at the time or not.*

The 75th anniversary events have drawn together new and long-time friends and especially former Members and Faculty. During the celebration of the School of Mathematics, Raoul Bott, Professor Emeritus at Harvard University and Member at the Institute for Advanced Study (1949-51, 1955-57, 1971-72), was among the returning Members who spoke of the impact of the Institute for Advanced Study on their lives and careers. "My life was fashioned by the Institute. There is no question that my whole career would have been completely different if I had not had the remarkable opportunity of participating in a place that is so single-mindedly determined to let your own imagination flourish."

The Institute was created to allow scholars the opportunity to advance the frontiers of knowledge in their individual ways. Scholars repeatedly acknowledge the importance of an extended period for intense focus on their intellectual pursuits, aided by their interactions with the permanent Faculty, with other Members, the help of an attentive and unfailingly supportive staff, and other aspects of this singularly fertile scholarly environment.

The Institute does indeed exist to encourage and support fundamental scholarship – the original, often speculative, thinking that produces advances in knowledge. Because some

of the most profound discoveries often involve a combination of ingredients from different fields, the Institute chooses Faculty members with broad interests and diverse specialties as well as recognized depth in a field of expertise. As Abraham Flexner also noted, "If the Institute… eschews the chase for the useful, the minds of its scholars will be liberated, they will be free to take advantage of surprises, and someday an unexpected discovery, apparently leading nowhere, will be found to be an indispensable link in a long and complex chain that may open new worlds in theory and practice."

Over the past decade, the Institute developed in ways that have greatly enhanced its vitality and its ability to fulfill its mission. For instance, most recently, the Center for Systems Biology has become a part of the School of Natural Sciences.

While visiting Members who come to the Institute, on average for a year at a time, and the Faculty constitute the core of the Institute, recent years have seen the growth of several important programs that provide for the mentoring of younger scholars and educators. These include the IAS/Park City Mathematics Institute to improve mathematics education at all levels and Prospects in Theoretical Physics for graduate students to address the latest advances and open questions in various areas of theoretical physics. The Program for Women in Mathematics has been held annually at the Institute since 1994 and recently became a joint initiative of the Institute for Advanced Study and Princeton University. The Millennium Science Initiative is an international program designed to build capacity in modern science and technology and their uses in developing countries.

The abiding and crucial core of the Institute is excellence. As noted in the Institute's Decadal Review, this concept is subtle and elusive, as complex as it is critical. "The quality of the Faculty provides the quality of the Institute, and their excellence sets the standard for the whole, in their own research, in their choice of colleagues, and in their selection of scholars with whom to work."

Excellence, however, requires funding, and the Director and Trustees have initiated a major effort to strengthen the financial foundation of the Institute. After the biology program reaches a critical mass, further substantial institutional growth is not anticipated; however, a substantially larger endowment is required to provide a stable funding source for the Institute's current scale and level of excellence. Our Board of Trustees is taking the lead in our endeavor to address this concern, and James Simons, Charles Simonyi, Nancy MacMillan, Shelby White and Martin Leibowitz stepped forward very quickly and generously in the initial stage of this effort. I am deeply grateful to each and every Trustee whose contributions demonstrate dedication and commitment to the work of the Institute.

We had the pleasure at the October 2004 meeting of the Board to welcome Roger W. Ferguson, Jr., Vice Chairman of the Board of Governors of the Federal Reserve System, as a Trustee of the Institute for Advanced Study. Before becoming a member of the Board of Governors in 1997, he was a Partner at McKinsey & Company, Inc., where he managed a variety of studies for financial institutions from 1984 to 1997. Earlier, Dr. Ferguson was an attorney with Davis Polk & Wardwell. He received his B.A., J.D. in law, and Ph.D. in economics all from Harvard University, where he currently serves on the Board of Overseers.

We accepted with regret the retirements of Trustees Robert B. Menschel and Marie-Josée Kravis. Since joining the Board in October 1992, Mr. Menschel has participated actively and contributed generously to the major efforts of the Institute. In addition, he provided the creative leadership and financial foundation for "Big Ideas," four one-hour programs about the Institute for Advanced Study on Thirteen/WNET. Mrs. Kravis actively served on the search committee that successfully brought to the Institute our Director, Peter Goddard, and has been involved in the outreach efforts of the Institute. To each we are deeply grateful.

I would also like to note that Immanuel Kohn accepted the request of the Board to establish an Audit Committee for the Institute. Mr. Kohn's dedication and commitment in this process is making an important contribution.

Knowledge is indeed the foundation of the Institute as it is of our society. On behalf of the Trustees, I want to thank each person who contributes to the work of the Institute as the Faculty and Members constantly seek to advance the frontiers of knowledge. Each and every member of the staff and each contributor adds in critical measure to the nurture and support of this unique center for theoretical research and intellectual inquiry. We are deeply grateful.

James D. Wolfensohn
Chairman

REPORT OF THE DIRECTOR 2004-05

As the academic year ends, we are in the midst of our celebrations of the seventy-fifth anniversary of the founding of the Institute. These have provided opportunities to reflect on the achievements of the Institute, its Faculty and Members over the years, and those who made them possible, to demonstrate the Institute's present breadth and vitality, and to consider its future.

The center of our celebrations was on Founders Day, May 20, when the Institute surveyed its early years and acknowledged its essential debt to its founders, Louis Bamberger and Caroline Bamberger Fuld, and its first Director, Abraham Flexner, who shaped and articulated the Bambergers' generous vision. In celebration of the work of the Institute, a new sculpture by Elyn Zimmerman, about which James Wolfensohn has written in his Report, was dedicated.

The day also marked the centenary of Albert Einstein's *annus mirabilis*. A series of talks gave explanations of his first famous papers, which set out the special theory of relativity, explained Brownian motion, and provided an explanation of the photoelectric effect based on quantum mechanical concepts, and considered Einstein's later skepticism about quantum theory. Other talks explored broader aspects of Einstein's life, opinions and connections.

Our anniversary festivities began on February 2, when talks on the early history of the Institute and the work of the four Schools marked not only the founding of the Institute in 1930 but also the twenty-fifth anniversary of the founding of the Friends of the Institute. The Friends, more than 400 in number, now a well-established part of the broader Institute community, are more active than ever in their support of the Institute, both through their attendance at Institute events and the special Friends talks and social occasions, which they arrange at the Institute, and through providing the stipends for four Members, one in each of the Schools, and very valuable matching funding necessary to secure grants from some other sources. As a well-informed group of advocates for the Institute and its mission, we have come to rely on their friendship.

Spread throughout 2005, four weekends, one for each of the Schools, have been planned. The first, organized by the School of Mathematics, took place on 11 and 12 March. Talks ranged from those aimed at a general audience to those requiring more mathematical background. As impressive as the list of distinguished speakers was the audience of former Members of the School, which contained many of the world's leading mathematicians. But perhaps the most moving session was on the Saturday morning when a panel of distinguished former Members spoke of the impact that the Institute had on their lives and work and, through them, on others.

Amongst those on the panel was Raoul Bott who described how, whilst a young electrical engineer, he had first come to the Institute in 1949 at the invitation of Hermann Weyl, so that he could write a book on network theory making his researches accessible to mathematicians. When he found himself torn between this project and a desire to learn about the fascinating work on topology going on around him, he was encouraged to follow his new interests, and not feel bound by the purpose for which he was invited. Thus liberated, his interests shifted and his life changed, and work of the first importance

emerged in due course. Fritz Hirzebruch, who came to the Institute from Germany in 1952, explained how one direct consequence of his time at the Institute, was that it inspired him to establish the Max Planck Institute for Mathematics in Bonn. Michael Atiyah, who has been both a Professor and, on a number of occasions, a Member, said that his periods at the Institute had been the most formative, creative part of his life, providing intellectual capital to live off in subsequent years. He described how the friendships and collaborations he had established with Bott, Hirzebruch and others in the 1950s had led to work elsewhere and to contacts between their students, so that, over the years, the influence of the Institute had continued and become more widely spread.

The second anniversary weekend, celebrating the work of the School of Historical Studies, on April 8 and 9, took the form of a symposium on *The Matter of History*. It began on Friday with a compelling multimedia presentation by John Elliott, Professor in the School from 1973 to 1990 and subsequently Regius Professor of Modern History in the University of Oxford. The presentation, which had been assembled by the Faculty of the School, illustrated the broad range of interests of the School and the wide variety of source materials on which research in these areas is now based.

On the following morning a collection of six interactive seminars took place on topics such as the *Vulnerability of History*, dealing with the misuse and corruption of historical sources, and *Hidden People*, discussing issues of gender and class in European history. As with the first weekend for the School of Mathematics, the participants in the School of Historical Studies weekend were gathered from the whole Institute community, including Faculty from other Schools, many former returning Members as well as present ones, Trustees, Friends of the Institute and other members of the local community. This enabled the Institute to renew contacts as well as communicating the nature of the Institute's work to a wider public.

On October 27, 2004 before our anniversary celebrations officially began in January 2005, the Institute marked the centenary year of the birth of J. Robert Oppenheimer, third Director of the Institute, serving from 1947 to 1966, with a program of talks and a showing of the 1980 documentary film, *The Day after Trinity,* on the development of the atomic bomb. Jeremy Bernstein, a physicist who may be the only Institute Member also to have been a staff writer for *The New Yorker,* and Emeritus Professors Freeman Dyson and Morton White spoke about their personal reminiscences of Oppenheimer.

A link with Oppenheimer passed from us when George Kennan, Professor in the School of Historical Studies since 1956, died on March 17, just over a year after he joined us and movingly addressed us impromptu at the beginning of the Institute's celebration of his 100th birthday. With Kennan's death, the Institute lost one of its most illustrious scholars, one who had had a major impact on the development of world history, and who had been part of the Institute for two-thirds of its history.

In January the Institute announced the appointment of Yve-Alain Bois, an historian of nineteenth and twentieth century European and American art, as Professor in the School of Historical Studies from July 1, 2005. Professor Bois joins us from the Department of History of Art and Architecture at Harvard University, where he has been Joseph Pulitzer Jr. Professor since 1991 and chair since 2002. His interests range from Matisse, Picasso and Mondrian to Ruscha, Serra and Barnett Newman. He is distinguished as curator of

exhibitions as well as influential texts and his appointment confirms the Institute's commitment to leadership in the history of art, a tradition dating back to Erwin Panofsky's appointment as Professor in 1935.

At the end of May, Jim Barbour, who had had responsibility for the buildings and grounds of the Institute, and the staff that look after them, retired after twenty-five years of distinguished service. Universally loved and respected for his integrity and determination, Jim inspired his staff to achieve high standards and take a pride in providing an environment dedicated to facilitating the work of the Faculty and Members.

Spurred on by the 75th anniversary, we have produced a booklet, describing the Institute's founding, development and current life and work, which has been distributed to the whole Institute community, including former Members. We plan to update this publication in the light of the information and comments we have received from former Members and others. The booklet reminds us not only of the Institute's illustrious history of achievement, the impact those who have worked here have had on the development of thought in the sciences and humanities through the twentieth century, it also reminds us of the consistency of the Institute's commitment to the mission given by its Founders, articulated and realized by Abraham Flexner.

The Institute's fundamental mission is to foster the disinterested pursuit of knowledge through research driven by the curiosity of the scientist or scholar, unconstrained by short-term considerations of immediate practical utility and uninfluenced by external pressures or agendas. At the front of this Report stands as always the statement of our Founders, proudly dated 1930, that is fundamental to this purpose that no account be taken of race, religion or sex in the selection of those who work here. This precept, essential for both the integrity of the Institute and for its pursuit of excellence, led in the earliest days of the institution to its international character, an aspect still strongly reflected in its present composition, both Members and Faculty. It is one of the features that make the Institute such a vibrant academic community.

Abraham Flexner envisioned an Institute that would be "small and plastic" and, although there has been some growth over the years, that remains our intention. As was testified to by participants in our anniversary celebrations thus far, the impact of the Institute has been felt powerfully and widely, not through great growth but rather through the work of its scholars and scientists, and the students and colleagues with whom they interact over subsequent years, and the other institutes for advanced study that have been inspired or influenced.

The constancy of the Institute's mission is a testimony not only to the clarity of the Bambergers' original vision and the fact that it is as relevant today as it was in 1930; it is also a testimony to their generosity in providing an initial endowment that provided the basis for the strong independence that the Institute has been able to maintain. In this anniversary year the Institute is reaffirming its commitment to its mission. Although subsequent benefactors have added generously to the resources provided by the Bambergers, to be able to sustain our commitment to our mission, we will need to strengthen the endowment and, with the strong support and active engagement of our Board of Trustees, we are making a major effort to raising funds for this purpose.

Meanwhile, notwithstanding all this celebration, the work of Institute continues. Mounting such events involves a great deal of extra work by the staff and Faculty of the Institute, but none of this has got in the way of real business which has gone on as usual. The Members who have come to the Institute from some fifty different countries are rightly more conscious of the opportunities that a term or two at the Institute provides than the occasional celebration. It is the research of those who work here, and its consequences over the succeeding decades, that demonstrates how farsighted was the vision of our Founders.

Peter Goddard
Director

OFFICE OF THE DIRECTOR
RECORD OF EVENTS

The following is a calendar of events sponsored by the Office of the Director

Academic Year 2004-05

September 21
Member Family Barbecue

September 30
Member/Faculty Reception

AMIAS Movie Mondays
The Lady Eve (1941)

October 5
Institute Lecture
"The Mars Exploration Rover Mission"
STEVEN SQUYRES, *Cornell University*

Playreading
After the Fall by Arthur Miller

October 2
Institute Trip
American Museum of Natural History

October 6
Friends Forum
"How Should Presidents be Elected?" ERIC MASKIN, *Albert O. Hirschman Professor, School of Social Science*

Friends Fireside Chat
"War, Secrecy and Deception and the Transformation of the Presidency from TR to George W"
STEPHEN GRAUBARD, *Professor of History Emeritus, Brown University*

October 13
Institute Film Series
Life on a String (1991)

October 15
Institute Concert Series
"Pianomorphosis"
Minimalist piano music of John Adams, John Cage, Alvin Curran, and Philip Glass; literary texts by authors including T.S. Eliot, Wallace Stevens, and Virginia Woolf; theatrical lighting and movement; BRUCE BRUBAKER, piano

Recent Pasts 20/21 Conversation
"Hearing and Seeing: Philip Glass speaks with Bruce Brubaker and Jon Magnussen"

October 16
Institute Concert Series
"Pianomorphosis"
Minimalist piano music of John Adams, John Cage, Alvin Curran, and Philip Glass; literary texts by authors including T.S. Eliot, Wallace Stevens, and Virginia Woolf; theatrical lighting and movement; BRUCE BRUBAKER, piano

Institute Concert Talk
BRUCE BRUBAKER with
JON MAGNUSSEN

October 26
Institute Film Series
Topaze (1951)

October 27
Oppenheimer Centennial Program
Remembrances by JEREMY BERNSTEIN, author of *Oppenheimer: Portrait of an Enigma*, FREEMAN DYSON, *Professor Emeritus, School of Natural Sciences*, and MORTON WHITE, *Professor Emeritus, School of Historical Studies;* film screening of *The Day after Trinity*

November 1
AMIAS Movie Mondays
Rear Window (1954)

November 3
Institute Lecture
"Cosmic Acceleration and Particle Physics"
EDWARD WITTEN, *Charles Simonyi Professor, School of Natural Sciences*

November 6
Institute Trip
Newark Museum and New Jersey Performing Arts Center

November 9
Playreading
After the Fall by Arthur Miller

November 10
Institute Film Series
Anna Christie (1930)

November 12
Friends Culture & Cuisine Series
"Ethnic Cuisine in America: The Italian Exception?"
KRISHNENDU RAY, *The Culinary Institute of America*

November 19
Friends Fireside Chat
"Collecting Photography: Value in an Overvalued Market"
JOHN L. STEFFENS, *Spring Mountain Capital*

November 23
Institute Film Series
The Silence (1998)

December 1
Friends Forum
"How Does the Sun Shine?"
JOHN BAHCALL, *Richard Black Professor, School of Natural Sciences*
"The Dark Side of the Universe"
NETA BAHCALL, *Princeton University*

December 2
Institute Concert Talk
A Princeton Connection, "The Contexts of Musical Technology"
PAUL LANSKY, composer

December 3
Institute Concert Series
A Princeton Connection, "Music for Voice"
Works by Milton Babbitt, Edward T. Cone, Mario Davidovsky, Tobias Picker, Mel Powell, David Rakowski, and Roger Sessions;
JUDITH BETTINA, soprano; JAMES GOLDSWORTHY, piano

Institute Concert Talk
A Princeton Connection, "Perspectives: Milton Babbitt and Andrew Imbrie, composers"

December 4
Institute Concert Series
A Princeton Connection, "Music for Piano"
Works by Mario Davidovsky, Emily Doolittle, John Harbison, Andrew Imbrie, Jon Magnussen, Frederic Rzewski, Su Lian Tan, and Barbara White;
BLAIR MCMILLEN, piano

Institute Concert Talk
Composers JON MAGNUSSEN, SU LIAN TAN and BARBARA WHITE with pianist BLAIR MCMILLEN

December 5
Seasonal Celebration for Friends and Family

December 6
AMIAS Movie Mondays
Oliver! (1968)

December 7
Playreading
Painting Churches by Tina Howe

December 9
Children's Holiday Celebration

December 10
Institute Film Series
Putney Swope (1969)

December 11
Institute Trip
Barnes Foundation

December 15
Institute Lecture
"The Paradox of National Liberation"
MICHAEL WALZER, UPS Foundation Professor, School of Social Science

January 10, 2005
AMIAS Movie Mondays
Funny Face (1957)

January 11
Playreading
Rashomon by Garson Kanin

January 19
Institute Film Series
All Quiet on the Western Front (1930)

January 21
Dinner for New Friends of the Institute

February 1
Institute Film Series
Hell's Angels (1930)

February 2
Special Program 75th Anniversary
"The History and Founding of the Institute for Advanced Study"
Peter Goddard, *Institute Director*
Remarks by Faculty: Robert MacPherson, *Professor, School of Mathematics;* Nicola Di Cosmo, *Luce Foundation Professor in East Asian Studies, School of Historical Studies;* John N. Bahcall, *Richard Black Professor, School of Natural Sciences;* Joan Wallach Scott, *Harold F. Linder Professor, School of Social Science*

February 6
Institute Trip
Metropolitan Museum of Art

February 7
AMIAS Movie Mondays
The Third Man (1949)

February 8
Playreading
The Weir by Conor McPherson

February 12
Mid-Winter Party

February 18
Institute Film Series
The Blue Angel (1930)

February 25
Institute Concert Series
CONTINUUM®: *"Music of the South Caucasus"*
Works by composers from Armenia: Alexander Aslamov, Suren Zakarian; Georgia: Sulkhan Nasidze, Ulkhan Nasidze, Giya Kancheli; and Azerbaijan: Oleg Felzer, Franghiz Ali-Zaheh, Faradzh Karayev; co-directed by CHERYL SELTZER and JOEL SACHS

Recent Pasts 20/21 Lecture
"The Musical World of the South Caucasus," JOEL SACHS, conductor

February 26
Institute Concert Series
CONTINUUM®: *"Music of the South Caucasus"*
Works by composers from Armenia: Alexander Aslamov, Suren Zakarian; Georgia: Sulkhan Nasidze, Ulkhan Nasidze, Giya Kancheli; and Azerbaijan: Oleg Felzer, Franghiz Ali-Zaheh, Faradzh Karayev; co-directed by CHERYL SELTZER and JOEL SACHS

Institute Concert Talk
CONTINUUM® members with JON MAGNUSSEN

March 8
Playreading
Brighton Beach Memoirs by Neil Simon

March 11
75th Anniversary Celebration: School of Mathematics
"Number Theory, Symmetry and Zeta Functions," PETER SARNAK, *Princeton University and the Courant Institute of Mathematical Sciences;* "Randomness, Games and Computers," AVI WIGDERSON, *Herbert H. Maass Professor, School of Mathematics;* "Veblen's Circle: Early Years of Mathematics at the Institute for Advanced Study," GEORGE DYSON, *historian of technology*

March 12
75th Anniversary Celebration: School of Mathematics
"Solitons and Symmetry," SIR MICHAEL ATIYAH, *Honorary Professor, University of Edinburgh;* "Topology, Marston Morse and Hermann Weyl," RAOUL BOTT, *Professor Emeritus, Harvard University;* "A Mathematical Theory of Solids–from Atomic to Macroscopic Scales," WEINAN E, *Princeton University;* "My joint-work with Armand Borel from 1952 to1954," FREDERICH HIRZEBRUCH, *Professor Emeritus, University of Bonn;* "Heegaard Diagrams and Holomorphic Disks," PETER OZSVÁTH, *Columbia University and University of California, Berkeley*

March 14
AMIAS Movie Mondays
Forbidden Planet (1956)

March 18
Institute Film Series
Whale Rider (2002)

March 26
Easter Egg Hunt

April 1
Friends Fireside Chat
"The Architecture of the Institute for Advanced Study from Flexner to Goddard" ROBERT GEDDES, Dean Emeritus, School of Architecture, Princeton University

April 2
Institute Trip
Philadelphia Museum of Art

April 4
AMIAS Movie Mondays
Annie Get Your Gun (1950)

April 5
Playreading
Ghosts by Henrik Ibsen

April 8
75th Anniversary Celebration: School of Historical Studies
"The Matter of History," Symposium: multi-media presentation: "Text, Space & Object," SIR JOHN ELLIOTT, *Regius Professor Emeritus of Modern History, Oxford University*

April 9
75th Anniversary Celebration: School of Historical Studies
"The Matter of History," Symposium: joint-led seminars: "The Vulnerability of History," HEINRICH VON STADEN, *Professor, School of Historical Studies*, and FRITZ STERN, *University Professor Emeritus and former Provost, Columbia University;* "Fraud and Forgery," GLEN BOWERSOCK, *Professor, School of Historical Studies*, and PATRICIA CRONE, *Andrew W. Mellon Professor, School of Historical Studies;* "Intellectual Rebels," JONATHAN ISRAEL, *Professor, School of Historical Studies*, and KINCH HOEKSTRA, *Balliol College, Oxford University;* "Hidden People," CAROLINE BYNUM, *Professor, School of Historical Studies*, and ROBERT DARNTON, *Princeton University;* "Museums and Great Collections," OLEG GRABAR, *Professor Emeritus, School of Historical Studies*, and HENRI ZERNER, *Harvard University; "National History,"* NICOLA DI COSMO, *Luce Foundation Professor in East Asian Studies*, and BERNARD HAYKEL, *New York University*

April 11
Institute Lecture
"In Orbit! Cassini Explores the Saturn System"
CAROLYN PORCO, *Director, Cassini Imaging Central Laboratory for Operations (CICLOPS) at the Space Science Institute, Boulder, Colorado*

April 13
Friends Forum
"Muslims and Non-Muslims in Modern Islamic Thought"
RAINER BRUNNER, *Member, School of Historical Studies*

Institute Film Series
Little Caesar (1930)

April 20
Friends Fireside Chat
"Spreading Liberty Round the World: the Devil in the Details"
DETLEV VAGTS, *Bemis Professor of International Law, Harvard Law School*

May 2
AMIAS Movie Mondays
The Man in the White Suit (1951)

May 3
Playreading
The Glass Menagerie by Tennessee Williams

May 6
Institute Lecture
"Einstein's Legacy as Scientist and Icon"
SIR MARTIN REES, *Professor of Cosmology and Astrophysics and Master of Trinity College, Cambridge University*

May 13
Friends Fireside Chat
"Prostate Cancer: Crouching Tiger or Toothless Lion?"
PETER SCARDINO, *Chairman, Department of Urology, Memorial Sloan-Kettering Cancer Center*

May 20
75th Anniversary Celebration: Founders Day and Einstein Day
Activities to mark the Institute's founding in 1930 and the 100th anniversary of Albert Einstein's *annus mirabilis* of 1905: Dedication of new sculpture by artist Elyn Zimmerman; Lectures: "Special Relativity," PHILIP ARGYRES, *Member, School of Natural Sciences;* "Brownian Motion and the Atomic Theory," SIMEON HELLERMAN, *Member, School of Natural Sciences;* "The Photoelectric Effect," GRAHAM KRIBS, *Member, School of Natural Sciences;* "Einstein and Quantum Mechanics: A Love-Hate Relationship," STEPHEN L. ADLER, *Professor, School of Natural Sciences;* "The Founding of the Institute," PETER GODDARD, *Director, Institute for Advanced Study;* "Einstein and the Institute," GEORGE DYSON, *historian of technology;* "Einstein, Freud, and their Pamphlet *Why War?*" PETER PARET, *Professor Emeritus, School of Historical Studies;* "Einstein's Politics," JOAN SCOTT, *Harold F. Linder Professor, School of Social Science;* "Einstein and Zionism," MICHAEL WALZER, *UPS Foundation Professor, School of Social Science;* "The Assassin of Relativity," PETER GALISON, *Mallinckrodt Professor of the History of Science and Physics, Harvard University*

May 21
World Year of Physics 2005: PhysicsQuest
The 9th grade physical science class at St. Albert Catholic Schools in Council Bluffs, Iowa, winners of a nation-wide competition organized by the American Physical Society visited the Institute as part of the celebrations of Albert Einstein's *annus mirabilis* of 1905

May 25
Friends Annual Meeting and Picnic

June 21
Staff picnic

LINDA ARNTZENIUS

"I have immensely enjoyed spending time at the Institute. The unique mix of people at the School of Natural Sciences makes this a great place to work, learn, discuss, and get inspired. I have been exposed to many new ideas during my visit, which will influence my future research."

— Member, School of Natural Sciences

Members in the School of Natural Sciences with astrophysicist John Bahcall (1934–2005)

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"I had what I felt were ambitious fantasies about the amount of work I wanted to get done at the Institute, and now I am almost a little surprised that I succeeded in completing most of it. This would not have been possible outside the Institute and without the unique conditions it provided."

— Member, School of Historical Studies

THE SCHOOL OF HISTORICAL STUDIES

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The School of Historical Studies is concerned principally with the history of Western European, Near Eastern, and East Asian civilizations. Both inside and outside these broad areas of study Faculty and Members have pursued a wide range of topics. The emphasis has been traditionally strong in the fields of Greek and Roman civilization, medieval, early modern and modern European history, and history of art, but over time the School's interests have been enlarged to include Islamic culture, the history of China and Japan, international relations, the history of science, ideas, and more recently, music studies. Well over one thousand Members have come to the School since its foundation, and their work here in these and other areas of research has regularly been enriched by the fruitful interaction of disciplines in a small and collegial community.

The various fields represented by the School are a product of its own history. Two years after the opening of the School of Mathematics in 1933, a School of Economics and Politics and a School of Humanistic Studies were established. The first professor in Humanistic Studies, Benjamin Dean Meritt, a specialist in Greek epigraphy, was closely associated with excavations in the Athenian Agora. The second appointment to the Faculty of the School of Humanistic Studies was that of the German art historian Erwin Panofsky. Panofsky's work ranged across European art from the middle ages to motion pictures, but he was most closely associated with the development of the field of iconology.

Three additional appointments strengthened the field of classical and Near Eastern studies: Elias Avery Lowe, a Latin palaeographer; Ernst Herzfeld, a Near Eastern archaeologist; and Hetty Goldman, a pioneering archaeologist who worked at Tarsus in Turkey. Modern history was represented at the Institute from the outset with the appointment of

the military and political historian Edward M. Earle. Earle was an original member of the School of Economics and Politics, which merged in 1949 with the School of Humanistic Studies to become the School of Historical Studies.

After World War II, classical studies were further augmented by the appointments of Homer A. Thompson in Greek archaeology, Harold F. Cherniss in Greek philosophy, and Andrew Alföldi in Roman history and numismatics. Medieval history came to the Institute Faculty with Ernst Kantorowicz, whose interests ranged in time from the later phases of classical antiquity to the sixteenth century. The art historical tradition was taken over from Panofsky by Millard Meiss, who completed his work on Burgundian manuscript painting during his years at the Institute.

Additional fields came with the appointments of Sir Ernest Llewelyn Woodward in diplomatic history, James F. Gilliam in Roman military history and papyrology, Kenneth M. Setton in the history of the medieval papacy and the Levant, and Felix Gilbert in renaissance as well as modern German history. George Kennan was appointed in the fields of international relations and contemporary history, and a new term professorship in his honor was established in 1996. To date, two Kennan professors have been appointed: Jack F. Matlock, Jr. and José Cutileiro. The School's tradition in the field of art history was refocused on the history of Modern Art with the appointment of Kirk Varnedoe in 2002, prematurely deceased in August 2003. The focus on Modern Art will continue with the recently appointed Yve-Alain Bois, who joined the School on July 1, 2005.

While the School has changed over time, many of the major scholars who came to the Institute in the decades after World War II are still active in School affairs, as illustrated in the list of current faculty and emeriti whose reports appear below. Their work illustrates the School's continued dedication to fields of historical inquiry that it has long supported, alongside an openness to new areas reflected in recent appointments in Islamic and East Asian history. As in the past, the School will continue in the years to come to encourage the exploration or creation of new fields of historical inquiry and the breaking down of traditional academic boundaries.

ACADEMIC ACTIVITIES

FACULTY

During the academic year 2004-2005, PROFESSOR GLEN BOWERSOCK published twelve articles, including a study of the late antique Jewish kingdom of converted Arabs in South Arabia. He attempted to relate the emergence and survival of this extraordinary nation to Byzantine and Persian foreign policy between the fourth and sixth centuries. Other papers examined a newly published mosaic inscription from Sepphoris in Israel, representations of "north" and "south" in ancient geographical writings, the place of Artemidorus' book of dream interpretations in the Second Sophistic, and the historian Josephus in the context of foreign elites in Flavian Rome. He continued his ongoing debate with Italian scholars about periodization in history by contributing to a discussion in *Studi Storici*.

Professor Bowersock attended a colloquium in Alexandria, Egypt, to assess the significance of the eighteen teaching auditoria from late antiquity that Polish archaeologists have discovered at Kom el dikka. He subsequently delivered a lecture at the University of Athens on higher education in late antique Athens in relation to the schools in Alexandria and Aphrodisias. On that occasion the University of Athens conferred upon him an honorary doctorate. He was also elected an Honorary Fellow of Balliol College, Oxford, and in Paris last October he received the decoration of Chevalier de la Légion d'honneur from the French government.

Professor Bowersock went twice to Florence for meetings of the consiglio scientifico of the Istituto di studi umanistici, with which he has been involved from the beginning. In early June he visited western Greece, including the Ionian islands. He fulfilled a lifelong ambition to explore the site of Nicopolis, which the emperor Augustus founded to commemorate the victory at Actium over Antony and Cleopatra. He is deeply obliged to the Greek excavation team from Ioannina for making this visit possible.

Professor Bowersock chaired the committee for the School of Historical Studies' celebration of the Institute's 75th anniversary on April 8th and 9th, leading a seminar on April 9th, together with Professor Crone, on fraud and forgery in history. He continued to administer the Fonds Louis Robert at the Académie des Inscriptions et Belles-Lettres in Paris and to direct the series *Revealing Antiquity* at the Harvard University Press.

PROFESSOR CAROLINE WALKER BYNUM spent the largest portion of the academic year 2004-2005 completing the first draft of a study of the cult of Christ's blood in fifteenth-century northern Germany against the broad background of European piety and theological debate. She published a general survey article on medieval women's piety in the catalogue for the exhibit *Krone und Schleier,* held in Bonn and Essen; an essay on relics in *The Medieval History Journal;* an article on the pilgrimage sites of Wilsnack and Sternberg in a Festschrift for Jeremy Adams; an autobiographical essay in a volume on women medievalists; and (with her student Anna Harrison) an article on the devotional writer Gertrude of Helfta. She lectured at the University of Arizona in Tucson, the University of Illinois in Champaign-Urbana, Manhattan College in The Bronx, Union Theological Seminary in New York City, and for the Einstein Forum in Berlin. She continued to direct Columbia University Ph.D. students both in dissertation work and in oral exam preparation. At the Institute, she sponsored two informal discussion groups, one on medieval studies and one on death and immortality. In the first of these groups, western medievalists, Byzantinists, and Islamicists from both the Institute and neighboring universities discussed such specialized topics as late medieval biological writing, the reception of the classics in the early Middle Ages, and Jewish poetry, and also broad issues of professional concern such as approaches to editing, plagiarism, and graduate training. In what came to be called "the death group," a number of Members from all chronological and geographical specializations discussed such topics as tomb sculpture, the nature of cemeteries, mysticism, slavery as social death, and cosmology. She continued to serve on the Selection Committee for the Yad-Hanadiv Foundation in Jerusalem. During the joint meeting of the American Society of Church History and the American Historical Association in January 2005, Professor Bynum was given the American Society of Church History Distinguished Career Award at a panel in which three of her graduate students spoke about her impact on their careers. In June 2005, she was awarded the degree of Doctor of Laws *honoris causa* from Harvard University.

PROFESSOR PATRICIA CRONE lecturered on 'post-colonialism' in the medieval Islamic world at Berkeley in October and delivered four lectures, partly on the same subject, at the *Ecole Pratique des Hautes Etudes* in Paris in November. She also contributed a paper on fallen angels at the conference in memory of Shlomo Pines at the Institute for Advanced Study in Jerusalem in February-March, and wrote the entry on anarchism for the third edition of the *Encyclopaedia of Islam*. Much of her time was spent reading manuscripts for the new series of short biographies, "Makers of the Muslim World." Nine books are now in print and the first four have been released in England. Professor Crone also participated in the task of editing the proceedings of the two-weeks' long conference on "the Greek strand in medieval Islamic political thought" held at the Institute for Advanced Study in June 2003, contributing an article on imperfect constitutions as seen by al-Farabi. This volume, a hefty 600-page work, is now in print. Other editorial work included the preparation of a Variorum reprint of twelve of her articles and the compilation of additions and corrections to the paperback version of her *Medieval Islamic Political Thought*. At the Institute, Professor Crone ran the Islamicist seminar and an informal group discussing empires past and present, attended by members of the School of Historical Studies and the School of Social Sciences alike. In addition, a small group of Islamicists met regularly to read medieval Arabic theological and philosophical texts on theodicy.

PROFESSOR NICOLA DI COSMO served as the School's Executive Officer for the Academic Year 2004-2005. His service to the Institute also included participation in the committee for the organization of the 75th Anniversary Celebration, held on April 8-9, 2005, on which occasion he co-hosted a seminar on Nationalism in Asia. In addition, he convened the East Asian seminar at the Institute.

In September, Professor Di Cosmo was invited as discussant to a workshop on the translation of the *Shiji* (*The Historian's Memoirs*, first c. BCE) at the University of Wisconsin. In December he presented a paper on Manchu sources for the study of Eastern Turkestan at a conference on Xinjiang Historical Sources held in Hakone, Japan; during the same trip he lectured at the Institute for the Study of Asian and African Languages and Cultures in Tokyo. In April 2005 he attended the annual conference of the Association of Asian Studies, where he was appointed vice-Chair of the China and Inner Asia Council. He was then invited to lecture on the subject of "Loving War: the Inner Asian Context," within a series of lectures on "Loving War" organized by Professor Geoffrey Parker at Ohio State University. In mid-April he went to Stanford University to lecture at the Silk Road Foundation. In May he was invited to speak at the *Deutsche Studienzentrum* in Venice on Mongol-Venetian relations, and spent two weeks at the *Archivio di Stato* in Venice to conduct some preliminary work on Venetian trade on the Black Sea. At the end of the month he presented a paper at the Second North-American Conference of Manchu Studies, held at Harvard University. Both the lecture at Stanford and the paper at Harvard proposed a critique of standard narratives of Inner Asian history.

Professor Di Cosmo supervised a doctoral thesis at the *Istituto di Studi Umanistici* (Florence) on Seventeenth-century Russo-Chinese, and another at the University of Pennsylvania on Mongol archaeology. During the spring term he taught graduate students on the subject of Chinese frontier history at the University of Pennsylvania and at Columbia University. He continued to serve on the editorial boards of several academic journals, and as series co-editor for Brill Publishers ("Handbuch der Orientalistik"

and "Brill Inner Asian Library"). Through the year he edited a book on Chinese military history (sole editor), and the *Cambridge History of Inner Asia* (co-editor). Two articles appeared in edited volumes, one on the subject military technology in the early Manchu state, the other on fourteenth-century trade between Europe and Asia. In June Professor Di Cosmo visited and actively participated in archaeological research at an Iron Age (c. 1st century CE) site in Mongolia that is of considerable relevance to the history of the Northern Xiongnu and Mongolian archaeology.

PROFESSOR JONATHAN ISRAEL spent the 2004-05 academic year bringing his new volume on the early Enlightenment in the period 1670-1752 to completion. The finished text was delivered to the publisher during the summer of 2005. Following on from his *Radical Enlightenment* (Oxford, 2001) this work has taken up most of his time since arriving at the Institute in January 2001. It attempts a general re-interpretation of one of the main shifts in the history of the modern West, the last reassessment on a comparable scale being that of Peter Gay in the 1960s.

Professor Israel gave the keynote address on John Locke's historical significance at the Yale Beinecke Library Symposium on Locke, and the annual C.Th. Dimaras Lecture on the Enlightenment, in Athens, both in October 2004, and a lecture on the Radical Enlightenment's conception of 16th century Italian naturalism at New York University in February 2005. He also participated in a workshop on the Radical Enlightenment at Columbia University, New York in March and together with one of this years' Institute Members, Kinch Hoekstra, of Balliol College Oxford, held a seminar on 'Intellectual Rebels' during the School of Historical Studies' celebration of the Institute's 75th anniversary in April. In addition, he delivered the 2004 annual Pierre Bayle Lecture in Rotterdam, in December, and spoke on the Dutch artist and libertine thinker, Romeyn de Hooghe in a conference on Russian-Dutch cultural relations in the 18th century, held in the Menshikov Palace of the University of Saint Petersburg in May. During a trip to the Netherlands in early May, he gave talks on the 'Radical Enlightenment' at Leiden, Nijmegen, Utrecht and in the Mennonite Church in Leeuwarden.. He also lectured on topics in Jewish history in Jerusalem in November, at Johns Hopkins University in March, and at the University of Pennsylvania in April. The expanded Dutch translation of his *Radical Enlightenment* was published at Franeker in April.

Besides book reviews, other publications included 'Pierre Bayle's Political Thought' in Anthony McKenna and G. Paganini (eds.) *Pierre Bayle dans la République des Lettres. Philosophie, religion, critique* (Paris, 2004), pp.349-79; 'Was there a pre-1740 Sephardic Jewish Enlightenment?' in *Arquivos do Centro Cultural Calouste Gulbenkian* xlviii (Lisbon, 2004), pp. 3-20 and 'Diasporas Jewish and non-Jewish and the world maritime empires' in I. Baghdiantz McCabe, G. Harlaftis, and I. Pepelasis Minoglou (eds.) *Diaspora Entrepreneurial Networks: Four Centuries of History* (Oxford, 2005), pp. 3-26.

During the academic year 2004-2005, PROFESSOR HEINRICH VON STADEN gave a talk at the University of La Coruña (Spain) in September on "Celsus' conception of the relation between *ars* and *natura*." In October he gave a keynote lecture at the annual retreat of the Department of Molecular Biology at Princeton University; the topic was Hellenistic medical experiments on human subjects. In November he gave a talk on Greek conceptions of the relation between *physis* and *techne* at the University of Tokyo, at the joint invitation of the Department of History and Philosophy of Science and the

Centre for Philosophy. In May 2005 he gave two lectures, one at a Princeton University symposium on the transmission and transformation of knowledge in Late Antiquity, the other a Loeb lecture at Harvard University on Hellenistic interpretations of scientific and medical texts. In early June followed two talks at the Academia Sinica in Taipei, one on "The Physiology of Morality and the Therapy of the Emotions," the other on ancient conceptions of hygiene. In addition, he lectured at the National Taiwan University (Taipei) on the role of 'limits' and self-regulation in ancient medical ethics. In mid-June he gave a lecture at a conference at the Free University of Berlin on pre-Aristotelian theories of catharsis. Professor von Staden also gave several talks at the Institute, including one in March, at a gathering of the Institute's biologists, on ancient Greek conceptions of the brain and of the nervous system.

Professor von Staden's publications in 2004-05 included several book reviews and articles, among them "Galen's Alexandria," in *Ancient Alexandria Between Egypt and Greece*, edited by W.V. Harris and Giovanni Rufini (Leiden/Boston, 2004), pp. 179-215, and "Early European Conceptions of the Brain and the Nerves: Classical Intuitions and Hellenistic Discoveries," *Sphinx* 2004-05 (Helsinki, 2005), pp. 11-30. In August delegates of more than forty classical associations meeting in Brazil, elected him president of the *Fédération Internationale des Études Classiques* for a term of five years. During the year he was awarded several academic honors: in May he was awarded an honorary degree (Doctor of Humane Letters) by Quinnipiac University, and in April he was elected a Foreign Member of the Finnish Academy of Science and Letters.

PROFESSORS EMERITI

PROFESSOR MARSHALL CLAGETT continued his new studies of the *Liber Calculationum* of the fourteenth century philosopher and logician, Richard Swineshead of Merton College, Oxford. Furthermore, he continued serving on editorial boards of journals in the history of science.

The academic year 2004-05 saw the publication (more than ten years after it was written) of PROFESSOR GILES CONSTABLE's contribution to the *Oxford Dictionary of National Biography*. He also published articles in the *Festschriften* for John R. Sommerfeldt, Hubert Mordek, and Roger Reynolds and in the proceedings of two conferences at Auxerre and Florence. He wrote the chapter on religious history in the volume commemorating the fiftieth anniversary of the *Centro italiano di studi sull'alto medioevo* (Spoleto) and contributed a chapter (in dialogue with C. Stephen Jaeger) in a volume on *Voices in Dialogue: Reading Women in Middle Ages*. A chapter from his book *Three Studies in Medieval Religious and Social Thought* was reprinted in *Medieval Religion: New Approaches*. He wrote the preface to *The Making of Christian Communities in Late Antiquity and the Middle Ages*. During the spring term he taught a course on the history of the crusades at Arizona State University, where he also gave a public lecture. He spoke at conferences in Leeds, Paderborn, Poitiers, Geneva, and Rome; attended conferences and meetings in Washington (DC), Cambridge (Mass.), Budapest, Tempe, and Kalamazoo, and gave lectures at Princeton University and Southern Methodist University. He continued to serve on the advisory board of the Delmas Foundation and on the editorial boards of several scholarly journals.

PROFESSOR OLEG GRABAR co-chaired a session of the International Congress of Art Historians (CIHA) in Montreal; co-chaired two sessions of the College Art Association

in Atlanta, where he received the CAA Award for Life-time achievement in the field of the History of Art; lectured on "the Image in Islamic Art" as the Silberding lecturer at the Institute of Fine Arts at New York University, on "Baghdad in Islamic Art" at the Virginian Commonwealth University, on the Dome of the Rock in Jerusalem at the Jewish Center in Princeton, on the archeology and history of Jerusalem and "The Study of Islamic Art" at the University of Minnesota; gave the inaugural lecture to a colloquium on Arab Painting at the School of Oriental and African Studies in London and the keynote lecture at a symposium on the arts of the 7th-8th centuries at the University of Maryland; introduced the study of Islamic art at a seminar on the 11th century at the University of Zaragozza in Spain and summarized a colloquium on *mudejar* art at Cornell University.

Professor Grabar's publications were: "Les portraits du Prophete Muhammad," *Comptes-Rendus de l'Academie des Inscriptions et Belles-Lettres,* Paris 2002, pp. 1431-1444; (with Mika Natif), "The Story of the Portraits of the Prophet," *Studia Islamica* 96 (2003), pp. 19-38; "Silks, Pots, and Jugs," B. O'Kane ed., *The Iconography of Islamic Art in honor of Robert Hillenbrand* (Edinburgh, 2005), pp. 197-200.

PROFESSOR CHRISTIAN HABICHT submitted the manuscript for *The Hellenistic Monarchies: Selected Papers* to the University of Michigan Press and checked the work of the copy-editor. The book, scheduled for publication in 2006, will contain eighteen essays, all in English, and an Appendix in which more recent work is reviewed. He delivered the opening address, "Das westliche Kleinasien im frühen 2. Jahrhundert v. Chr." at a conference in honor of R. M. Errington, held at the University of Marburg in July 2004. A revised version of the talk was accepted for publication in *Chiron* 35, 2005. In April 2005 he attended an international conference in honor of P. J. Rhodes in Rhodes. While there, he visited the two archaeological museums, the ancient sites of Kamiros and Ialysos, and the island of Syme. He received (and declined for technical reasons) a request of the Greek Ministry of Development to evaluate, on the basis of onsite visits scheduled for July 2005, the Institute of Greek and Roman Antiquity of the National Hellenic Research Foundation in Athens.

Professor Habicht's publications were "Adolf Wilhelm und die attischen Inschriften," **ΑΤΤΙΚΑΙ ΕΠΙΓΡΑΦΑΙ** (Proceedings of an International Symposium in memory of Adolf Wilhelm [Athens, 2004]), 7-18; "The dating of the Koan *monarchoi*," in K. Hghammar (Ed.), *The Hellenistic Polis of Kos,* Proceedings of an International Seminar, held at Uppsala University in May, 2000 (Uppsala, 2004), 61-67; "Das Ehrendekret von Serrai für Rebilus," *Zeitschrift für Papyrologie und Epigraphik* 148, 2004, 283-288; "Ein neuer Gymnasiarch am Fest der Athena Ilias," *Epigraphica Anatolica* 37, 2004 [2005], 91-94; "Notes on the priests of Athena Lindia," *Studi Ellenistici* 16, 2005, 71-78.

During the academic year 2004-05, PROFESSOR IRVING LAVIN continued to serve on the editorials boards of several scholarly journals, including: *Quaderni d'italianistica, History of European Ideas, Art e Dossier, Palladio,* and *Rivista di storia dell' architettura e restauro.* He participated as a member of the Board of Trustees of the SacraTech Foundation at St. Louis University. In November, he participated as co-director and contributor to the seminar entitled "Barroco: retórica y arte de la persuasión" held at the *Escuela del Barroco: Fundación Focus-Abengoa,* in Seville, Spain. In December, he was plenary speaker at the Colloquium *I Barberini,* held in the Palazzo Barberini in Rome. In April/May, Profes-

sor Lavin lectured in Edinburgh at the National Gallery of Scotland, and at the University of St. Andrews. In June, he lectured at the *Galleria Estense* in Modena, Italy, and at the University of Salerno, and gave a course of lectures at the *Istituto Italiano per gli Studi Filosofici* in Naples. His most recent publications are: "Bernini giovane," in Olivier Bonfait and Anna Coliva, eds., *Bernini dai Borghese ai Barberini. La cultura a Roma intorno agli anni venti* (Atti del convegno, Rome, February 17-19, 1999), Rome, 2004, 134-48; "Going for Baroque: Observations on the Post-Modern Fold," in Sebastian Schütze ed., *Estetica barocca,* Rome, 2004 (Atti del convegno internationale tenutosi a Roma dal 6 al 9 marzo 2002), 423-52; "Bernini at Saint Peter's: *singularis in singulis, in omnibus unicus,"* in William Tronzo, ed., *St. Peter's in the Vatican,* Cambridge and New York, 2005, III-243.

Professor Lavin was awarded the prestigious Italian prize, the *Premio Internazionale "Galileo Galilei,"* for a foreign scholar in any field of Italian history. He is the fifth art historian to receive the prize since its inception in 1962. The award is to be conferred in a ceremony at the University of Pisa, October 6-8, 2005.

During the 2004-2005 academic year, PROFESSOR PETER PARET published "Images as Documents in the History of War," in *Central European History,* vol. 38, no. 2. An expanded version of his talk "Einstein and Freud's Pamphlet *Why War*" at the celebration of the 75th anniversary of the founding of the Institute will appear in *Historically Speaking* in summer 2005. Professor Paret published reviews in *European History Quarterly, Central European History, The International History Review,* and *The Journal of Military History.* His article, "The Relationship between the American Revolutionary War and European Military Thought and Practice of the Period," originally published in 1977, was reprinted in *The International Library of Essays in Military History,* ed. Jeremy Black, Ashgate Publishers, Aldershot, 2005.

PROFESSOR MORTON WHITE's volume of forty-one selected essays, *From a Philosophical Point of View,* was published by Princeton University Press in 2005. His article, "Holmes and Hart on Prediction and Legal Obligation," appeared in the *Transactions of the Charles S. Pierce Society* (Fall, 2004, Vol. XL, pp. 569-73). At a meeting at the Institute for Advanced Study commemorating the centenary of Robert Oppenheimer, Professor White delivered a talk entitled "Remembering Robert Oppenheimer." A French translation of Professor White's book, *A Philosophy of Culture,* will soon be published in Paris, and he continues to work on a book in which he will examine the decline and fall of classical rationalism – a "prequel" to *A Philosophy of Culture,* which has just been issued in paperback.

THE SCHOOL OF HISTORICAL STUDIES

MEMBERS, VISITORS, AND RESEARCH STAFF

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Centre National de la Recherche Scientifique, Paris · *s*

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Old English Literature
Arizona State University

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Imperial College London · *s*

PAOLO DESIDERI
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VITTORIO HOSLE
Philosophy and Literature
University of Notre Dame

THOMAS JANSEN
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Universität Leipzig

JOEL KAYE
Medieval Intellectual and Economic History
Barnard College

a Research Assistant · *b* Both Member and Visitor · *f* First Term
j Joint Member with School of Natural Sciences · *s* Second Term · *v* Visitor

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Indiana University · *f*

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University of Notre Dame

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University of Padua · *f*

ROBERT WARDY
Ancient Philosophy
University of Cambridge · *b*

MAREK WIECZOREK
Art History
University of Washington · *b*

CHRISTIAN WILDBERG
Classical Philosophy
Princeton University · *f, v*

VICTORIA WOHL
Ancient Greek Literary and Cultural History
Ohio State University

a Research Assistant · *b* Both Member and Visitor · *f* First Term
j Joint Member with School of Natural Sciences · *s* Second Term · *v* Visitor

THE SCHOOL OF HISTORICAL STUDIES

RECORD OF EVENTS

The following is a calendar of events sponsored by the School of Historical Studies

Academic Year 2004-05

September 27
Historical Studies Lunchtime Colloquium:
Introductions

October 4
Historical Studies Lunchtime Colloquium:
"The School of Libanius in Late-Antique Antioch: The Curriculum"
RAFFAELLA CRIBIORE, *Columbia University; Member, School of Historical Studies*

October 11
Historical Studies Lunchtime Colloquium:
"Archaeological Work in Northeast China: Preliminary Perspectives on Local Processes and Interregional Interactions"
GIDEON SHELACH, *Hebrew University, Jerusalem; Member, School of Historical Studies*

October 12
East Asian Studies Seminar:
"What's 'Medieval' about Medieval Japan?"
THOMAS KEIRSTEAD, *Indiana University; Member, School of Historical Studies*

October 18
Historical Studies Lunchtime Colloquium:
"Mondrian's Reinvention of Pictorial Space"
MAREK WIECZOREK, *University of Washington; Member, School of Historical Studies*

October 19
Early Modern European Workshop:
"Friend of Flood? The Dilemmas of Water Management in Early Modern Venice"
KARL APPUHN, *New York University; Member, School of Historical Studies*

October 21
Islamicist Seminar:
"Two Texts on Clerical Authority in the Early Qajar Period"
SAID ARJOMAND, *State University of New York, Stony Brook*

October 25
Historical Studies Lunchtime Colloquium:
"Is the Future Medieval? Japan's New Medievalism"
THOMAS KEIRSTEAD, *Indiana University; Member, School of Historical Studies*

October 26
East Asian Studies Seminar:
"The Qin State - Archaeological and Historical Perspectives on State Formation and Social Change"
GIDEON SHELACH, *Hebrew University, Jerusalem; Member, School of Historical Studies*

November 1
Historical Studies Lunchtime Colloquium:
"Shaping Muslim Identity in Europe"
RAINER BRUNNER, *University of Freiburg; Member, School of Historical Studies*

November 3
Islamicist Seminar:
"Conjectural Emendation of Book Titles in the Legal Section of the Fihrist"
DEVIN STEWART, *Emory University; Member, School of Historical Studies*

November 8
Historical Studies Lunchtime Colloquium:
"How Rustam Killed the White Div: Poetic and Pictorial Narrative in Firdausi's Shahnama"
MARIANNA SHREVE SIMPSON, *Independent Scholar; Member, School of Historical Studies*

November 9
East Asian Studies Seminar:
"Popular Religious Scriptures of Late Imperial China: Religious, Social and Literary Aspects"
THOMAS JANSEN, *Universität Leipzig; Member, School of Historical Studies*

November 10
Early Modern European Workshop: Panel Discussion on the "Myth of Venice"
Participants included:
JONATHAN ISRAEL, *Permanent Faculty, School of Historical Studies*
KARL APPUHN, *New York University; Member, School of Historical Studies*
MATTEO CASINI, *University of Padua; Member, School of Historical Studies*
KINCH HOEKSTRA, *University of Oxford; Member, School of Historical Studies*
SUSAN MORRISSEY, *University College London; Member, School of Historical Studies*
ALFREDO VIGGIANO, *University of Padua; Member, School of Historical Studies*

November 15
Historical Studies Lunchtime Colloquium:
"Isaac haGorni: the Man, the Myth, and the Manuscript"
SUSAN EINBINDER, *Hebrew Union College; Member, School of Historical Studies*

November 22
Historical Studies Lunchtime Colloquium:
"The Name of the Barbarian and the Formulation of Chinese Ethnonymy"
MAGNUS FISKESJÖ, *Museum of Far Eastern Antiquities, Stockholm; Member, School of Historical Studies*

November 23
East Asian Studies Seminar:
"The Position of the 'Barbarians' in the Idea of the Imperial Chinese State"
MAGNUS FISKESJÖ, *Museum of Far Eastern Antiquities, Stockholm; Member, School of Historical Studies*

November 29
Historical Studies Lunchtime Colloquium:
"Did the American Occupation Democratize Japan? Photography and Political Subjectivity"
JULIA ADENEY THOMAS, *University of Notre Dame; Member, School of Historical Studies*

November 30
East Asian Studies Seminar:
"Archaeological Remains of the Nomadic Migrations from China to Central Asia"
KAZIM ABDULLAEV, *Institute of Archaeology, Samarkand; Member, School of Historical Studies*

December 6
Historical Studies Lunchtime Colloquium:
"Popular Religious Scriptures in 16th and 17th Century China: A Case of Heterodoxy?"
THOMAS JANSEN, *Universität Leipzig; Member, School of Historical Studies*

December 7
East Asian Studies Seminar:
"The Chinese Rare Book Project at Princeton University"
SOREN EDGREN, *Princeton University*

December 13
Historical Studies Lunchtime Colloquium:
"What are Philosophical Dialogues and Why do People Write Them?"
VITTORIO HÖSLE, *University of Notre Dame; Member, School of Historical Studies*

December 17
Early Modern European Workshop:
"Virtue and Vice in the Age of Enlightenment (Towards a History of Suicide in Russia)"
SUSAN MORRISSEY, *University College London; Member, School of Historical Studies*

January 10
Historical Studies Lunchtime Colloquium:
Introductions

January 17
Historical Studies Lunchtime Colloquium:
"Tomorrow's News Today: Astrology, Fate, and the Way Out"
DARYN LEHOUX, *University of King's College, Halifax; Member, School of Historical Studies*

January 19
Early Modern European Workshop:
"Thomas Hobbes and the State of Nature"
KINCH HOEKSTRA, *University of Oxford; Member, School of Historical Studies*

January 24
Historical Studies Lunchtime Colloquium:
"What is History of Science?"
TIAN YU CAO, *Boston University; Member, School of Historical Studies*

January 25
Empire Group:
"The Changing Meaning of the Term 'Empire'"
MARK BEISSINGER, *University of Wisconsin; Member, School of Social Science*

January 31
Historical Studies Lunchtime Colloquium:
"Roman Law, New Institutional Economics, and the Economy of the Roman Empire"
DENNIS KEHOE, *Tulane University; Member, School of Historical Studies*

February 7
Historical Studies Lunchtime Colloquium:
"Francis Bacon and the Scientific Revolution"
PETER HARRISON, *Bond University, Queensland; Member, School of Historical Studies*

February 8
Empire Group:
"The Typology of Colonies"
KRISHAN KUMAR, *University of Virginia; Member, School of Social Science*

February 9
Early Modern European Workshop:
"Why Giordano Bruno's 'Tranquil Universal Philosophy' Finished in a Fire"
HILARY GATTI, *Università di Roma "La Sapienza;" Member, School of Historical Studies*

February 14
Historical Studies Lunchtime Colloquium:
"Architects in Late Antiquity"
SERAFINA CUOMO, *Imperial College London; Member, School of Historical Studies*

February 22
Empire Group:
"The Native Reaction to Incorporation in Foreign Empires"
PATRICIA CRONE, *Permanent Faculty, School of Historical Studies*

East Asian Studies Seminar:
"Administration of Justice in Late Imperial China"
WEJEN CHANG, *Academia Sinica, Taiwan; Member, School of Historical Studies*

February 28
Historical Studies Lunchtime Colloquium:
"Urbanization, Culture and the Enlightenment"
WIJNAND MIJNHARDT, *University of Utrecht; Member, School of Historical Studies*

March 2
East Asian Studies Seminar and Art History Lunch:
"Collecting and Displaying Asia: The Modern History of Sweden's Museum of Far East Antiquities, 1926 – 2004"
N. MAGNUS FISKESJÖ, *Museum of Far Eastern Antiquities, Stockholm; Member, School of Historical Studies*

March 3
History of Science Seminar:
"Drawing the Line; Boundary Disputes, Technology, and Representation in the Roman Empire"
SERAFINA CUOMO, *Imperial College London; Member, School of Historical Studies*

March 4
Empire Group:
"Imperial Frontiers"
NICOLA DI COSMO, *Permanent Faculty, School of Historical Studies*

March 7
Historical Studies Lunchtime Colloquium:
"The Pitfalls of Translating Babylonian Poetry"
ANDREW GEORGE, *University of London; Member, School of Historical Studies*

School of Historical Studies Lecture:
"The Correspondence of Heloise and Abelard"
JACQUES DALARUN, *l'Institut de Recherche et d'Histoire des Textes, Paris; Visiting Professor, Franciscan Institute of St Bonaventure University, New York*

March 8
East Asian Studies Seminar:
"The Primacy of the Situation in Classical Chinese Philosophy and Rhetoric"
PAUL R. GOLDIN, *University of Pennsylvania*

March 9
Early Modern European Workshop:
"The Limits of Present-day Historiography on Republicanism"
WIJNAND MIJNHARDT, *University of Utrecht; Member, School of Historical Studies*

Islamicist Seminar:
"The Drunken Gods: Babylonian Strategies for Explaining What is Wrong With the World"
ANDREW GEORGE, *School of Oriental and African Studies, London; Member, School of Historical Studies*

March 14
Historical Studies Lunchtime Colloquium:
"The Judicial Process of Late Imperial China"
CHANG WEJEN, *Academia Sinica, Taiwan; Member, School of Historical Studies*

March 17
History of Science Seminar:
"Religion and the Origins of Modern Science"
PETER HARRISON, *Bond University, Queensland; Member, School of Historical Studies*

March 21
Historical Studies Lunchtime Colloquium:
"E.G., The IAS: Science, Civics & American Jews"
NOAH EFRON, *Bar Ilan University; Member, School of Historical Studies*

March 23
East Asian Studies Seminar:
"Strait Talk"
NANCY BERNKOPF TUCKER, *Georgetown University; Member, School of Historical Studies*

March 28
Historical Studies Lunchtime Colloquium:
"The Augustan Economy: A Core - Periphery Model"
OCTAVIAN BOUNEGRU, *Al. I. Cuza University, Iasi; Member, School of Historical Studies*

March 31
History of Science Seminar:
"The Yates Hypothesis and the Scientific Revolution"
HILARY GATTI, *Università di Roma "La Sapienza;" Member, School of Historical Studies*

April 6
Islamicist Seminar:
"On Ibn Rushd's Liberalism"
NELLY LAHOUD, *Goucher College*

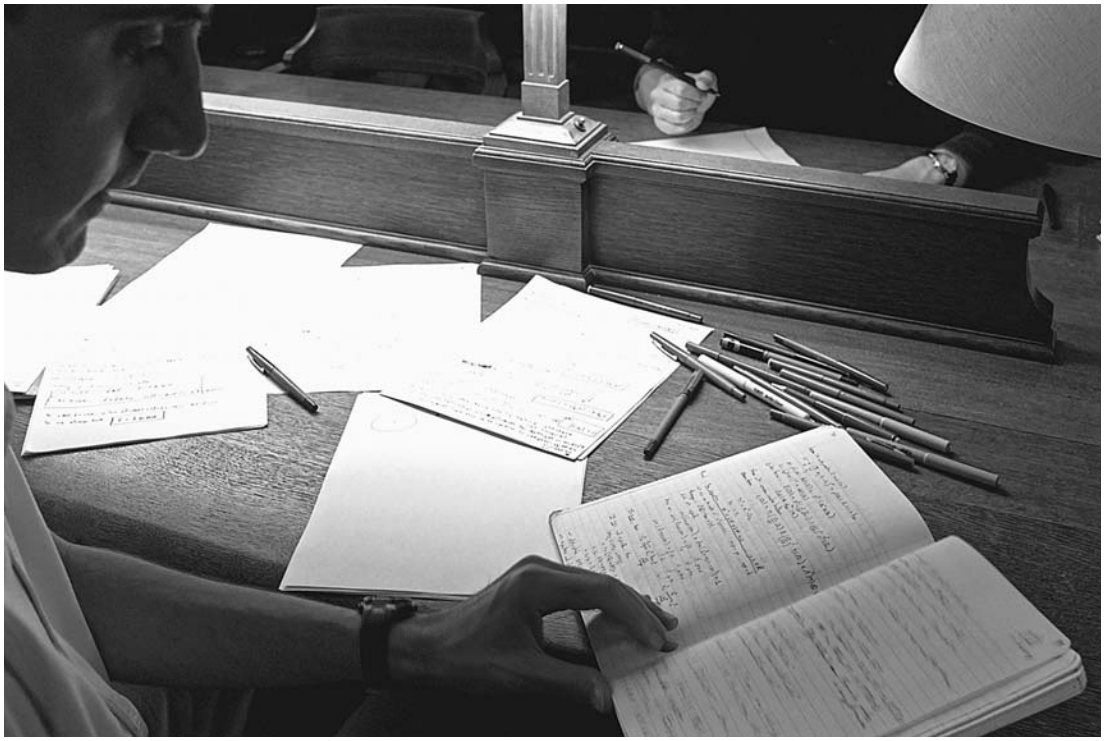
April 11
Islamicist Seminar:
"The Relationship Between Testimony, Reasoning, and Passions in Arabic Philosophy"
MAROUN AOUAD, *Centre National de la Recherche Scientifique, Paris; Member, School of Historical Studies*

April 12
Empire Group:
"Some Difficulties of Empire: Present, Past and Future"
LINDA COLLEY, *Princeton University*

April 13
Early Modern European Workshop:
"Adam's Encyclopaedia: Science, Sin, and Human Nature, 1500-1700"
PETER HARRISON, *Bond University, Queensland; Member, School of Historical Studies*

April 26
East Asian Studies Seminar:
"Archaeological Monuments in the Mongolian Altai"
DIIMAAJAV ERDENEBAATAR, *Institute of History of Mongolia*
and "The Khanuy Valley Project on Early Nomadic Pastoralism in Mongolia"
FRANCIS ALLARD, *Indiana University of Pennsylvania*

April 28
Empire Group:
"Ancient Ways of Legitimating the Roman Empire and Contemporary Debates"
PAOLO DESIDERI, *Università degli Studi di Firenze; Member, School of Historical Studies*



DAVID GRAHAM

"Being exposed to the breadth of knowledge represented by the Faculty and visitors has compelled me to look beyond my narrow interests in homotopy theory to new projects in geometry and algebra."

— Member, School of Mathematics

Mathematics-Natural Sciences Library, Fuld Hall

THE SCHOOL OF MATHEMATICS

Faculty

ENRICO BOMBIERI, *IBM von Neumann Professor*
JEAN BOURGAIN
PIERRE DELIGNE
PHILLIP A. GRIFFITHS
ROBERT P. LANGLANDS, *Hermann Weyl Professor*
ROBERT MacPHERSON
THOMAS SPENCER
VLADIMIR VOEVODSKY
AVI WIGDERSON, *Herbert H. Maass Professor*

Professors Emeriti

ATLE SELBERG

ACADEMIC ACTIVITIES

During the 2004-05 year, the School of Mathematics held a special program on the Bloch-Kato conjecture. There are two well-known conjectures in mathematics bearing this name. One concerns the behavior of L-functions and another relates Milnor's K-theory and etal cohomology. The topic of the program was the second Bloch-Kato conjecture. In its modern form this conjecture was formulated in the early 1980s when it was recognized that several previously known theorems and conjectures are particular cases of one general statement. Two most famous examples are the 'cyclicity' conjecture for central simple algebras which was formulated in the 1930s and proved by A. Merkurjev and A. Suslin in 1982 and the Milnor conjecture formulated in 1970 and proved by V. Voevodsky in 1995. The current approach to the general Bloch-Kato conjecture is based on a combination of ideas of V. Voevodsky and M. Rost.

The goal of the program was two-fold: to provide an opportunity for senior participants to interact and work together on completing the remaining components of the proof, and to introduce younger people interested in this subject to the techniques which were developed for the proof of the conjecture but which appear to be also applicable in a wider mathematical context.

The choice of program participants reflected these goals. Senior participants included M. Rost of the University of Bielefeld and A. Suslin of Northwestern University both of whom spent the full academic year at the Institute. A good group of mid-career people and a smaller number of postdocs were involved in the program. The relatively high proportion of senior and mid-career people in the program reflected the fact that the mathematics surrounding the Bloch-Kato conjecture is very complex.

The program was organized and led by V. Voevodsky with very active participation from P. Deligne. C. Weibel from Rutgers, The State University of New Jersey, was actively involved in the organization, and F. Morel of the University of Munich, A. Suslin of Northwestern and M. Rost of the University of Bielefeld were consulted in preparation.

In connection with the program, the School organized two weekly lecture series in the fall term and a lecture series and a seminar in the spring term. The fall lectures were given by V. Voevodsky and A. Suslin. Voevodsky's lectures were concentrated around the motivic cohomology of the motivic Eilenberg-MacLane spaces. Suslin gave a simple and detailed exposition of some of the results of M. Rost. In the fall there was also an informal seminar on Voevodsky's work. In the spring M. Rost continued Suslin's fall lectures concentrating on more recent aspects of his work. The seminar, largely organized by P. Deligne and C. Weibel, consisted of talks on Voevodsky's part of the Bloch-Kato conjecture proof and were given by younger participants of the program.

Younger participants of the program also contributed to the main lecture series by taking notes which were later typed. After final processing, these notes will be available in preprint form on the School of Mathematics website as well as on the standard preprint servers (notes of Voevodsky's lectures by V. Guletskii, notes of Suslin's lectures by S. Joukhovitski and notes of the Rost lectures by C. Haesemeyer).

As a result of the program, there were a number of interactions initiated several new collaborations among the participants.

The 2005 Marston Morse Memorial Lectures were given by R. Bezrukavnikov of Northwestern University, who spoke about recent advances in geometric representation theory. He gave two talks entitled "From Commutative to Non-Commutative Resolutions of Singularities via Quantization in Positive Characteristic" and "Algebraic Symplectic Resolutions, Representation Theory and Loop Groups."

The traditional number theory seminars with Princeton University continued to attract a good number of mathematicians from Princeton, the Institute and neighboring universities.

As in recent years the seminars in theoretical computer science and the related mathematics organized by A. Wigderson and A. Razborov were well-attended by both mathematicians and computer scientists from the Institute and other area scholars.

In October of 2004 with funds provided by the NSF, the School hosted a three-day conference on "Geometry, Combinatorics and Algebraic Groups" on the occasion of the 60th birthday of Robert MacPherson. The organizers of the conference were Pierre Deligne, Robert Langlands and Mark Goresky of the Institute. Speakers included D. Bliss at the Institute, A. Bjorner of The Royal Institute of Technology, Stockholm (KTH), T. Braden of the University of Massachusetts, W. Casselman of the University of British Columbia, W. Fulton of the University of Michigan, A. Goncharov of Brown University, L. Jeffrey of the University of Toronto, R. Kottwitz of the University of Chicago, E. Looijenga of the University of Utrecht, G. Lusztig of Massachusetts Institute of Technology, Zoltan Szabo of Princeton and K. Vilonen of Northwestern University.

During the 2005 year the Institute celebrates the 75th anniversary of it's founding in 1930 by holding a series of weekends dedicated to each School. The School of Mathematics, as the oldest School, was first to celebrate with a series of public lectures held on March 11-12. The lectures on March 11 were targeted for a general audience; speakers were Peter Sarnak of Princeton University, Avi Wigderson of the School of Mathematics, and

author George Dyson. The lectures on March 12 were for a mathematical audience; speakers were Sir Michael Atiyah of the University of Edinburgh, Raoul Bott of Harvard University, Weinan E of Princeton University, Frederich Hirzebruch of Bonn University and Peter Ozsváth of Columbia University.

Pierre Deligne received the 2004 Balzan Prize for "major contributions to several important domains of mathematics (like algebraic geometry, algebraic and analytic number theory, group theory, topology, Grothendieck theory of motives), enriching them with new and powerful tools and with magnificent results such as his spectacular proof of the 'Riemann hypothesis over finite fields' (Weil conjectures)."

In January 2005 Robert Langlands received the Leroy P. Steele Prize for seminal contribution to research.

THE SCHOOL OF MATHEMATICS

MEMBERS AND VISITORS

SCOTT AARONSON
Quantum computing, computational complexity
University of California, Berkeley

ALEJANDRO ÁDEM
Orbifolds and group cohomology
University of Wisconsin · *f*

SELMAN AKBULUT
Topology
Michigan State University · *s*

MIKHAIL ALEKHNOVITCH
Complexity theory
Institute for Advanced Study

NOGA ALON
Combinatorics
Tel Aviv University, Israel · *vp, s*

JARED ANDERSON
Geometric representation theory
University of Pittsburgh

ENRICO ARBARELLO
Algebraic geometry
Università di Roma "La Sapienza" · *s*

SHIRI ARTSTEIN
Asymptotic geometric anaylsis
Tel Aviv University, Israel · *vri*

MAHDI ASGARI
Automorphic forms
The University of Michigan

IOAN BADULESCU
Lie groups, representation theory
Institute for Advanced Study · *f*

BOAZ BARAK
Cryptography, complexity theory
Institute for Advanced Study

PAUL BAUM
K-theory
Pennsylvania State University · *f*

ELI BERGER
Combinatorics
Princeton University

PATRICK BROSNAN
Algebraic geometry
University of California, Los Angeles

JOHN CARDY
Statistical mechanics and quantum field theory
University of Oxford, United Kingdom · *j, f*

MARIA CHUDNOVSKY
Combinatorics and graph theory
Institute for Advanced Study · *vri*

MAURIZIO CORNALBA
Algebraic curves
Università di Pavia, Italy · *s*

VIOREL COSTEANU
Geometry
Massachusetts Institute of Technology

OVIDIU COSTIN
Nonlinear PDEs
Rutgers, The State University of New Jersey · *s*

SERGUEI DENISSOV
Spectral theory
California Institute of Technology

HAO FANG
Mathematical physics
Courant Institute of Mathematical Science

ERIC FRIEDLANDER
Algebraic K-theory
Northwestern University · *s*

JOHN FRIEDLANDER
Number theory
University of Toronto, Canada · *f*

SUSAN FRIEDLANDER
Fluid dynamics, PDEs
University of Illinois at Chicago · *s*

f First term · *j* Joint with School of Natural Sciences · *s* Second Term · *v* Visitor · *vp* Visiting Professor
vri Veblen Research Instructorship

ROLAND FRIEDRICH
Conformal quantum field theory
Institute for Advanced Study · *f*

HIDEKAZU FURUSHO
Number theory
Kyoto University, Japan

DAVID GALVIN
Combinatorics and graph theory
Microsoft Corporation

VÉRONIQUE GODIN
Algebraic topology
Stanford University

EDWARD GOLDSTEIN
Differential geometry, special structures on manifolds
Stanford University

MARK GORESKY
Geometry, automorphic forms
Institute for Advanced Study

VLADIMIR GULETSKII
Algebraic cycles
Universität Bielefeld, Germany · *f*

CHRISTIAN HAESEMEYER
Algebraic K-theory
University of Illinois

AMIR JAFARI
Number theory
Northwestern University

VSEVOLOD JOUKHOVITSKI
Motivic cohomology
University of California, Los Angeles

EFSTRATIA KALFAGIANNI
Low dimensional topology
Michigan State University

NIKITA KARPENKO
Quadratic forms
Universite d'Artois, France · *f*

MASAYUKI KAWAKITA
Algebraic geometry
University of Tokyo, Japan

MOTOKO KAWAKITA
Coding theory
Ochanomizu University, Japan · *v*

GUY KINDLER
Approximation
Rutgers, The State University of New Jersey

BO'AZ KLARTAG
High-dimensional geometry
Tel Aviv University, Israel

MIKHAIL KOGAN
Symplectic geometry
Institute for Advanced Study

GADY KOZMA
Harmonic analysis
Tel Aviv University, Israel

DANIEL KRASHEN
Homogeneous varieties
Yale University

AMALENDU KRISHNA
K-theory
University of California, Los Angeles

AOBING LI
Conformal geometry
Rutgers, The State University of New Jersey

XIAOCHUN LI
Harmonic analysis
University of California, Los Angeles

CIPRIAN MANOLESCU
Gauge theory and low-dimensional topology
Harvard University · *vri*

CARLO MAZZA
Algebraic cycles
Rutgers, The State University of New Jersey · *s*

WERNER MÜLLER
Geometric analysis
Universität Bonn, Germany · *s*

WALTER NEUMANN
Geometry and topology
Columbia University · *s*

f First term · *j* Joint with School of Natural Sciences · *s* Second Term · *v* Visitor · *vp* Visiting Professor
vri Veblen Research Instructorship

ZHAOHU NIE
Algebraic geometry
The State University of New York at Stony Brook · *v*

MARTIN OLSSON
Arithmetic algebraic geometry
Massachusetts Institute of Technology

DMITRI ORLOV
Algebraic geometry
Steklov Mathematical Institute, Russia · *f*

PAUL ARNE ØSTVÆR
Algebraic K-theory
University of Oslo, Norway · *s*

IVAN PANIN
Motivic cohomology
Steklov Mathematical Institute, Russia · *f*

GEORGIOS PAPPAS
Galois modules, Shimura varieties
Michigan State University

GREGORY PEARLSTEIN
Variations of Hodge structures
University of California, Irvine

AUGUSTO PONCE
Nonlinear PDEs
Rutgers, The State University of New Jersey

ZOI RAPTI
Nonlinear waves, Hamiltonian systems
University of Massachusetts · *v*

JACOB RASMUSSEN
Gauge-theoretic invariants of manifolds
Institute for Advanced Study · *vri*

ETIENNE RASSART
Combinatorial aspects of representation theory
Massachusetts Institute of Technology

ALEXANDER RAZBOROV
Combinatorics, theoretical computer science, complexity theory
Institute for Advanced Study · *vp*

MORTEN RISAGER
Automorphic forms
Aarhus Universitet, Denmark

MARKUS ROST
Motivic cohomology
Universität Bielefeld, Germany

SHMUEL SAFRA
Complexity theory
Tel Aviv University, Israel

ALEXANDR SMIRNOV
Arithmetic algebraic geometry
Steklov Mathematical Institute, Russia

EUGENE SPEER
Statistical mechanics
Rutgers, The State University of New Jersey · *f*

JACOB STERBENZ
Non-linear wave equations
Institute for Advanced Study · *vri*

ANDRÁS STIPSICZ
Contact and symplectic topology
Hungarian Academy of Sciences, Hungary

ANDREI SUSLIN
Algebraic K-theory
Northwestern University

YURI TSCHINKEL
Arithmetic of algebraic varieties
Universität Göttingen, Germany · *s*

NIKOLAOS TZIRAKIS
Dispersive PDEs
University of Massachusetts

ALEXANDER VISHIK
Quadratic forms, motives
Moscow Independent University, Russia

THOMAS WATSON
Automorphic forms, L-functions
University of California, Los Angeles

KATRIN WEHRHEIM
Gauge theory and symplectic geometry
Princeton University

DROR WEITZ
Randomized algorithms
University of California, Berkeley

CRAIG WESTERLAND
Homotopy theory
University of Michigan

f First term · *j* Joint with School of Natural Sciences · *s* Second Term · *v* Visitor · *vp* Visiting Professor
vri Veblen Research Instructorship

THE SCHOOL OF MATHEMATICS

RECORD OF EVENTS

The following is a calendar of events sponsored by the School of Mathematics

Academic Year 2004-05

September 23

Short Talks by Postdoctoral Members:
"Bases for Equivariant Cohomology and K-Theory"
MIKHAIL KOGAN, *Institute for Advanced Study*
"BCOV Torsion for Calabi-Yau Manifolds"
HAO FANG, *Institute for Advanced Study*
"Fat Graphs and the Bordered Mapping Class Group"
VÉRONIQUE GODIN, *Institute for Advanced Study*
"Floer Theories in Symplectic Geometry and Gauge Theory"
KATRIN WEHRHEIM, *Institute for Advanced Study*
"Knot Polynomials and Knot Homologies"
JACOB RASMUSSEN, *Institute for Advanced Study*
"Volume Minimization for Isotropic Submanifolds"
EDWARD GOLDSTEIN, *Institute for Advanced Study*

September 24

Short Talks by Postdoctoral Members:
"Algebraic K-Theory of Singularities"
CHRISTIAN HAESEMEYER, *Institute for Advanced Study*
"Function Spaces in Algebraic Topology"
CRAIG WESTERLAND, *Institute for Advanced Study*
"On the Reduced Whitehead Group of a Central Simple Algebras"
VSEVOLOD JOUKHOVITSKI, *Institute for Advanced Study*
"p-Adic Hodge Theory for Homotopy Groups"
MARTIN OLSSON, *Institute for Advanced Study*
"p-Adic Multiple Zeta Values"
HIDEKAZU FURUSHO, *Institute for Advanced Study*
"Regulators on Curves"
AMIR JAFARI, Institute for Advanced Study

September 27

Computer Science/Discrete Math Seminar I:
"On the Measure of Interesting Families via Spectral Methods"
EHUD FRIEDGUT, *Hebrew University of Jerusalem*

Short Talks by Postdoctoral Members:
"Explicit Study of the Three-Folds"
MASAYUKI KAWAKITA, *Institute for Advanced Study*
"Karoubi's Construction for Motivic Cohomology Operations"
ZHAOHU NIE, *Institute for Advanced Study*
"On the p-Typical de Rham-Witt Complex"
VIOREL COSTEANU, *Institute for Advanced Study*
"Singularities of Variations of Mixed Hodge Structure"
GREGORY PEARLSTEIN, *Institute for Advanced Study*
"Zero-Cycles on Homogeneous Varieties"
DANIEL KRASHEN, *Institute for Advanced Study*

September 28

Short Talks by Postdoctoral Members:
"Computing Combinatorial Invariants from Representation Theory"
ETIENNE RASSART, *Institute for Advanced Study*
"Jacquet-Langlands Correspondence"
IOAN BADULESCU, *Institute for Advanced Study*
"Mirkovic-Vilonen Polytopes and Polynomials"
JARED ANDERSON, *Institute for Advanced Study*
"Modular Symbols and Existence of Maass Cusp Forms"

MORTEN RISAGER, *Institute for Advanced Study*
"Rankin Triple Products and Quantum Chaos"
THOMAS WATSON, *Institute for Advanced Study*
"Transfer of Generic Automorphic Representations to GL(N)"
MAHDI ASGARI, *Institute for Advanced Study*

September 29
Short Talks by Postdoctoral Members:
"Global Well-Posedness for the Klein-Gordon-Schrödinger System in Low Dimensions Below the Energy Space"
NIKOLAOS TZIRAKIS, *Institute for Advanced Study*
"Instabilities for NLS Equations With a Periodic Potential"
ZOI RAPTI, *Institute for Advanced Study*
"On Some Conformally Invariant Fully Nonlinear Equations"
AOBING LI, *Institute for Advanced Study*
"The Hilbert Transform Along Vector Field"
XIAOCHUN LI, *Institute for Advanced Study*

October 1
Special Seminars:
"Divisibility of the Kappa Class"
ULRIKE TILMAN, *Oxford University*
"Moduli of Connections With a Small Parameter on a Curve"
DIMA ARINKIN, *University of Chicago*

October 4
Short Talks by Postdoctoral Members:
"Counting Graph Homomorphisms"
DAVID GALVIN, *Institute for Advanced Study*
"Dynamic Monopolies of Constant Size"
ELI BERGER, *Institute for Advanced Study*
"Loop-Erased Random Walk"
GADY KOZMA, *Institute for Advanced Study*

Computer Science/Discrete Math Seminar I:
"Lower Bounds for Linear Degeneracy Testing"
NIR AILON, *Princeton University*

Short Talks by Postdoctoral Members:
"Multidimensional Schrödinger Operators With Slowly Decaying and Random Potentials"
SERGUEI DENISSOV, *Institute for Advanced Study*
"Stochastic Lowner Equation Conformal Field Theory"
ROLAND FRIEDRICH, *Institute for Advanced Study*
"Structural Graph Theory"
MARIA CHUDNOVSKY, *Institute for Advanced Study*

October 5
Computer Science/Discrete Math Seminar II:
"The Complexity of Agreement"
SCOTT AARONSON, *Institute for Advanced Study*

Short Talks by Postdoctoral Members:
"Curves with Many Rational Points"
MOTOKO KAWAKITA, *Institute for Advanced Study*
"How a Theorem of A. A. Markov's Younger Brother Tells Us a Limitation of Quantum Advisors"
SCOTT AARONSON, *Institute for Advanced Study*
"Reduced Measures and Nonlinear Elliptic Equations"
AUGUSTO PONCE, *Institute for Advanced Study*
"SAT Problems from a Spin-Systems Point of View"
DROR WEITZ, *Institute for Advanced Study*
"Some Conjectures on Noise-Stability with Applications to Computer-Science"
GUY KINDLER, *Institute for Advanced Study*
"The Slicing Problem and Geometric Symmetrization Methods"
BO'AZ KLARTAG, *Institute for Advanced Study*
"Zero Cycles on Singular Surfaces"
AMALENDU KRISHNA, *Institute for Advanced Study*

October 7-9
A Conference on the Occasion of the Sixtieth Birthday of Robert MacPherson: "Geometry, Combinatorics and Algebraic Groups"

October 11
Computer Science/Discrete Math Seminar I:
"Toward Privacy in Public Databases"
CYNTHIA DWORK, *Microsoft Research*

October 12
Computer Science/Discrete Math Seminar II:
"The Intersection of a Matroid and a Simplicial Complex"
ELI BERGER, *Institute for Advanced Study*

October 13
Bloch-Kato Conjecture Seminar:
"Introductory Talk"
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

October 14
Informal Seminar:
"Isoperimetric Inequalities and Random Walk"
GADY KOZMA, *Institute for Advanced Study*

October 19
Special Statistical Mechanics Seminar:
"Hiking on the Gaussian Free Field With an Altimeter and a Compass"
SCOTT SHEFFIELD, *University of California, Berkeley*

October 20
Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties:
ANDREI SUSLIN, *Institute for Advanced Study*

Special Statistical Mechanics Seminar:
"Diffusions on Moduli Spaces as Generators for Random Sets"
ROLAND FRIEDRICH, *Institute for Advanced Study*

October 22
Ruth and Irving Adler Expository Lecture in Mathematics:
"Calibrations in Geometry and Topology"
ROBERT BRYANT, *Duke University*

October 25
Computer Science/Discrete Math Seminar I:
"Tic-Tac-Toe Games: Exact Values of Infinitely Many Game Numbers"
JOZSEF BECK, *Rutgers, The State University of New Jersey*

October 26
Computer Science/Discrete Math Seminar II:
"Explicit Constructions of Bipartite Ramsey Graphs"
BOAZ BARAK and GUY KINDLER, *Institute for Advanced Study*

Special Statistical Mechanics Seminar:
"Tug of War and the Infinity Laplacian"
SCOTT SHEFFIELD, *University of California, Berkeley*

October 27
Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties:
ANDREI SUSLIN, *Institute for Advanced Study*

October 28
Informal Seminar:
"Limits on Efficient Computation in the Physical World"
SCOTT AARONSON, *Institute for Advanced Study*

November 1
Computer Science/Discrete Math Seminar I:
"Influences and Decision Tree Complexity"
MICHAEL SAKS, *Rutgers, The State University of New Jersey*

November 2
Computer Science/Discrete Math Seminar II:
"Explicit Constructions of Bipartite Ramsey Graphs"
BOAZ BARAK and GUY KINDLER, *Institute for Advanced Study*

November 3
Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties:
ANDREI SUSLIN, *Institute for Advanced Study*

November 4
Mathematical Physics Seminar:
"Conformal Invariance and the Diffusion on Moduli Space for Radial SLE"
ROBERT BAUER, *University of Illinois, at Urbana-Champaign*

November 8
Computer Science/Discrete Math Seminar I:
"Approximation Algorithms for Embeddings into Low-Dimensional Spaces"
PIOTR INDYK, *Massachusetts Institute of Technology*

November 9
Computer Science/Discrete Math Seminar II:
"Slow Mixing of Local Dynamics for Colourings and Independent Sets"
DAVID GALVIN, *Institute for Advanced Study*

Mathematical Physics Seminar:
"Matrix Models, Random Partitions, Planar Graphs and Random Surfaces"
VLADIMIR KAZAKOV, *École Normale Supérieure de Lyon*

November 10
Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, Institute for Advanced Study

Norm Varieties:
ANDREI SUSLIN, *Institute for Advanced Study*

November 15
Computer Science/Discrete Math Seminar I:
"On Sensitivity and Chaos"
ELCHANAN MOSSEL, *University of California, Berkeley*

November 16
Computer Science/Discrete Math Seminar II:
"Slow Mixing of Local Dynamics for Colourings and Independent Sets"
DAVID GALVIN, *Institute for Advanced Study*

Mathematical Physics Seminar:
"Seiberg-Witten Theory and Random Partitions"
ANDREI OKOUNKOV, *Princeton University*

November 17
Norm Varieties:
ANDREI SUSLIN, *Institute for Advanced Study*

November 22
Computer Science/Discrete Math Seminar I:
"Using Nondeterminism to Amplify Hardness"
EMANUELE VIOLA, *Harvard University*

Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

November 23
Computer Science/Discrete Math Seminar II:
"Learnability and Automatizability"
MICHAEL ALEKHNOVICH, *Institute for Advanced Study*

November 24
Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties:
ANDREI SUSLIN, *Institute for Advanced Study*

November 29
Computer Science/Discrete Math Seminar I:
"An Unconditional Study of Computational Zero Knowledge"
SALIL VADHAN, *Harvard University*

November 30
Algebraic Groups and Convexity:
"Equivariant Localization"
CHRISTOPHER WOODWARD, *Rutgers, The State University of New Jersey*

Computer Science/Discrete Math Seminar II:
"On Random Bernoulli Matrices: Singularity and Determinant"
VAN VU, *University of California, San Diego*

K-Theory of Group C* Algebras (an Introduction to K-Theory and the Baum-Connes Conjecture):
"Some Classical Problems and Conjectures"
PAUL BAUM, *Institute for Advanced Study*

December 1
Function Theory:
"ABC, Waring and Fermat for Functions"
WALTER K. HAYMAN, *Imperial College, London*

Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties:
ANDREI SUSLIN, I*nstitute for Advanced Study*

December 2
K-Theory of Group C* Algebras (an Introduction to K-Theory and the Baum-Connes Conjecture):
"What Is K-Theory and What Is It Good For?"
PAUL BAUM, *Institute for Advanced Study*

Special Mathematical Physics Seminar:
"Supersymmetric Formulation of Network Models in Class C"
JOHN CARDY, *Oxford University and Institute for Advanced Study*

December 3
Special Seminar:
"Equidistribution and Bounds for L-Functions"
AKSHAY VENKATESH, *Clay Mathematics Institute and New York University*

December 6
Computer Science/Discrete Math Seminar I:
"Several Geometric Applications of Chernoff Estimates: A Zigzag Approximation for Balls and Some Random Matrices"
SHIRI ARTSTEIN, *Princeton University and Institute for Advanced Study*
Members Seminar:
"Completing the Bernstein Program (a Geometric Conjecture Within the Representation Theory of p-Adic Groups)"
PAUL BAUM, *Institute for Advanced Study*

December 7
Computer Science/Discrete Math Seminar II:
"Variance/Entropy Decomposition Techniques for Proving Fast Mixing of the Glauber Dynamics"
DROR WEITZ, *Institute for Advanced Study*
K-Theory of Group C* Algebras (an Introduction to K-Theory and the Baum-Connes Conjecture):
"Dirac Operator"
PAUL BAUM, *Institute for Advanced Study*

Mathematical-Physics Seminar:
"Large Deviations for a Point Process of Bounded Variability"
EUGENE SPEER, *Rutgers, The State University of New Jersey*

December 8
Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties:
ANDREI SUSLIN, *Institute for Advanced Study*

December 9
K-Theory of Group C* Algebras (an Introduction to K-Theory and the Baum-Connes Conjecture):
"Universal Example for Proper Actions"
PAUL BAUM, *Institute for Advanced Study*

December 13
Computer Science/Discrete Math Seminar I:
"On Learning Random Decision Trees and DNF Formulas"
ROCCO SERVEDIO, *Columbia University*

December 14
Computer Science/Discrete Math Seminar II:
"Variance/Entropy Decomposition Techniques for Proving Fast Mixing of the Glauber Dynamics"
DROR WEITZ, *Institute for Advanced Study*
Mathematical Physics Seminar:
"Jamming and k-core Percolation"
ANDREA LIU, *University of Pennsylvania*

December 15
Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

January 17
Computer Science/Discrete Math Seminar I:
"Multicommodity Flow, Well-Linked Terminals, and Routing Problems"
CHANDRA CHEKURI, *Lucent Technologies, Bell Labs*

January 18
Algebraic Groups and Convexity Seminar:
"Morse Theory and Tilting Sheaves"
DAVID NADLER, *University of Chicago*

Computer Science/Discrete Math Seminar, II:
"On Lattices, Learning With Errors, Random Linear Codes, and Cryptography"
ODED REGEV, *Tel Aviv University*

January 19
Motivic Eilenberg-MacLane Spaces:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties Seminar:
MARKUS ROST, *Institute for Advanced Study*

January 24
Computer Science/Discrete Math Seminar I:
"Shorter and Simpler PCPs"
MADHU SUDAN, *Massachusetts Institute of Technology*

January 25
Computer Science/Discrete Math Seminar II:
"The Tic-Tac-Toe Theory"
JOZSEF BECK, *Rutgers, The State University of New Jersey*

January 26
Norm Varieties Seminar:
MARKUS ROST, *Institute for Advanced Study*

January 27
Algebraic Groups and Convexity Seminar:
"Equivariant Localization and Quot Schemes"
TOM BRADEN, *University of Massachusetts at Amherst*

January 31
Computer Science/Discrete Math Seminar I:
"Extremal Graphs, Recursive Functions and a Separation Theorem in Property Testing"
ASAF SHAPIRA, *Tel Aviv University*

Members Seminar:
"Approximation Algorithms and Grothendieck Type Inequalities"
NOGA ALON, *Institute for Advanced Study*

February 1
Computer Science/Discrete Math Seminar, II:
"Geometric Symmetrizations in High Dimension"
BO'AZ KLARTAG, *Institute for Advanced Study*

February 2
Motivic Eilenberg-MacLane Spaces Seminar:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties Seminar:
MARKUS ROST, *Institute for Advanced Study*

February 7
Computer Science/Discrete Math Seminar I:
"Embedding Almost Spanning Bounded Degree Trees"
MICHAEL KRIVELEVICH, *Tel Aviv University*

Members Seminar:
"Local Models of Shimura Varieties"
GEORGE PAPPAS, *Institute for Advanced Study*

February 8
Complex Geometry Seminar:
"A Hodge Theoretic Approach to the Decomposition Theorem"
LUCA MIGLIORINI, *University of Bologna, Italy*

Computer Science/Discrete Math Seminar II:
"Forcing With Random Variables"
JAN KRAJICEK, *Academy of Sciences of Czech Republic*

February 9
Motivic Eilenberg-MacLane Spaces Seminar:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

Norm Varieties:
MARKUS ROST, *Institute for Advanced Study*

February 14
Computer Science/Discrete Math Seminar I:
"The Dynamics of Boosting"
CYNTHIA RUDIN, *New York University*

Members Seminar:
"Blow up in a 3-D 'toy' Model for the Euler Equations"
SUSAN FRIEDLANDER, *Institute for Advanced Study*

February 15
Computer Science/Discrete Math Seminar II:
"Fixed Point Properties of Random Groups"
LIOR SILBERMAN, *Princeton University*

February 16
Motivic Cohomology with Z/l-Coefficients Part 1:
CHUCK WEIBEL, *Rutgers, The State University of New Jersey*
Norm Varieties Seminar:
MARKUS ROST, *Institute for Advanced Study*

February 21
Computer Science/Discrete Math Seminar I:
"Cryptography in NC0"
YUVAL ISHAI, *Technion*

February 22
Computer Science/Discrete Math Seminar, II:
"Quadratic Forms on Graphs"
KONSTANTIN MAKARYCHEV, *Princeton University*

Members Seminar:
"A New Characterization of Sobolev Spaces"
AUGUSTO PONCE, *Institute for Advanced Study*

February 23
Motivic Cohomology with Z/l-Coefficients Part 2:
CHUCK WEIBEL, *Rutgers, The State University of New Jersey*

Motivic Cohomology with Z/l-Coefficients Part 3:
ANDREI SUSLIN, *Institute for Advanced Study*

February 28
Norm Varieties:
MARKUS ROST, *Institute for Advanced Study*

Special Seminar:
"Undirected Graph Connectivity in Log-Space (SL=L)"
OMER REINGOLD, *Weizmann Institute of Science*

March 1
Computer Science/Discrete Math Seminar II:
"Pseudorandom Walks in Biregular Graphs and the RL vs. L Problem"
OMER REINGOLD, *Weizmann Institute of Science*

March 2
Joint IAS-Princeton Complex Geometry Seminar:
"An Obstruction to Constant Scalar Curvature Kahler Metrics"
JULIUS ROSS, *Columbia University*
Norm Varieties:
MARKUS ROST, *Institute for Advanced Study*

March 7
Computer Science/Discrete Math Seminar I:
"Graph Homomorphisms, Statistical Physics, and Limits of Graph Sequences"
LASZLO LOVASZ, *Microsoft Research, Redmond, WA and Eotvos Lorand University, Budapest*

Norm Varieties:
MARKUS ROST, *Institute for Advanced Study*

Members Seminar:
"p-Adic Multiple Zeta Values"
HIDEKAZU FURUSHO, *Institute for Advanced Study*

March 8
Computer Science/Discrete Math Seminar II:
"Excited Random Walk"
GADY KOZMA, *Institute for Advanced Study*

March 9
Motivic Cohomology:
ALEXANDER VISHIK, *Institute for Advanced Study*

Norm Varieties:
MARKUS ROST, *Institute for Advanced Study*

March 14
Computer Science/Discrete Math Seminar I:
"Random Walk on Oriented Hypercubes"
TIBOR SZABO, *Eidgenössische Technische Hochschule Zürich*

Members Seminar:
"A Liouville Type Result for Some Conformally Invariant Fully Nonlinear Equations"
AOBING LI, *Institute for Advanced Study*

March 15
Computer Science/Discrete Math Seminar II:
"Gems of Combinatorial Number Theory"
AVI WIGDERSON, *Institute for Advanced Study*

Marston Morse Lectures:
"From Commutative to Non-Commutative Resolutions of Singularities via Quantization in Positive Characteristic"
ROMAN BEZRUKAVNIKOV, *Northwestern University and Hebrew University of Jerusalem*

March 16
Marston Morse Lectures:
"Algebraic Symplectic Resolutions, Representation Theory, and Loop Groups"
ROMAN BEZRUKAVNIKOV, *Northwestern University and Hebrew University of Jerusalem*

Motivic Cohomology:
VLADIMIR GULETSKII, *Institute for Advanced Study*

Norm Varieties:
MARKUS ROST, *Institute for Advanced Study*

March 21
Computer Science/Discrete Math Seminar I:
"Network Games and the Price of Stability or Anarchy"
EVA TARDOS, *Cornell University*

Members Seminar:
"Polynomiality Properties of Type A Weight and Tensor Product Multiplicities"
ETIENNE RASSART, *Institute for Advanced Study*

March 22
Computer Science/Discrete Math Seminar II:
"1 Dimensional Diffusion Limited Aggregation (DLA)"
GIDEON AMIR, *Weizmann Institute of Science*

Computer Science/Discrete Math Seminar III:
"Information Theory and Probability Estimation"
ALON ORLITSKY, *University of California, San Diego*

IAS/Princeton Complex Geometry:
"Analytic Torsion on Calabi-Yau Manifolds"
HAO FANG, *Institute for Advanced Study*

March 23
Motivic Cohomology:
CHRISTIAN HAESEMEYER, *Institute for Advanced Study*

Norm Varieties:
MARKUS ROST, *Institute for Advanced Study*

March 28
Computer Science/Discrete Math Seminar I:
"Max Cut - A Combinatorial Perspective"
BENNY SUDAKOV, *Princeton University*

Members Seminar:
"Exotic Smooth Structures on Rational Surfaces"
ANDRAS STIPSICZ, *Institute for Advanced Study*

March 29
Computer Science/Discrete Math Seminar II:
"Controlled Linear Programming and Linear Complementarity for Some Infinite Games in NP ∩ CoNP"
SERGEI VOROBYOV, *Uppsala University, Sweden*

April 4
Computer Science/Discrete Math Seminar I:
"Conflict-Free Colorings"
SHAKHAR SMORODINSKY, *Courant Institute*

April 5
Computer Science/Discrete Math Seminar II:
"Even Hole Free Graphs"
MARIA CHUDNOVSKY, *Institute for Advanced Study*

April 6
Motivic Cohomology:
VLADIMIR VOEVODSKY, *Institute for Advanced Study*

April 11
Computer Science/Discrete Math Seminar I:
"Aggregating Inconsistent Information: Ranking and Clustering"
NIR AILON, *Princeton University*
Members Seminar:
"Iterated Integrals and Algebraic Cycles"
AMIR JAFARI, *Institute for Advanced Study*

April 12
Computer Science/Discrete Math Seminar II:
"Cuts, Quadratic Programs and in Between"
MULI SAFRA, *Institute for Advanced Study*

April 13
Motivic Cohomology:
ZHAOHU NIE, *Institute for Advanced Study*

Special Computer Science/Discrete Math Seminar III:
"Linear-Degree Extractors and the NP-Completeness of Approximating Clique and Chromatic Number"
DAVID ZUCKERMAN, *University of Texas at Austin*

April 18
Computer Science/Discrete Math Seminar I:
"Towards Strong Inapproximability Results in the Lovasz-Schrijver Hierarchy"
IANNIS TOURLAKIS, *Princeton University*

April 19
Computer Science/Discrete Math Seminar II:
"Additive Approximation for Edge-Deletion Problems"
NOGA ALON, *Institute for Advanced Study*

April 25
Computer Science/Discrete Math Seminar I:
"On Non-Uniform Multicommodity Buy-at-Bulk Network Design"
ADRIANA KARAGIOZOVA, *Princeton University*

April 26
Computer Science/Discrete Math Seminar II:
"Lower Bounds for the Noisy Broadcast Problem"
NAVIN GOYAL, *Rutgers, The State University of New Jersey*

May 2
Computer Science/Discrete Math Seminar I:
"Capacities of Graph Powers"
EYAL LUBETZKY, *Tel Aviv University*

May 3
Computer/Science Discrete Math Seminar II:
"Extremal Erdös-Szekeres Permutations and Square Young Tableaux"
DAN ROMIK, *Mathematical Sciences Research Institute*

May 6
Computer Science/Discrete Math Seminar III:
"An O(log n log log n) Space Algorithm for Undirected st-Connectivity"
VLADIMIR TRIFONOV, *University of Texas at Austin*

May 9
Computer Science/Discrete Math Seminar I:
"On Routing Without Regret"
AVRIM BLUM, Carnegie Mellon University

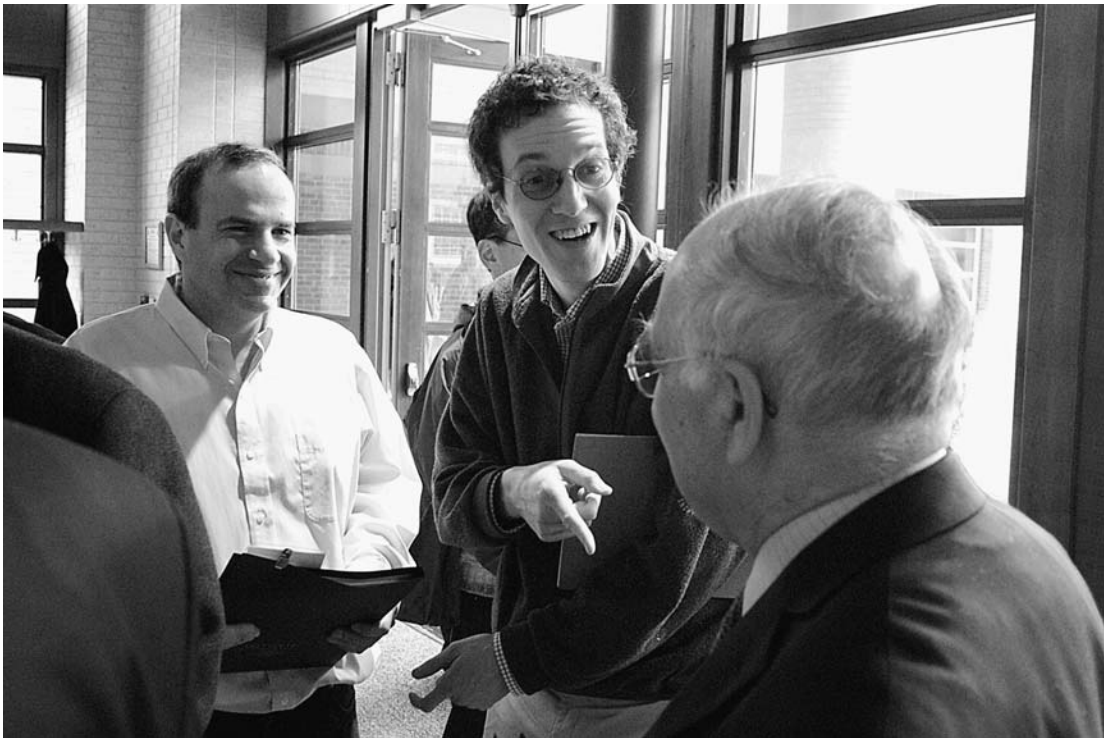
May 31
Computer Science/Discrete Math Seminar I:
"A Formal Model for Dynamic Programming"
RUSSELL IMPAGLIAZZO, *University of California, San Diego*

Computer Science/Discrete Math Seminar II:
"Approximation Algorithms for Unique Games"
LUCA TREVISAN, *University of California, Berkeley*

June 1
Computer Science/Discrete Math Seminar III:
"Computing Equilibria"
CHRISTOS PAPADIMITRIOU, *University of California, Berkeley*

June 7 - 18
Focused Research Group:
"Holomorphic Curves Workshop"

June 13
Computer Science/Discrete Math Seminar I:
"The PCP Theorem by Gap Amplification"
IRIT DINUR, *Hebrew University of Jerusalem*



CLIFF MOORE

"I have greatly benefited from the academic environment here. In particular, the collaborations and informal discussions with Faculty and fellow postdocs in the School of Natural Sciences have been stimulating and highly valuable for my scientific work. Moreover, I have had the opportunity for frequent interactions with Members in the School of Mathematics, and these have been valuable as well."

— Member, School of Natural Sciences

Wolfensohn Hall on the occasion of the School of Mathematics' celebration of the Institute's 75th anniversary

THE SCHOOL OF NATURAL SCIENCES

Faculty

STEPHEN L. ADLER, Particle Physics

JOHN N. BAHCALL, Astrophysics
Richard Black Professor

PETER GOLDREICH, Astrophysics

ARNOLD J. LEVINE, Systems Biology

JUAN MALDACENA, Theoretical Physics

NATHAN SEIBERG, Theoretical Physics

EDWARD WITTEN, Mathematical Physics
Charles Simonyi Professor

Professor Emeritus

FREEMAN J. DYSON, Mathematical Physics and Astrophysics

ACADEMIC ACTIVITIES

During the 2004-05 academic year, PROFESSOR STEPHEN ADLER divided his time between historical and survey writing, and research on the phenomenology of stochastic modifications of the Schrödinger equation. In the category of history and surveys: (1) Adler wrote an article on the relationship of aspects of his work on monopoles and quaternionic quantum mechanics to issues in pure mathematics. This article discusses events leading to the proof of an important multimonopole existence proof by Clifford Taubes in the course of a visit to the Institute, and then analyzes the relationship between Adler's introduction of the concept of a weak projective group representation and a classification theorem proved by Tao and Millard. The article is intended for a volume on the influence of Yang-Mills theory on pure mathematics, with G. 't Hooft and W. Nahm as editors, to be published by *World Scientific*. (2) Adler wrote an article surveying the field of anomalies that will appear in the *Encyclopedia of Mathematical Physics*. (3) He wrote some short remarks on the history of quantum chromodynamics that have been submitted as a Letter to *Physics Today*. (4) Adler's current major historical project is a book, entitled "Adventures in Theoretical Physics," containing reprints of his selected papers and a group of historical commentaries about different topics on which he has worked. The commentaries are nearly complete and have been posted on the Archive for comment; the final manuscript will be submitted in early fall.

In the category of stochastic Schrödinger equations, Adler wrote two papers in collaboration with Bassi and Ippoliti, that analyzed the Marshall et al. experiment designed to test Penrose's ideas on state vector reduction, to see what constraints it would put on stochastic localization models. In the course of this work they found an exact solution to the stochastically modified equation for the Marshall et al. apparatus, that can also be viewed as an exact solution to a decoherence problem. They concluded that the proposed experiment is still about 8 orders of magnitude away from confronting stochastic local-

ization theories. Adler also wrote a paper analyzing the implications of stochastic localization models for a nanomechanical resonator and for LIGO-type gravitational wave detection experiments, as applications of an exact solution that he gave for the non-dissipative decoherent forced harmonic oscillator. The proposed LISA experiment comes closest to having the capability of seeing an effect, but is still about 3 orders of magnitude away from the needed sensitivity. In this paper he also corrected a factor of 2 error in estimates for the free particle case given earlier by Ghirardi, Pearle, and Rimini; Pearle has subsequently confirmed this correction.

PROFESSOR JOHN BAHCALL concentrated on problems related to helioseismology (which determines the interior properties of the Sun by measuring waves on the surface of the Sun), on refinements in the interpretation of solar neutrino oscillations, on the implications of new measurements of the surface composition of the Sun and of the calculated radiative opacity, and on the frequency of wide binaries in the Galaxy.

The most ambitious project is a Monte Carlo simulation of what we think we know about the Sun. This project, being carried out together with Aldo Serenelli (Institute for Advanced Study Member) and Sarbani Basu (Yale University and former Institute Member), will utilize 10,000 precise solar models calculated with the aid of the new Scheide computer cluster. For each model, the 21 important input parameters are chosen separately from their individual probability distributions. At this stage, we are using the models to calculate 23 output (predicted) quantities describing solar neutrino emission, solar energy generation, and helioseismologically determined quantities (such as the profiles of sound speeds and densities versus solar radius, the surface helium abundance, and the depth of the solar convective zone). At this writing, we have calculated 5,000 solar models (using an older and preferred set, according to some criteria, of surface chemical elements) and have analyzed 3,000 of these models. We need still to construct 5,000 additional models that incorporate the most recent determinations of the surface chemical composition of the Sun. The results of this Monte Carlo study will provide directly the only quantitative measure of the agreement or disagreement between the helioseismologically measured solar parameters and the solar model predictions. We expect that this Monte Carlo technique will be adopted for the emerging studies of other stars by astroseismology techniques (although the measured parameter space will be much smaller). The data-base produced by the Monte Carlo study, which is unprecedented in the theory of stellar evolution, will be publicly available and will be used by astrophysicists and physicists to study a variety of problems. For example, Bahcall and Carlos Pena-Garay (Institute Member) have already begun to use the calculated correlations between all of the solar neutrino fluxes to refine determinations of solar neutrino oscillations parameters (mass and mixing angles) and to make more precise predictions for future solar neutrino experiments.

In a series of papers published during the year, Bahcall, Serenelli, and Basu studied implications of the new determination of solar surface abundances of heavy elements. They showed that solar models constructed with the new abundances gave worse agreement with solar model predictions than was achieved using the older (previously standard) abundances. Bahcall et al. conjectured that the radiative opacity might be incorrectly calculated by about 11% at temperatures and densities that correspond to 0.45 solar radii to 0.7 solar radii. The first test by the Opacity Project headed by Professor M. Seaton did not confirm this conjecture. A very different possible explanation of the conflict between

helioseismological measurements and theoretical solar models was also proposed by Bahcall, Basu, and Serenelli. They suggested that the surface abundance of neon, which is very difficult to measure for stars like the Sun, could be a factor of about 2.5 times larger than the currently standard value. This conjecture has been supported by the measurement of the neon abundance in nearby stars (where neon is easier to observe) using x-ray observations with the Chandra satellite. This observational program was led by J. Drake (Center for Astrophysics, Harvard). Bahcall et al. regard the present evidence on the radiative opacity and on the surface abundance of neon as very important but not yet conclusive.

In a completely different kind of project, Bahcall, S. Tremaine (former Institute Member, now professor at Princeton University), and T. Sumi (Princeton University, postdocdoctoral), are using the Sloan Digital Sky Survey (for which partial initial funding was provided by Institute Trustee Richard Black), to identify pairs of very widely separated stars that are bound together by gravity. This project has been going for almost a year and has identified a very large number of these unique systems of stars that can themselves be exploited to tell us new things about the gravitational field of our Galaxy.

During the year 2004-2005, Professor Bahcall produced the following: "What Is the Neon Abundance of the Sun?" (with Sarbani Basu and Aldo M. Serenelli), to be published in ApJ, 630 (September 005), astro-ph/0502563; "New Solar Opacities, Abundances, Helioseismology, and Neutrino Fluxes," (with Aldo M. Serenelli and Sarbani Basu), ApJ, 621, L85, astro-ph/0412440; "How Do Uncertainties in the Surface Chemical Composition of the Sun Affect the Predicted Solar Neutrino Fluxes?" with Aldo M. Serenelli), ApJ, 626. 530 (June 10, 2005), astro-ph/0412096; "Solar Neutrinos" to appear in Encyclopedia of Physics, 3rd edition, eds. G. Trigg and R. Lerner (Wiley-VCH, Weinheim 2005), physics/0411190; "Chemical Controversy at the Solar Surface," Physics World, 18, No. 2, 26 (2005); "The Future of the Hubble Space Telescope," International Space Review, March 2005, Issue 3, p. 3; and "Solar Models and Solar Neutrinos: Current Status," proceedings of the Nobel Symposium 2004, Enkoping, Sweden, August 19-24, 2004, hep-ph/0412068.

During the 2004-05 academic year, PROFESSOR PETER GOLDREICH worked on the following projects: Together with S. Sridhar, Professor Goldreich developed a novel model for the extreme scattering of small angular diameter radio sources. Scattering data has long been interpreted under the assumption that the spectrum of electron density fluctuations is a power law between some outer scale, l_0, and some inner scale, $l_1 << l_0$. This interpretation encounters difficulty when applied to the scattering of radio sources near the galactic center. Combining the scattering data with free-free emission and absorption measurements constrains the outer scale to be $l_0 \leq 10^{-7}$ pc, which is much smaller than any plausible physical scale. Moreover, such a small outer scale implies a rate of turbulent energy dissipation that is much larger than radiative cooling can balance. To resolve this problem it is necessary to discard the notion of a power law spectrum of density fluctuations. Novel developments in the theory of the small–scale dynamo offer an alternative approach. Any turbulent motion of an electrically conducting fluid amplifies the magnetic field on scales smaller than (or of order) the outer scale. Recent investigations provide evidence that the amplified field has a folded structure. That is, it is arranged in planes separated by current sheets across which its direction reverses. Since the turbulent region has nearly constant total pressure, regions of strong B have small plasma density. The shapes of the regions of strong density fluctuations may be inferred

from the geometry of the folded fields. In directions transverse the planes, the correlation length is of order the resistive decay length scale, $d << l_0$. It is much larger within the planes. In folded fields large fractional density fluctuations occur at scales much smaller than the outer scale. Although they possess thin current sheets, ohmic dissipation is no greater than the dissipation rate of kinetic energy based on the large outer scale.

Roman Rafikov and Goldreich investigated the origin of the eclipses in the double pulsar system J0737-3039. The recent discovery of the binary pulsar J0737-3039 — a millisecond pulsar (pulsar A with a period PA = 23 ms) and a normal pulsar (pulsar B with a period PB = 2.8 s) in a tight 2.4 hrs orbit offers unprecedented tests of general relativity and also reveals a variety of magnetospheric phenomena. Among the latter are periodic eclipses of pulsar A when it passes behind pulsar B. They demonstrate that absorption of radiation from pulsar A heats charged particles in B's magnetosphere to relativistic energies and describe how this enables the magnetosphere to accumulate additional, charge neutral plasma. As a result, the radio emission of pulsar A can be significantly extinguished by synchrotron absorption.

Alison Farmer and Goldreich revisited the dynamics of Prometheus and Pandora, two small moons flanking Saturn's F ring. Departures of their orbits from freely precessing ellipses result from mutual interactions via their 121:118 mean motion resonance. Motions are chaotic because the resonance is split into four overlapping components. A more detailed understanding of the dynamics is obtained by analogy with that of a nearly adiabatic, parametric pendulum. In terms of this analogy, the current value of the action of the satellite system is close to its maximum value in the chaotic zone. Consequently, at present, the two separatrix crossings per precessional cycle occur close to apse antialignment. In this state libration only occurs when the potential's amplitude is nearly maximal, and the "jumps" in mean motion arise during the short intervals of libration that separate long stretches of circulation. Because chaotic systems explore the entire region of phase space available to them, at other times the Prometheus-Pandora system is expected to be found in states of medium or low action. In a low action state, the system would spend most of the time in circulation, and separatrix crossings would occur near apse alignment. It is predicted that transitions between different states may take place within a few decades.

Farmer and Goldreich have a long-term collaboration to investigate the spokes on Saturn's rings. More than 25 years after their discovery by the Voyager spacecraft, their nature remains a matter of speculation. Their location at the corotation radius and their rapid formation imply that electrodynamics plays an essential role in their origin. The most widely quoted hypothesis is that spokes form under radially moving plasma clouds produced by meteoroid impacts. However, a careful analysis shows that the speed at which a plasma cloud can move relative to the ring material is bounded from above by the difference between the Keplerian and corotation velocities. The radial orientation of new spokes requires radial speeds more than an order of magnitude faster.

During the 2004-2005 academic year, PROFESSOR ARNOLD J. LEVINE worked on the projects described below:

The human genome contains approximately 30,000 genes, each of which encodes the information to produce one or more proteins which in turn function to develop the

human form, allowing it to maintain and reproduce itself, respond to stress, and determine its longevity. Several hundred proteins act together to form signal transduction pathways that both inform the human organism and permit it to act upon outside information to respond to nutrient levels, signals to divide, and various types of stress. In a cell a few central nodes can coordinate and integrate these extrinsic signals. The p53 gene and its nine different isoforms constitute one of these central nodes, which respond to both extrinsic stress and intrinsic signals. For example various types of radiation or chemical damage to the DNA, which comprises the genetic information of the cell, are reported to the p53 protein. The p53 protein then makes a decision, to cease cell division and permit repair of the DNA damage, or in the extreme case, to initiate a program of cell death or apoptosis. The effect of apoptosis is to eliminate the cell and any defective progeny that carry mutations arising during the replication of damaged DNA. The p53 protein is regulated (down) in its level and function by a second protein at this central node in the signal transduction network, called the MDM-2 protein. We have identified significant genetic differences among people, termed single nucleotide polymorphisms or SNPs, in the DNA of the MDM-2 gene. About 12% of individuals have a SNP that permits them to produce high levels of MDM-2 in their cells, 46% of people have a form of this SNP that results in low levels of the MDM-2 protein in their cells and about 42% of individuals produce intermediate levels of MDM-2. The 12% of individuals who have high levels of MDM-2, and, therefore, low levels of p53, respond inefficiently to damage of their DNA. In some cases this damaged DNA is replicated and the error frequency rises, placing many mutations in the progeny of that damaged cell. This process can lead to the development of cancers over a lifetime.

These concepts have been tested in populations of individuals (with G. Bond). Those people who have high MDM-2 levels possess a 2.4 fold increased risk of developing cancer over their lifetime when compared to those with low MDM-2 and high p53. Individuals with intermediate levels of MDM-2 have a 1.7 fold increased risk of developing cancer over their lifetimes. By the age of 80-100 years, 55% of all of those individuals with high MDM-2 levels have had a reported cancer. In addition to the frequency of developing a cancer, the higher levels of the MDM-2 protein will often lower the age of onset of a cancer in a cohort of people who have obtained one or more cancers during their lifetime.

In mice, too much MDM-2 also predisposes these animals to cancers. Too much p53 however, while it protects against cancer formation, lowers the average age that mice will live. Remarkably those humans that have intermediate levels of MDM-2 and p53, are associated with longer life spans, while those people with higher p53 levels are less abundant in older age groups. Thus the genes at the central nodes in molecular pathways that respond to extrinsic and intrinsic stress play a critical role in setting the limits upon longevity in the mouse and human species.

In a second project (with H. Robins and M. Krasnitz) we examined the frequency of oligonucleotide sequences (the subunits of DNA) that occur in DNA's from a large number of diverse bacterial species. Interestingly, some sequences occur much more frequently than expected whereas other sequences are considerably under represented in the bacterial genome. Those sequences that are over or under represented are specific to related species and genera and differ considerably among evolutionarily less-related species. Thus, these novel sequence motifs can be employed to build an evolutionary tree that demonstrates the time since these species separated from a common ancestor. Each of

these bacterial species has a number of viral parasites that infect and kill their hosts. It has been possible to detect these same over or under represented DNA sequences in the viral chromosomes and thereby assign many of the viruses to their specific hosts. Thus, it appears that different organisms optimize an oligonucleotide sequence code, preferring some sequences to others, and that this code is different in very different organisms. The functional significance of these codes is a focus of ongoing investigation.

PROFESSOR JUAN MALDACENA conducted research on string theory and its relation with quantum field theory, during the academic 2004-05 year. Part of the time he studied a specific model which is based on the large N limit of matrix quantum mechanics, where N is the size of the matrix. These models are related to string theories in two dimensions. Some of the time was spent trying to find a simple model for two-dimensional black holes. In a paper with Karczmarek and Strominger, he showed that no black holes form in the simplest version of this model. He later analyzed a slightly more complicated model, which is a promising candidate for describing black holes in these two-dimensional string theories. This model is based on coupling quarks to the matrix quantum mechanics. In addition, with N. Seiberg, he studied the matrix model description of two-dimensional backgrounds with Ramond-Ramond fluxes. This is an important ingredient of higher dimensional string theories. In this two-dimensional context one can solve the problem exactly and find a precise description for many phenomena that are believed to occur in higher dimensional string theory. In a paper with G. Moore, N. Seiberg and D. Shih, Maldacena studied the difference between exact versus semi-classical computations in the matrix model. In some cases the semi-classical approximation is a good guide to the exact results, but not always. This work could provide some insights for understanding the interior of the black holes, which is a region that is expected to exist based on semi-classical computations but that is not that easy to extract from exact computations.

The rest of Maldacena's projects involved the relation between four-dimensional field theories and ten-dimensional string theory. In a paper with H. Lin and O. Lunin, Maldacena studied a special class of states of $\ominus = 4$ supersymmetric Yang Mills theory. The magic of supersymmetry ensures that many properties of these states can be studied precisely. In the Yang-Mills description these states reduce to a single matrix model similar to the one mentioned in the above paragraph. The dynamics of this matrix model reduces to a system of free fermions in a magnetic field at the lowest Landau level. The fermions behave like an incompressible fluid. Droplets of this fluid were shown to be in one to one correspondence with nonsingular solutions of the ten dimensional gravity equations. This provides a simple tractable system where a quantity on both sides can be computed precisely. It leads to a model where the effects of topology change (within this supersymmetric family) can be computed exactly. In an article with O. Lunin he has considered the problem of extending the duality between $\ominus = 4$ super Yang Mills and $AdS_5 \times S^5$ to marginal deformations of the gauge theory. There are some marginal deformations, which preserves $\ominus = 1$ supersymmetry and conformal invariance which were known to exist on the field theory side, but a detailed treatment on the gravity side was not known. In their paper they showed how to solve this problem for deformations that preserve certain $U(1) \times U(1)$ symmetries. It turned out that there is a very elegant way to generate these solutions from the known solutions. This method can be applied to many other examples of the gauge theory/gravity correspondence. In a paper with I. Klebanov, Maldacena studied a possible relation between the simplest $\ominus = 1$ Yang-Mills theories with

N_f quarks. These theories can be conformal for a window of values of Nf. In this case, the large N limit is expected to involve a non-critical string theory living in six dimensions. Unfortunately, we do not know how to treat the resulting equations exactly. Nevertheless they did some approximate computations and saw that the solution has some features, which match the expected behavior of the field theory.

During the academic year 2004-05, PROFESSOR NATHAN SEIBERG continued his investigation of low dimensional string theories. These tractable models exhibit rich phenomena that are shared by more generic theories. Since all observables are exactly solvable, they lead to many new and surprising phenomena. Together with D. Kutasov, K. Okuyama, J. Park, and D. Shih, Seiberg studied the annulus amplitudes of (p,q) minimal string theory. The ZZ-FZZT annulus amplitude was used as a target-space probe of the ZZ brane, and confirmed that the ZZ branes are localized in the strong-coupling region. Along the way it was realized that the ZZ-FZZT open strings are fermions, even though the theory is bosonic! They also provided a geometrical interpretation of the annulus amplitudes in terms of the Riemann surface M(p,q) that emerges from the FZZT branes. The ZZ-FZZT annulus amplitude measures the deformation of M(p,q) due to the presence of background ZZ branes; each kind of ZZ-brane deforms only one A-period of the surface. Finally, they used the annulus amplitudes to argue that the ZZ branes can be regarded as "wrong-branch" tachyons which violate the bound alpha <Q/2.

With J. Maldacena, G. Moore, and D. Shih, he studied both the classical and the quantum target space of (p,q) minimal string theory, using the FZZT brane as a probe. By thinking of the target space as the moduli space of FZZT branes, parametrized by the boundary cosmological constant x they showed that classically it consists of a Riemann surface M(p,q) which is a p-sheeted cover of the complex x plane. However, using the dual matrix model they showed that the exact quantum FZZT observables exhibit Stokes' phenomenon and are entire functions of x. Along the way they clarified some points about the semi-classical limit of D-brane correlation functions. The upshot was that non-perturbative effects modify the target space drastically, changing it from M(p,q) to the complex x plane. To illustrate these ideas, they studied in detail the example of (p,q)=(2,1), which is dual to the Gaussian matrix model. Here the other sheets of the classical Riemann surface describe instantons in the effective theory on the brane. They also discussed possible applications to black holes and the topological string.

With D. Shih he analyzed exactly the simplest minimal superstring theory, using its dual matrix model. Its target space is one dimensional (the Liouville direction), and the background fields include a linear dilaton, a possible tachyon condensate, and RR flux. The theory has both charged and neutral branes, and these exhibit new and surprising phenomena. The smooth moduli space of charged branes has different weakly coupled boundaries in which the branes have different RR charges. This new duality between branes of different charges shows that the semiclassical notion of localized charge is not precise in the quantum theory, and that the charges of these branes can fluctuate. Correspondingly, the RR flux in some parts of target space can also fluctuate -- only the net flux at infinity is fixed. They substantiated their physical picture with a detailed semiclassical analysis of the exact answers. Along the way, they uncovered new subtleties in super-Liouville theory. With D. Shih he summarized the recent developments in minimal string theory. This summary had been presented in the Strings 2004 meeting.

Seiberg also explored the moduli space of the two dimensional fermionic string with linear dilaton. In addition to the known 0A and 0B theories, there are two theories with chiral GSO projections, which are called IIA and IIB. They are similar to the IIA and IIB theories of ten dimensions, but are constructed with a different GSO projection. Compactifying these theories on various twisted circles leads to eight lines of theories. Three of them, 0A on a circle, super-affine 0A and super-affine 0B had been known. The other five lines of theories are new. At special points on two of them the known non-critical superstring was found.

With J.L. Davis and F. Larsen he discussed heterotic string theories in two dimensions with gauge groups Spin(24) and Spin(8) x E(8). After compactification the theories exhibit a rich spectrum of states with both winding and momentum. At special points some of these stringy states become massless, leading to new first order phase transitions. For example, the thermal theories exhibit standard thermodynamics below the phase transition, but novel and peculiar behavior above. The full moduli space of compactified theories is 13 dimensional, when Wilson lines are included; the Spin(24) and Spin(8) x E(8) theories correspond to distinct de-compactification limits.

With J. Maldacena he analyzed the two-dimensional type 0 theory with background RR-fluxes. Both the 0A and the 0B theory have two distinct fluxes q and q´. They studied these two theories at finite temperature (compactified on a Euclidean circle of radius R) as a function of the fluxes, the tachyon condensate mu and the radius R. Surprisingly, the dependence on q, q´ and mu is rather simple. The partition function is the absolute value square of a holomorphic function of y= | q | + | q´| + i mu (up to a simple but interesting correction). As expected, the 0A and the 0B answers are related by T-duality. Their answers are derived using the exact matrix models description of these systems and are interpreted in the low energy spacetime Lagrangian.

PROFESSOR EDWARD WITTEN, in collaboration with some of the postdoctoral fellows at the Institute (R. Britto, F. Cachazo, and B. Feng) continued his work on perturbative gauge theory scattering amplitudes. These functions are important in interpreting elementary particle collider experiments. Witten also, with a student, C. Beasley, resolved some longstanding questions about instanton effects in supersymmetric gauge theories. In a separate paper, the same authors gave a Feynman path integral explanation of some surprising empirical facts about Chern-Simons gauge theory in three dimensions. In another project, Witten explained from a physical point of view the significance of the mathematical theory of "chiral differential operators." With another student, V. Pestun, Witten computed the one-loop corrections that arise in quantizing the Hitchin functional, giving results that agreed with proposals about black holes. Finally, in the latter part of the year, Witten initiated a promising project of understanding the geometric Langlands program via twisted supersymmetric gauge theory.

PROFESSOR EMERITUS FREEMAN DYSON continued thinking sporadically about the question whether single gravitons are in principle detectable. He looked at the process of photon-graviton oscillation, which occurs when a photon or a graviton travels through a strong transverse magnetic field. The oscillation is similar to the phenomenon of neutrino oscillation, which occurs when neutrinos travel through matter. The photon-graviton oscillation is a classical effect but applies also to single photons and gravitons. It was first calculated by the Russian physicist Gertsenshtein in 1962. The oscillation wave-

length is given by the simple formula $L = 4\pi c^2/G^{½} B$, where G is Newton's constant and B is the magnetic field. The probability that a photon becomes a graviton or vice versa is $(2\pi D/L)^2$, where D is the path length in the magnetic field. Because the probability increases with the square of D and B, this process might conceivably be the basis for a graviton detector. It might also be the basis for an astrophysical source of high-energy gravitons.

Dyson is serving as a member of the external advisory board of the Global Climate and Energy Program at Stanford University. In this capacity, he gave a keynote address at the June 2005 meeting of GCEP. He also gave the Commencement address at Georgetown University in May 2005.

THE SCHOOL OF NATURAL SCIENCES

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THE SCHOOL OF NATURAL SCIENCES

RECORD OF EVENTS

The following is a calendar of events sponsored by the School of Natural Sciences

Academic Year 2004-05

Particle Physics Activities

September 13
High Energy Theory Seminar:
"Fine Structure of Hagedorn Transitions"
HONG LIU, *Massachusetts Institute of Technology*

September 17
High Energy Theory Seminar:
"Target Space in Minimal String Theory"
DAVID SHIH, *Princeton University*

September 22
Physics Group Meeting:
"Matrix Factorizations and Mirror Symmetry"
JOHANNES WALCHER, *Institute for Advanced Study*

September 23
Informal Phenomenology Seminar:
"T-Parity and the Littlest Higgs"
IAN LOW, *Institute for Advanced Study*

September 27
High Energy Theory Seminar:
"D-Branes and Phases on String Worldsheet"
TAKUYA OKUDA, *California Institute of Technology*

September 29
Physics Group Meeting:
"Statistics of Flux Vacua"
MICHAEL DOUGLAS, *Rutgers, The State University of New Jersey*

September 30
Informal Phenomenology Seminar:
"Can We Use Neutrino Oscillations for the Tomography of the Earth's Interior?"
WALTER WINTER, *Institute for Advanced Study*

October 1
High Energy Theory Seminar:
"BPS Deformations of $AdS_p \times S_q$"
OLEG LUNIN, *Institute for Advanced Study*

October 6
Physics Group Meeting:
"Topological Branes in Minimal Models"
CALIN LAZAROIU, *Institute for Advanced Study*

October 8
Informal Phenomenology Seminar:
"String-Operator Expansion for Inclusive B Decays"
MATTHIAS NEUBERT, *Institute for Advanced Study/Cornell University*

October 11
High Energy Theory Seminar:
"Deconstructing Supergravity"
MATTHEW SCHWARTZ, *Lawrence Berkeley National Lab*

October 13
Physics Group Meeting:
"Thermodynamical Aspects of String Theories"
ELIEZER RABINOVICI, *Racah Institute of Physics, Hebrew University*

October 14
Informal Phenomenology Seminar:
"Measuring Neutrino Interactions with Atmospheric Neutrinos"
ALEXANDER FRIEDLAND, *Los Alamos National Laboratory*

October 18
High Energy Theory Seminar:
"Gauge Theory Loops and Twistors"
DAVID KOSOWER, *CEA/Saclay, France*

October 20
Physics Group Meeting:
"From Callan, Coleman, Wess, and Zumino to Electroweak Symmetry Breaking"
IAN LOW, *Institute for Advanced Study*

October 21
Informal Phenomenology Seminar:
"Higgs as a Holographic Pseudo-Goldstone Boson"
ROBERTO CONTINO, *Johns Hopkins University*

October 22
High Energy Theory Seminar:
"The Character of Pure Spinors"
NIKITA NEKRASOV, *Institut des Hautes Études Scientifiques, France*

October 25
High Energy Theory Seminar:
"Three-Dimensional Yang-Mills Theory: About Mass Gap, Vacuum and String Tension"
V.P. NAIR, *City University of New York*

October 26
Informal Phenomenology Seminar:
"Smelling the Roses: New Results and Future Prospects for CP Violation at the B Factories"
JIM OLSEN, *Princeton University*

October 27
Physics Group Meeting:
"Algebraic Curve for AdS/CFT"
VLADIMIR KAZAKOV, *École Normale Supérieure*

October 28
Informal Phenomenology Seminar:
"New Rules for Perturbative (Tree Level) Calculations in SUSY QCD"
FREDDY CACHAZO, *Institute for Advanced Study*

October 29
High Energy Theory Seminar:
"Black Holes at c=1"
ANDREW STROMINGER, *Harvard University*

November 2
Informal Phenomenology Seminar:
"New Rules for Perturbative (One Loop) Calculations in SUSY QCD"
FREDDY CACHAZO, *Institute for Advanced Study*

November 3
Physics Group Meeting:
"D-Branes in Yang-Mills Theory and Emergent Gauge Symmetry"
BO FENG, *Institute for Advanced Study*

November 4
Informal Phenomenology Seminar:
"Massive and Metastable Gravitons"
GREGORY GABADADZE, *New York University*

November 8
High Energy Theory Seminar:
"Aspects of AdS/CFT Near the BMN/pp-wave Limit"
IAN SWANSON, *California Institute of Technology*

November 10
Physics Group Meeting:
"The Derivative Expansion in Supersymmetric Effective Actions"
PHILIP ARGYRES, *University of Cincinnati*

November 11
Informal Phenomenology Seminar:
"Goldstone Dynamics of Spontaneous Lorentz Violation"
HSIN-CHIA CHENG, *Harvard University*

November 12
High Energy Theory Seminar:
"Conformal Supergravity and Twistor-String Theory"
CHANGHYUN AHN, *Institute for Advanced Study/Kyungpook National University*

November 17
Physics Group Meeting:
"String Fluid vs. Closed Strings from Decay of a Boundary State"
PILJIN YI, *Institute for Advanced Study/Korea Institute for Advanced Study*

November 18
Informal Phenomenology Seminar:
"Non-Decoupling D-Terms and Gauge Coupling Unification"
JAY WACKER, *Stanford University*

November 22
High Energy Theory Seminar:
"Towards a Dual Description of Cosmological Singularities"
GARY HOROWITZ, *University of California, Santa Barbara*

December 1
Physics Group Meeting:
"Conformal Sequestering"
RAMAN SUNDRUM, *Johns Hopkins University*

December 6
High Energy Theory Seminar:
"Elements of Topological M-Theory"
ANDY NEITZKE, Harvard University

December 8
Physics Group Meeting:
"The New Moduli Dynamics of Monopoles: Decay and Proliferation of N=2 BPS States"
PILJIN YI, *Institute for Advanced Study/Korea Institute for Advanced Study*

December 9
Informal Phenomenology Seminar:
"Structure and Safety from Warped Compactifications"
RAMAN SUNDRUM, *Johns Hopkins University*

December 10
High Energy Theory Seminar:
"Moduli Stabilization, de Sitter Vacua and Inflation in Heterotic M-Theory"
EVGENCY BUCHBINDER, *Institute for Advanced Study*

January 20
Informal Phenomenology Seminar:
"Muon Physics"
BILL MARCIANO, *Institute for Advanced Study/Brookhaven National Laboratory*

February 2
Physics Group Meeting:
"Non-Renormalization Theorems from Lower Dimension Superspace and AdS/CFT Duality"
ZACHARY GURALNIK, *Humboldt-Universität zu Berlin*

February 3
Informal Phenomenology Seminar:
"Estimates of the Higgs Boson Mass and Bounds on M_w, M_t, and $\sin^2 \theta_{\{eff\}}^{\{lept\}}$ and Precision Measurements and CKM Unitarity"
ALBERTO SIRLIN, *New York University*

February 4
High Energy Theory Seminar:
"Minimal Flux Vacua"
NATHAN SEIBERG, *Institute for Advanced Study*

February 7
High Energy Theory Seminar:
"Aspects of Dual Theories for Singular and Massless Spin Backgrounds"
ELIEZER RABINOVICI, *Racah Institute of Physics, Hebrew University*

February 9
Physics Group Meeting:
"Floer Theories in Symplectic Geometry and Gauge Theory"
KATRIN WEHRHEIM, *School of Math, Institute for Advanced Study*

February 10
Informal Phenomenology Seminar:
"Mass Varying Neutrinos is the Early Universe"
NEIL WEINER, *New York University*

February 14
High Energy Theory Seminar:
"A Heterotic Standard Model"
YANG-YUI HE, *University of Pennsylvania*

February 17
Informal Phenomenology Seminar:
"The Littlest Higgs with T-parity: Dark Matter and Faking SUSY"
JAY HUBISZ, *Cornell University*

February 18
High Energy Theory Seminar:
"Supertwister Orbifolds: Gauge Theory Amplitudes and Topological Strings"
JAEMO PARK, *Pohang University of Science and Technology*

February 23
Physics Group Meeting:
"Unification in the Conformal Window"
GRAHAM KRIBS, *Institute for Advanced Study*

February 24
Informal Phenomenology Seminar:
"Seesaw Geometry and Leptogenesis"
PASQUALE DI BARI, *Max-Planck-Institut für Physik, Munich*

February 28
High Energy Theory Seminar:
"Black Hole Attractors and Superconformal Quantum Mechanics"
DAVIDE GAIOTTO, *Harvard University*

March 2
Physics Group Meeting:
"Floer Theory in Symplectic Geometry and Gauge Theory"
KATRIN WEHRHEIM, *School of Math, Institute for Advanced Study*

March 3
Informal Phenomenology Seminar:
"Localized Terms and Precision Tests in Warped Backgrounds"
EDUARDO PONTON, *Columbia University*

March 4
High Energy Theory Seminar:
"Tree Level Recursion in Gauge Theory"
FREDDY CACHAZO, *Institute for Advanced Study*

March 9
Physics Group Meeting:
"Semi-classical Decays in Asymptotically Locally AdS"
JOAN SIMON, *University of Pennsylvania*

March 10
Informal Phenomenology Seminar:
"QCD and a Holographic Model of Hadrons"
JOSH ERLICH, *William & Mary College*

March 14
High Energy Theory Seminar:
"The View from the Top: How can Theorists Contribute to the Tevatron and the LHC?"
MATT STRASSLER, *University of Washington*

March 15
Physics Group Meeting:
"AdS Meets QCD at BFKL (and wins)"
MATT STRASSLER, *University of Washington*

March 16
Physics Group Meeting:
"Tachyon Condensation and Open-Closed Duality in the OB ĉ=1 String Theory"
JOERG TESCHNER, *Freie Universität Berlin*

March 24
Informal Phenomenology Seminar:
"The Supersymmetric Little Hierarchy Problem"
SPENCER CHANG, *New York University*

March 28
High Energy Theory Seminar:
"Disorder Operators in Gauge Theories and Duality"
ANTON KAPUSTIN, *California Institute of Technology*

March 30
Physics Group Meeting:
"Infinite Coupling in N=2 Gauge Theories"
PHILIP ARGYRES, *Institute for Advanced Study/University of Cincinnati*

April 1
High Energy Theory Seminar:
"Stability of Landau-Ginzburg Branes"
JOHANNES WALCHER, *Institute for Advanced Study*

April 7
Informal Phenomenology Seminar:
"Supersymmetry without Supersymmetry"
SIEW-PHANG NG, *Bartol Research Institute*

April 11
High Energy Theory Seminar:
"Testing Some Black Hole/Topological String Conjectures"
GREG MOORE, *Rutgers, The State University of New Jersey*

April 12
High Energy Theory Special Seminar:
"Branches of the Flux Landscape"
MICHAEL DINE, *University of California, Santa Cruz*

April 14
Informal Phenomenology Seminar:
"Neutrino Masses in Heterotic String Theory"
PAUL LANGACKER, *University of Pennsylvania*

April 15
Joint High Energy Theory/Phenomenology Seminar:
"Supersoft Supersymmetry Breaking"
PADDY FOX, *University of California, Santa Cruz*

April 19
Informal Phenomenology Seminar:
"High Precision QCD at Hadron Colliders"
FRANK PETRIELLO, *Johns Hopkins University*

April 20
Physics Group Meeting:
"Effective Superpotentials in Supersymmetric QCD with Many Light Flavors"
MOHAMMAD EDALATI, *University of Cincinnati*

April 25
High Energy Theory Seminar:
"Hartle-Hawking Wave-Function for Flux Compactifications"
CUMRUN VAFA, *Harvard University*

April 27
Physics Group Meeting:
"Can Superhorizon Cosmological Perturbations Explain the Acceleration of the Universe?"
CHRIS HIRATA, *Princeton University*

April 28
Informal Phenomenology Seminar:
"Little Higgses and Heavy Resonances"
MAURIZIO PIAI, *Yale University*

April 29
High Energy Theory Seminar:
"One-Loop Amplitude of SQCD"
BO FENG, *Institute for Advanced Study*

May 4
Physics Group Meeting:
"Informal Comments on Mathematics and String Theory"
ERIC SHARPE, *University of Utah*

May 9
High Energy Theory Seminar:
"Branches of the Landscape"
SCOTT THOMAS, *Stanford University*

May 13
Special High Energy Theory Seminar:
"On Dark Matter Detection in Underground Labs"
CARLOS PEÑA-GARAY, *Institute for Advanced Study*

May 23
High Energy Theory Seminar:
"Topological Sigma-Models and Generalized Geometries"
YI LI, *California Institute of Technology*

June 9
Informal Phenomenology Seminar:
"Coupling Unifications in Gauge-Higgs Unified Orbifold Models"
SATYA NANDI, *Oklahoma State University*

Astrophysics Activities

September 15
Institute for Advanced Study Informal Seminar:
"Neutron Star Superbursts as Probes of Accretion Disk Physics"
DAVID BALLANTYNE, *Canadian Institute for Theoretical Astrophysics*

September 21
Institute for Advanced Study Astrophysics Seminar:
"Reionization of the Universe, The First Stars and Quasars"
JEREMIAH OSTRIKER, *Princeton University*

September 22
Institute for Advanced Study Informal Seminar:
"Interstellar Absorption Across the Electromagnetic Spectrum"
JOHN BLACK, *Chalmers University of Technology*

September 23
Institute for Advanced Study Informal Seminar:
"Dynamical Models and Numerical Simulations of Incomplete Violent Relaxation"
MICHELE TRENTI, *Scuola Normale Superiore*

September 27
Institute for Advanced Study Informal Seminar:
"Astronomical Odds: A Policy Framework for the Cosmic Impact Hazard"
GEOFFREY SOMMER, *Rand Corporation*

September 28
Institute for Advanced Study Astrophysics Seminar:
"Numerical Models of Black Hole Accretion Flows"
CHARLES GAMMIE, *University of Illinois at Urbana-Champaign*

October 4
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter II. Particle Motions"

October 5
Institute for Advanced Study Astrophysics Seminar:
"Scientific Results from the Mars Exploration Rover Mission"
STEVE SQUYRES, *Cornell University*

October 6
Institute for Advanced Study Informal Seminar:
"Simulations of Jets Driven by Black Hole Rotation"
BRIAN PUNSLY, *Boeing Space and Intelligence Systems*

October 7
Institute for Advanced Study Informal Seminar:
"Binary Evolution in Globular Clusters: Compact Binaries and Beyond"
NATASHA IVANOVA, *Northwestern University*

October 11
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter II. Particle Motions"

October 12
Institute for Advanced Study Astrophysics Seminar:
"Gamma-ray Bursts and Supernovae"
SHRI KULKARNI, *California Institute of Technology*

October 13
Institute for Advanced Study Journal Club on Dark Matter:
"Evidence for Dark Matter"
ZHENG ZHENG, *Institute for Advanced Study*

October 14
Institute for Advanced Study Joint Phenomenology/Astrophysics Seminar:
"Measuring Neutrino Interactions with Atmospheric Neutrinos"
ALEXANDER FRIEDLAND, *Los Alamos National Laboratory*

October 18
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter III. Magnetohydrodynamics"

October 19
Institute for Advanced Study Astrophysics Seminar:
"Accretion of Dwarf Satellites and the Formation of M31's Stellar Halo"
RAJA GUHATHAKURTA, *UCO/Lick Observatory, University of California*

October 20
Institute for Advanced Study Journal Club on Dark Matter:
"DM in Cosmology, Alternatives to Dark Matter"
NEAL DALAL, *Institute for Advanced Study*

October 25
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter III. Magnetohydrodynamics (continued)"

Institute for Advanced Study Informal Seminar:
"Anomalous Meteor Sounds: 300 Years of History of a Still Unexplained Phenomenon"
DEJAN VINKOVIC, *Institute for Advanced Study*

October 26
Institute for Advanced Study Astrophysics Seminar:
"Two-year Total Intensity and One-year Polarization Microwave Background Observations with the Cosmic Background Imager"
ANTHONY READHEAD, *California Institute of Technology*

October 28
Institute for Advanced Study Informal Seminar:
"Dynamical Estimates of Star Clusters Properties from Proper Motion Measurements"
RICHARD DSOUZA, *Max Planck Institute for Astronomy*

Institute for Advanced Study Journal Club on Dark Matter:
"Modifications of Gravity at Large Distances"
MASSIMO PORRATI, *New York University*

November 1
Institute for Advanced Study Discussion Group on Plasma Physics:
Chapter IV. Conservation Relations"

November 2
Institute for Advanced Study Astrophysics Seminar:
"GRBs: Progress and Open Questions"
ELI WAXMAN, *Weizmann Institute*

November 3
Institute for Advanced Study Journal Club on Dark Matter:
"DM in CMB"
CHRIS HIRATA, *Princeton University*

November 8
Institute for Advanced Study One Day Workshop on Gravitational Lensing:

November 9
Institute for Advanced Study Astrophysics Seminar:
"Hydrodynamically Driven Turbulence in Accretion Disks"
RAMESH NARAYAN, *Harvard University*

November 10
Institute for Advanced Study Informal Astrophysics Seminar:
"Stellar Disk in the Galactic Center and a New Method of Mass Estimation in Gravitating Systems"
ANDREI BELOBORODOV, *Columbia University*

Institute for Advanced Study Journal Club on Dark Matter:
"Halo Structure"
ADI NUSSER, *Israel Institute of Technology*

November 15
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter IV. Conservation Relations"

November 16
Institute for Advanced Study Astrophysics Seminar:
"First Results from MOST–A Precise Photometry Space Telescope"
DIMITAR SASSELOV, *Harvard University*

November 17
Institute for Advanced Study Informal Seminar:
"Starburst Disks and AGN Fueling"
TODD THOMPSON, *University of California, Berkeley*

Institute for Advanced Study Journal Club on Dark Matter:
"SUSY Fundamentals"
RYUICHIRO KITANO, *Institute for Advanced Study*

November 22
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter III (continued): Pulsars"

November 29
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter IV. Conservation Relations"

November 30
Institute for Advanced Study Astrophysics Seminar:
"Stellar Rotation, Supernovae, and Gamma-Ray Bursts"
STAN WOOSLEY, *University of California, Santa Cruz*

December 1
Institute for Advanced Study Informal Seminar:
"Astrophysical Constraints on Dark Matter Particles and Physics Beyond the Standard Model"
GIANFRANCO BERTONE, *Fermi National Accelerator Laboratory*

December 2
Institute for Advanced Study Informal Seminar:
"Dynamics of Black Holes and Binaries Near Sgr A*"
ERIC PFAHL, *University of Virginia*

December 3
Institute for Advanced Study Informal Seminar:
"Ghosts of Saturn: Understanding the Ring Spokes"
ALISON FARMER, *Institute for Advanced Study*

December 6
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter IV: Conservation Relations (continued)"

December 7
Institute for Advanced Study Astrophysics Seminar:
"Gravitational Lensing"
MARTIN WHITE, *University of California, Berkeley*

December 8
Institute for Advanced Study Informal Seminar:
"Indirect Searches for Particle Dark Matter"
DAN HOOPER, *Oxford University*

Institute for Advanced Study Journal Club on Dark Matter:
"Indirect Searches of Dark Matter: Data"
DAN HOOPER, *Oxford University*

December 9
Institute for Advanced Study Informal Seminar:
"Non-thermal Radiation from Intergalactic Shocks"
URI KESHET, *Weizmann Institute*

December 14
Institute for Advanced Study Astrophysics Seminar:
"Interstellar Dust Grains"
BRUCE DRAINE, *Princeton University; Member School of Natural Sciences*

December 15
Institute for Advanced Study Journal Club on Dark Matter:
"SUSY Candidates"
TIANJUN LI, *Institute for Advanced Study*

January 17
Institute for Advanced Study Informal Seminar:
"A Coupling Net to Capture Rogue Runaway R-modes"
JEANDREW BRINK, *Cornell University*

January 19
Institute for Advanced Study Journal Club on Dark Matter:
"Primordial Black Holes"
GRAHAM KRIBS, *Institute for Advanced Study*

January 20
Institute for Advanced Study Informal Seminar:
"Far-IR SEDs of Protostars and Dusty Galaxies"
SUKANYA CHAKRABARTI, *University of California, Berkeley*

January 25
Institute for Advanced Study Astrophysics Seminar:
"The Sloan Digital Sky Survey"
JAMES GUNN, *Princeton University; Member, School of Natural Sciences*

February 1
Institute for Advanced Study Astrophysics Seminar:
"Deep Extragalactic Surveys with Chandra and XMM-Newton: Keyhole Views of the Distant X-ray Universe"
NEIL BRANDT, *The Pennsylvania State University*

February 8
Institute for Advanced Study Astrophysics Seminar:
"Galaxies, Structure, and the IGM at $z \sim 2$"
CHUCK STEIDEL, *California Institute of Technology*

February 9
Institute for Advanced Study Journal Club on Dark Matter:
"Gravitational Lensing by Large Scale Structures"
BRICE MÉNARD, *Institute for Advanced Study*

February 14
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter VI. Non Linear Steepening and Shocks (Continued)"

February 15
Institute for Advanced Study Astrophysics Seminar:
"Future Opportunities for the Sudbury Neutrino Observatory"
MARK CHEN, *Queen's University*

February 16
Institute for Advanced Study Journal Club on Dark Matter:
"Coupling Fields to Gravity"
MATTHEW KLEBAN, *Institute for Advanced Study*

February 21
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter VII. The Energy Principle and Instabilities"

Institute for Advanced Study Informal Seminar:
"Cosmic Magnification with the SDSS"
RYAN SCRANTON, *University of Pittsburgh*

February 22
Institute for Advanced Study Astrophysics Seminar:
"Early Results from the Spitzer Infrared Nearby Galaxies Survey"
ROBERT KENNICUTT, *University of Arizona*

February 23
Institute for Advanced Study Informal Seminar:
"The Nature of Dark Matter from Cluster Lensing"
PRIYA NATARAJAN, *Yale University*

February 28
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter VII. The Energy Principle and nstabilities (continued)"

March 2
Institute for Advanced Study Journal Club on Dark Matter:
"Dark Matter Constraints by Microlensing"
TAKAHIRO SUMI, *Princeton University*

March 7
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter VII. The Energy Principle and Instabilities (continued)"

March 8
Institute for Advanced Study Astrophysics Seminar:
"Overview of the Far Ultraviolet Spectroscopic Explorer Mission"
WARREN MOOS, *The Johns Hopkins University*

March 9
Institute for Advanced Study Informal Seminar:
"Transit Searches for Extrasolar Planets: Properties, Pitfalls, Payoffs, and Promises"
SCOTT GAUDI, *Harvard-Smithsonian Center for Astrophysics*

March 14
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter VII. The Energy Principle and Instabilities (continued)"

March 15
Institute for Advanced Study Astrophysics Seminar:
"Nearby AGN Seen with Keck Telescope Adaptive Optics"
CLAIRE MAX, *University of California, Santa Cruz*

March 16
Institute for Advanced Study Journal Club on Dark Matter:
"WMAP and Dark Matter Annihilation in the Inner Galaxy"
DOUG FINKBEINER, *Princeton University*

March 21
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter VII. The Energy Principle and Instabilities (continued)"

March 22
Institute for Advanced Study Astrophysics Seminar:
"21 cm Fluctuations: A New Window for Cosmology"
MATIAS ZALDARRIAGA, *Harvard University*

March 29
Institute for Advanced Study Astrophysics Seminar:
"Gas Dynamics in Galactic Nuclei: Starbursts and AGN Fueling"
ELIOT QUATAERT, *University of California, Berkeley*

March 31
Institute for Advanced Study Astrophysics Talk:
"Latest Results on QSO Absorption Lines: A Summary of the IAU Colloquium 199"
BRICE MÉNARD, *Institute for Advanced Study*

April 5
Institute for Advanced Study Astrophysics Seminar:
"Measuring and Predicting Cosmological Parameters"
MAX TEGMARK, *Massachusetts Institute of Technology*

April 6
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter VIII: The Braginski Equations"

Institute for Advanced Study Informal Astrophysics Seminar:
"Mass Loss by X-ray Winds in Active Galactic Nuclei"
DORON CHELOUCHE, *Institute for Advanced Study*

April 7
Institute for Advanced Study Special Astrophysics Colloquium:
"Sky in Hard X-rays–some INTEGRAL Results and Perspectives of the Field"
RASHID SUNYAEV, *Max-Planck Institut fuer Astrophysik, Garching, and Space Research Institute, Moscow*

April 11
Institute for Advanced Study, School of Natural Sciences Public Lecture:
"In Orbit! Cassini Explores the Saturn System"
CAROLYN PORCO, *CICLOPS, Space Science Institute*

April 12
Institute for Advanced Study Astrophysics Seminar:
"Highlights from Cassini's Imaging Adventures at Saturn"
CAROLYN PORCO, *CICLOPS, Space Science Institute*

April 13
Institute for Advanced Study Informal Seminar:
"Astrophysical Limitations on Meaningful Measurements of the Equation of State of Dark Energy"
LAWRENCE KRAUSS, *Institute for Advanced Study*

April 18
Institute for Advanced Study Discussion Group on Plasma Physics:
"Chapter IX. Collisionless Plasmas"

April 19
Institute for Advanced Study Astrophysics Seminar:
"Pan-STARRS: The Next Generation Optical Sky Survey"
JOHN TONRY, *Institute for Astronomy, University of Hawaii*

April 20
Institute for Advanced Study Informal Seminar:
"Progress in MHD Turbulence in the Solar Wind and the Galactic Center"
SESHADRI SRIDHAR, *Raman Research Institute; Member, School of Natural Sciences*

April 26
Institute for Advanced Study Astrophysics Seminar:
"Black Holes in Galaxy Mergers"
LARS HERNQUIST, *Harvard-Smithsonian Center for Astrophysics*

April 27
Institute for Advanced Study Informal Seminar:
"The MUSYC Census of Protogalaxies at $z = 3$"
ERIC GAWISER, *Yale University*

May 3
Institute for Advanced Study Astrophysics Seminar:
"The ESSENCE Survey: Measuring w from the Ground"
CHRISTOPHER STUBBS, *Harvard-Smithsonian Center for Astrophysics*

May 4
Institute for Advanced Study Informal Seminar:
"Structure, Statistics and Information at All Cosmological Scales"
KEV ABAZAJIAN, *Los Alamos National Laboratory*

May 10
Institute for Advanced Study Astrophysics Seminar:
"Double Pulsar J0737–a Rosetta Stone of Pulsar Physics"
ROMAN RAFIKOV, *Institute for Advanced Study*

May 18
Institute for Advanced Study Informal Seminar:
"The Effect of Baryons on Cosmic Structures"
STELIOS KAZANTZIDIS, *KICP, University of Chicago; Institute for Theoretical Physics, University of Zurich*

May 24
Institute for Advanced Study Informal Seminar:
"The First Miniquasar"
MIKE KUHLEN, *University of California, Santa Cruz*

May 26
Institute for Advanced Study Informal Seminar:
"Wringing More Information Out Of Clustering of Galaxy Clusters"
GIL HOLDER, *McGill University*

Center for Systems Biology Activities

August 24
Center for Systems Biology Seminar:
"Detecting Selection Using a Single Genome Sequence"
JOSHUA PLOTKIN, *Harvard University*

September 14
First Annual Central New Jersey Systems Biology Symposium

"Predicting and Analyzing Protein-Protein Interactions"
MONA SINGH, *Princeton University*

"Learning Biology from Network-Level Observations"
SAEED TAVAZOIE, *Princeton University*

"Single Nucleotide Polymorphisms in the p53 Network"
GARETH BOND, *University of Medicine and Dentistry of New Jersey*

"Predicting MicroRNA Targets with High Precision"
HARLAN ROBINS, *Institute for Advanced Study*

"Clustering Gene Expression Data - Some Statistical Approaches"
REBECKA JORNSTEN, *Rutgers, The State University of New Jersey*

"Identifying Chromosomal Abnormalities on the Genomic Level"
OLGA TROYANSKAYA, *Princeton University*

"E. Coli's Division Decision: Modeling Min-Protein Oscillations"
NED WINGREEN, *Princeton University*

September 17
Virology Course:
"Introduction to Viruses"
ARNOLD J. LEVINE, *Professor, School of Natural Sciences*

September 20
Center for Systems Biology Seminar:
"Structure and Design of DNA-Binding Proteins"
CARL PABO, *Visiting Professor at Stanford University*

September 21
Center for Systems Biology Seminar:
"Theories of Thought"
CARL PABO, *Visiting Professor at Stanford University*

September 24
Virology Course:
"Emerging Viruses"
LYNN ENQUIST, *Princeton University*

September 28
Center for Systems Biology Seminar:
"Genome-wide Approaches to a Hereditary Tumor Model: Potential for Gene Discovery and Identification of Novel Signaling Interactions in Pheochromocytomas"
PATRICIA DAHIA, *Dana-Farber/Harvard Cancer Center*

October 4
Virology Course:
"Retroviruses"
ARNOLD J. LEVINE, *Professor, School of Natural Sciences*

October 8
Center for Systems Biology Seminar:
"Using RNA Interference to Study the RNAi Pathway Itself"
GARY RUVKUN, *Harvard Medical School*

October 18
Virology Course:
"DNA Tumor Viruses"
ARNOLD J. LEVINE, *Professor, School of Natural Sciences*

October 19
Joint Meeting - Institute for Advanced Study Center for Systems Biology & Cancer Institute of New Jersey

"Introduction to the p53-IGF-Tor Pathways"
ARNOLD J. LEVINE, *Institute for Advanced Study*

"p53 and Autophagy"
HAIYAN ZHANG, *Cancer Institute of New Jersey*

"Inter-relationships in the p53-IGF-1-Tor Pathway"
ZHOUWEI FENG, *Cancer Institute of New Jersey*

"Role of Autophagy in Mitochondrial Turnover"
YONG ZHANG, *Cancer Institute of New Jersey*

"The Role of Beclin in Autophagy"
REBECCA BAERGE, *Cancer Institute of New Jersey*

"The Regulation of Translation"
PETER SARNOW, *Stanford University*

"MDR Gene Regulation by p73"
ROBERT JOHNSON, *Cancer Institute of New Jersey*

"SNP's in the p53 Pathway""
SANDI HARRIS, *Cancer Institute of New Jersey*

"SNP 309 - Mechanism of Action and Clinical Studies"
WENWEI HU, *Cancer Institute of New Jersey*

"Micro RNA Targets"
HARLAN ROBINS, *Institute for Advanced Study*

October 20
Center for Systems Biology Seminar:
"Optimal Control of Disease Processes"
ROBERT STENGEL, *Princeton University*

November 1
Virology Course:
"Herpes Virus Transport through Neurons"
LYNN ENQUIST, *Princeton University*

November 29
Virology Course:
"Herpes Virus Latency"
THOMAS SHENK, *Princeton University*

November 30
Center for Systems Biology Seminar:
"Modeling Cancer Incidence at the MDM2 SNP309 Locus"
GARETH BOND and GERMAN ENCISO, *Cancer Institute of New Jersey*

December 10
Center for Systems Biology Seminar:
"Exonic Splicing Silencers and Conserved Alternative Splicing"
CHRIS BURGE, *Massachusetts Institute of Technology*

December 15
Center for Systems Biology Seminar:
"p53 Posttranslational Modifications and Regulation of p53-Mediated Gene Expression"
CARL ANDERSON, *Brookhaven National Laboratory*

January 17
Center for Systems Biology Seminar:
"Monotonicity and the Stability of Biological Systems"
GERMAN ENCISO, *Rutgers, The State University of New Jersey*

January 21
Center for Systems Biology Seminar:
"Quantum Instanton Evaluation of the Kinetic Isotope Effects"
JIRI VANICEK, *University of California, Berkeley*

February 18
Center for Systems Biology Seminar:
"Gene Regulation by Alternative Polyadenylation"
BIN TIAN, *UMDNJ/New Jersey Medical School*

February 25
Center for Systems Biology Seminar:
"Stem Cells and Systems Biology"
IHOR LEMISCHKA, *Princeton University*

March 2
Center for Systems Biology Seminar:
"Information Theoretic Analysis of Biological Data"
NOAM SLONIM, *Princeton University*

March 4
Center for Systems Biology Seminar:
"Statistical Physics in Biological Modeling and Analyses: From Barn Owls to Yeast"
GURINDER SINGH ATWAL, *Princeton University*

March 9
Center for Systems Biology Seminar:
"Timing the Onset of Transcription in the Drosophila Embryo"
ERIC WIESCHAUS, *Princeton University*

March 14
Center for Systems Biology Seminar:
"Long Term Potentiation and Synaptic Plasticity: A Molecular Mechanism for Learning and Memory"
LILLIAN CHIANG, *Institute for Advanced Study*

March 15
Center for Systems Biology Seminar:
"Genetic Variation, Gene Regulation and Cancer"
IMMACULATA DE VIVO, *Harvard Medical School/Harvard School of Public Health*

March 16
Center for Systems Biology Seminar:
"p53 and Aging"
HEIDI SCRABLE, *University of Virginia*

March 22
Center for Systems Biology Seminar:
"Molecular and Cellular Mechanisms of Pain"
LILLIAN CHIANG, *Institute for Advanced Study*

March 29
Center for Systems Biology Seminar:
"Mining Gene Array Data: Experimental and Biological Aspects for Gene Discovery in the Nervous System
LILLIAN CHIANG, *Institute for Advanced Study*

April 6
Center for Systems Biology Seminar:
"Genome-wide Mapping of Regulatory Variation in Yeast: A Simple Model System for Genetic Complexity"
LEONID KRUGLYAK, *Princeton University*

April 27
Center for Systems Biology Public Lecture:
"How Human Tumors Form"
ROBERT WEINBERG, *Massachusetts Institute of Technology*

May 3
Center for Systems Biology Seminar:
"How Complex Systems Can Simplify a Complex Problem: What Epidemiologists Can Learn From Insects"
NINA FEFFERMAN, *Tufts University School of Medicine*

May 4
Center for Systems Biology Seminar:
"Using 'Pathways' Approaches to Reveal the Biological Insights Hidden in Functional Genomics Datasets"
RON BLACKMAN, *Dana-Farber Cancer Institute*

June 17
Center for Systems Biology Seminar:
"Gene Expression Profiling of Colon Cancer and Metastases"
ROBERT STENGEL, *Princeton University/ Institute for Advanced Study*

CHRISTINE FERRARA

"What stands out to me from this year, perhaps more than anything, is the caliber and collegiality of the fellow Members.... This stood out to me keenly in the question and answer periods following the weekly seminars.... I learned an enormous amount about how to think collegially through these sessions."

— Member, School of Social Science

Members in the School of Social Science in the courtyard outside the Institute's Dilworth Room

THE SCHOOL OF SOCIAL SCIENCE

Faculty

ERIC S. MASKIN, *Albert O. Hirschman Professor*
JOAN WALLACH SCOTT, *Harold F. Linder Professor*
MICHAEL WALZER, *UPS Foundation Professor*

Professors Emeriti

ALBERT O. HIRSCHMAN
CLIFFORD GEERTZ

Visiting Associate Professor

ADAM ASHFORTH

ACADEMIC ACTIVITIES

The School of Social Science invited seventeen scholars from a pool of 168 applicants from the United States and abroad to be part of the School's scholarly community as Members for the 2004-2005 academic year. Four visitors and two research assistants also participated in the year's activities. The National Endowment for the Humanities partially or fully funded three Members. Economists were supported by a grant from the Andrew W. Mellon Foundation, as well as the Richard B. Fisher and the Deutsche Bank Memberships. Fields of inquiry of the group included anthropology (three), cultural studies (one), economics (five), history (six), law (one), philosophy (one), political science (four), and sociology (three).

The thematic focus for 2004-2005 was *Interdisciplinarity and its Objects*. Interdisciplinary work has become increasingly common in the social sciences, despite debate about its impact on the (disciplinary) organization of knowledge. Although interdisciplinarity is sometimes a facade behind which entirely conventional work is carried on, the School was interested in what disciplines may define as the unconventional, and especially in the relationship between objects of inquiry and interdisciplinary approaches.

The School conducted three seminar series – the Social Science Thursday Luncheon Seminar, the Interdisciplinarity Thematic Seminar, and the IAS/Princeton University Economics Workshop. The School continued publication of its series of *Occasional Papers* and *Economics Working Papers*, which can be accessed online from the Institute's website.

FACULTY

In July 2004, PROFESSOR ERIC MASKIN gave plenary addresses at the Far East meeting of the Econometric Society in Seoul and the second World Congress of the Game Theory Society in Marseille on the subject of cooperative game theory. He also spoke on this subject at conferences in Berlin; Paris; Guanajuato, Mexico; Riverside, CA and the

University of Essex and at seminars at Harvard, Stanford and Montreal Universities. He gave lecture series on cooperative games at the Stockholm School of Economics, and Wuhan University in China. In November 2004, he gave the Zeuthen Lectures at the University of Copenhagen on "Auctions and Resource Allocation."

In the fall of 2004, Eric Maskin gave a graduate course at Princeton University on voting theory and also gave a talk on presidential elections to the Friends of the Institute. In February 2005, he gave a lunch seminar to the School of Social Science on "Why Do We Procrastinate?" and later in the year spoke on this subject at the University of Chicago, Stockholm School of Economics, University of California Riverside, National University of Singapore and Cambridge University. In January 2005, he spoke at the Bank of Mexico on the advantages and drawbacks of accountability in government. In February, he gave the keynote address at the opening of the Renmin-Monash Advanced Economics Center in Beijing on the topic of "Why Has Inequality Increased in China?" In March, he gave the keynote address at the Symposium of Default Rules, Florida State University on "An Economic Theorist Looks at Default Rules." Finally, in June, Eric Maskin gave a keynote address at the Fourth International Conference on Logic, Game Theory, and Social Choice in Caen, France on "Majority Rule and Strategic Voting." He was elected an honorary fellow of St. John's College, Cambridge, in October 2004.

PROFESSOR JOAN W. SCOTT was awarded the degree of Doctor *honoris causa,* by the University of Bergen (Norway). She gave the Gauss Seminars in Criticism at Princeton University. She lectured at the New School for Social Research, Smith College, the Wesleyan University Humanities Center, Duke University, and the City University of New York. She presented papers at conferences at Rutgers, The State University of New Jersey and at the New York University Institute for French Studies. She gave a series of lectures and seminars at the University of La Laguna (Tenerife, Spain). She was keynote speaker at the Critical Psychology Forum at Dusquesne University, at the Finnish Women's Studies Association meetings in Jyvaskyla, Finland, at a conference on Gender and History at Brown University, and at the Spanish Women's History Association meetings in Madrid. The conference in Madrid was titled "Joan Scott and Feminist Historiography in Spain."

Professor Scott published "Feminism's History" in the *Journal of Women's History* 16:2 (Fall 2004). A paperback version of her *Gender and the Politics of History* was published in Japan. Professor Scott continues as a senior fellow of the School of Criticism and Theory (SCT). For this summer's session of the SCT, held at Cornell University, she offered a series of seminars on "French Universalism in Crisis." Professor Scott continues as adjunct professor of history at Rutgers, The State University of New Jersey. In June 2005, she ended her term as chair of the Committee on Academic Freedom and Tenure of the American Association of University Professors; she will now serve as a consultant to that committee and she will continue to lecture, as she did this past year, on issues related to academic freedom and higher education.

During the academic year 2004-2005, PROFESSOR MICHAEL WALZER gave the three-part Julius Rosenthal Foundation Lecture Series at Northwestern University's School of Law, the 2004 lecture of the Daniel L. Golden '34 Speaker Series in Government and Law at Lafayette College (Easton, PA), and the keynote speech for the 46th Annual Meeting of The Society of Jewish Ethics; he also lectured at Centre Pompidou in

Paris, the publishing house of Editori Laterza in Rome, Tavistock Centre in London, Harvard University, Georgetown University, University of North Carolina-Chapel Hill, University of Wisconsin-Madison, and Syracuse University. His collection of essays and articles entitled *Arguing About War* was released in Spanish, French, and Italian; his book *Thick and Thin: Moral Argument at Home and Abroad* appeared in French and Japanese. His Horkheimer Lectures, published in German in 1999, came out in Italian; an expanded English version of the lectures entitled *Politics and Passion: Toward a More Egalitarian Liberalism* was published by Yale University Press.

VISITING ASSOCIATE PROFESSOR ADAM ASHFORTH presented lectures at Princeton University and Brown University on the political implications of the pervasive sense of spiritual insecurity in post-apartheid South Africa. He participated in an international symposium in Berlin on the anthropology of AIDS sponsored by the Free University of Berlin. He attended the meetings of the International Scientific Advisory Board and participated in the Five-Year Review of the Africa Centre for Health and Population Studies in Kwa-Zulu Natal, South Africa, where he is developing an interdisciplinary and multinational research initiative to study the social and cultural dynamics surrounding the rollout of anti-retroviral drugs to treat HIV/AIDS in a poor African rural area with severe HIV prevalence. In January, his book *Witchcraft, Violence, and Democracy in South Africa* was published by the University of Chicago Press and in May a paperback edition of *Madumo, A Man Bewitched* was released by the same press.

PROFESSOR EMERITUS CLIFFORD GEERTZ gave the Irving Howe Lecture at City University, New York, in November 2004. The lecture, entitled "What Was the Third World Revolution?" was subsequently published in *Dissent*. A collection of commentaries on Professor Geertz's work, together with a response from him, *Clifford Geertz by His Colleagues*, edited by Richard A. Shweder and Byron Good, was published by The University of Chicago Press.

The 2004-2005 academic year brought commendations for PROFESSOR EMERITUS ALBERT O. HIRSCHMAN's seminal contributions to sociopolitical/economic theory. On May 6, 2005, Professor Hirschman was presented with the Bernardo O'Higgins Award given by the government of Chile in the person of Ignacio Walker, the Foreign Minister of Chile.

Professor Hirschman's book *The Passions and the Interests* was named on the Princeton University Press listing of their 100 best books. The Fondo de Cultura Economica released their third printing of the Spanish language edition of *The Rhetoric of Reaction*. This year saw new translations in Japanese of *Exit, Voice, and Loyalty* and *A Propensity to Self-Subversion* published by the Hosei University Press, as well as a Korean language translation of *Exit, Voice and Loyalty* published by the Nanam Publishing House. The Japanese translation of *Exit, Voice, and Loyalty* by Shuichi Yano was also published. Shuichi Yano, a professor of international political economy, paid a visit to Professor Hirschman in March bringing him the English summary of his own book *Political Economics of Possibilism: A Study on Albert O. Hirschman*, to be published by Hosei University Press. During the academic year Professor Hirschman celebrated his 90th birthday. Having reached this milestone, he considers himself truly retired.

THE SCHOOL OF SOCIAL SCIENCE

MEMBERS, VISITORS, AND RESEARCH STAFF

CAROLINE ARNI
History
University of Berne

MARK R. BEISSINGER
Political Science
University of Wisconsin · *n*

ELCHANAN BEN-PORATH
Economics
Hebrew University · M

PAUL BOGHOSSIAN
Philosophy
New York University · *v*

MATTHEW BRADY BROWER
History
Rutgers, The State University of New Jersey · *a*

ALESSANDRA CASELLA
Economics
Columbia University · M

PATRICIA TICINETO CLOUGH
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The Graduate Center, The City University of New York

DAN DINER
History
Leipzig University *and* Hebrew University of Jerusalem

PAULLA A. EBRON
Anthropology
Stanford University

DUANA FULLWILEY
Anthropology
New York University

BRUCE GRANT
Anthropology
Swarthmore College · *n*

SARAH E. IGO
History
University of Pennsylvania

MADELINE KOCHEN
Law and Political Science
Harvard University · *a*

KRISHAN KUMAR
Sociology
University of Virginia

WOLF LEPENIES
Sociology
Wissenschaftskolleg zu Berlin · *v f*

CHUN LIN
Political Science
London School of Economics · *v*

JOHN M. MEYER
Political Science
Humboldt State University

JOHN MOWITT
Cultural Studies
University of Minnesota

KENDA MUTONGI
History
Williams College · *n*

KLAUS NEHRING
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University of California, Davis · *v*

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KONSTANTIN SONIN
Economics
New Economic School *and* Center for Economic and Finanicial Research (CEFIR), Moscow · M

HELEN TILLEY
History
Princeton University · *v*

a Research Assistant · *v* Visitor · M Mellon Supported · *n* NEH Supported · *f* First Term

THE SCHOOL OF SOCIAL SCIENCE

RECORD OF EVENTS

The following is a calendar of events sponsored by the School of Social Science

Academic Year 2004-05

September 27
IAS/Princeton University Economics Workshop:
"Clock Games: Theory and Experiments"
MARKUS K. BRUNNERMEIER, *Bendheim Center for Finance* and *Princeton University* (with John Morgan)

September 29
Interdisciplinarity Thematic Seminar

September 30
Social Science Thursday Luncheon Seminar:
"Contemporary Empires: Imperialism and the Politics of Identity in a World of States"
MARK R. BEISSINGER, *University of Wisconsin; Member, School of Social Science*

October 4
IAS/Princeton University Economics Workshop:
"Secure Implementation"
JOHN TOMAS SJÖSTRÖM, *Rutgers, The State University of New Jersey; Member, School of Social Science* (with Tatsuyoshi Saijo and Takehiko Yamato)

October 7
Social Science Thursday Luncheon Seminar:
"Prisoners of the Caucasus: A Cultural History of Kidnapping"
BRUCE GRANT, *Swarthmore College; Member, School of Social Science*

October 11
IAS/Princeton University Economics Workshop:
"Further Work Using the Agencies Model for Cooperation"
JOHN NASH, *Princeton University*

October 14
Social Science Thursday Luncheon Seminar:
"Storable Votes"
ALESSANDRA CASELLA, *Columbia University; Member, School of Social Science*

October 18
IAS/Princeton University Economics Workshop:
"Majority Voting and Deliberative Democracy"
KLAUS NEHRING, *University of California, Davis; Visitor, School of Social Science*

October 20
Interdisciplinarity Thematic Seminar

October 21
Social Science Thursday Luncheon Seminar:
"Empire and Identities"
KRISHAN KUMAR, *University of Virginia; Member, School of Social Science*

October 25
IAS/Princeton University Economics Workshop:
"Dictators and Their Viziers: Agency Problems in Dictatorships"
KONSTANTIN SONIN, *New Economic School* and *CEFIR; Member, School of Social Science*

October 27
Interdisciplinarity Thematic Seminar

October 28
Social Science Thursday Luncheon Seminar:
"Social Scientific Citizens: Surveys, Statistics, and the Public in Twentieth-Century America"
SARAH E. IGO, *University of Pennsylvania; Member, School of Social Science*

November 1
IAS/Princeton University Economics Workshop:
"Behavioral Identification in Coalitional Bargaining: An Experimental Analysis of Demand Bargaining and Alternating Offers"
MASSIMO MORELLI, *Ohio State University* (with Frechette and Kagel)

November 4
Social Science Thursday Luncheon Seminar:
"Markering Race: Logics of Origins, Illness and Minority Genes"
DUANA FULLWILEY, *New York University; Member, School of Social Science*

November 8
IAS/Princeton University Economics Workshop:
"Market Design with Endogenous Preferences"
ELLA SEGEV, *Tel Aviv University, Israel*

November 10
Interdisciplinarity Thematic Seminar

November 11
Social Science Thursday Luncheon Seminar:
"Dictators and their Viziers: Agency Problems in Dictatorships"
KONSTANTIN SONIN, *New Economic School* and *CEFIR; Member, School of Social Science*

November 18
Social Science Thursday Luncheon Seminar:
"Rationalizable Expectations"
ELCHANAN BEN-PORATH, *Hebrew University of Jerusalem; Member, School of Social Science*

December 1
Interdisciplinarity Thematic Seminar

December 2
Social Science Thursday Luncheon Seminar:
"German Romanticism, American Democracy, and a Touch of Irony"
WOLF LEPENIES, *Wissenschaftskolleg zu Berlin; Visitor, School of Social Science*

December 6
IAS/Princeton University Economics Workshop:
"A Simple, Robust Procedure to Improve the Efficiency of Referenda"
ALESSANDRA CASELLA, *Columbia University; Member, School of Social Science* (with A. Gelman)

December 9
Social Science Thursday Luncheon Seminar:
"Affective Technologies, Affective Economies: Rethinking the Social"
PATRICIA TICINETO CLOUGH, *The Graduate Center, City University of New York; Member, School of Social Science*

December 15
Interdisciplinarity Thematic Seminar

December 16
Social Science Thursday Luncheon Seminar:
"Nature, Property, and Democracy in the Debate Over Genetically Modified Organisms (GMOs)"
JOHN M. MEYER, *Humboldt State University; Member, School of Social Science*

January 27
Interdisciplinarity Thematic Seminar

February 3
Social Science Thursday Luncheon Seminar:
"Rivalry and Friendship in Marriage: Challenges to Discourses of Society in Late 19th/Early 20th Century Europe"
CAROLINE ARNI, *University of Berne; Member, School of Social Science*

February 7
IAS/Princeton University Economics Workshop:
"A General Theory of Time Preferences"
EFE OK, *New York University*

February 9
Interdisciplinarity Thematic Seminar

February 10
Social Science Thursday Luncheon Seminar:
"Why Do We Procrastinate? An Evolutionary Perspective"
ERIC MASKIN, *Professor, School of Social Science*

February 14
IAS/Princeton University Economics Workshop:
"An Exercise in Searching for Diamonds"
KONSTANTIN SONIN, *New Economic School* and *CEFIR; Member, School of Social Science*

February 17
Social Science Thursday Luncheon Seminar:
"The (Im)Possibility of a Paretian Rational: A Puzzle in the Foundations of Deliberative Democracy"
KLAUS NEHRING, *University of California, Davis; Visitor, School of Social Science*

February 24
Social Science Thursday Luncheon Seminar:
"Game Theoretic Models of Conflict"
JOHN TOMAS SJÖSTRÖM, *Rutgers, The State University of New Jersey; Member, School of Social Science*

February 28
Economics Seminar:
"Equilibrium or Simple Rule at Wimbledon"
CHEN-YING HUAN, *National Taiwan University* and *Harvard University*

February 28
IAS/Princeton University Economics Workshop:
"Rationalizable Expectations"
ELCHANAN BEN-PORATH, *Hebrew University of Jerusalem; Member, School of Social Science*

March 2
Joint Seminar of Interdisciplinarity and Economics Members

March 3
Social Science Thursday Luncheon Seminar:
"Mobilizing Mud: Colonial Projects and the Making of the U.S. Georgia Sea Islands"
PAULLA A. EBRON, *Stanford University; Member, School of Social Science*

March 8
IAS/Princeton University Economics Workshop:
"Diversity and the Metric of Opportunity"
CLEMENS PUPPE, Universität Karlsruhe

March 10
Social Science Thursday Luncheon Seminar:
"Africa as a Living Laboratory: Science, Nature, and Imperial Development in the British Tropics"
HELEN TILLEY, *Princeton University; Visitor, School of Social Science*

March 17
Social Science Thursday Luncheon Seminar:
"Poverty and Human Rights: One Step Forward, Two Steps Back."
CHUN LIN, *London School of Economics; Visitor, School of Social Science*

March 23
Interdisciplinarity Thematic Seminar

March 28
IAS/Princeton University Economics Workshop:
"Reputation for Toughness in Bargaining"
ELLA SEGEV, *Tel Aviv University, Israel*

March 31
Social Science Thursday Luncheon Seminar:
"Nietzsche on Secularization and Moral Decadence"
TAMSIN SHAW, *Princeton University; Member, School of Social Science*

April 4
IAS/Princeton University Economics Workshop:
"The Overconfidence Problem in Insurance Markets"
FRANCESCO SQUINTANI, *UCL* (with Alvaro Sandroni)
"The Killing Game: Reputation and Knowledge in Politics of Succession"
GEORGY EGOROV, *New Economic School* and *CEFIR*

April 7
Social Science Thursday Luncheon Seminar:
"What is Social Construction?"
PAUL BOGHOSSIAN, *New York University; Visitor, School of Social Science*

April 11
IAS/Princeton University Economics Workshop:
"Growing Strategy Sets, Entropy, and Growing Recall in Repeated Games"
DAIJIRO OKADA, *Rutgers, The State University of New Jersey* (with A. Neyman)

April 14
Social Science Thursday Luncheon Seminar:
"The Object of Radio Studies"
JOHN MOWITT, *University of Minnesota; Member, School of Social Science*

April 19
IAS/Princeton University Economics Workshop:
"On the Measurement of Segregation"
ROLAND FRYER, *Harvard University*

April 21
Social Science Thursday Luncheon Seminar:
"Residues of Empire: The Paradigmatic Meaning of Jewish Transterritoriality for an Integrated European History"
DAN DINER, *Leipzig University* and *Hebrew University of Jerusalem; Member, School of Social Science*

April 25
IAS/Princeton University Economics Workshop:
"Storable Votes and Minorities"
ALESSANDRA CASELLA, *Columbia University; Member, School of Social Science* (with T. Palfrey and R. Reizman)

April 27
Interdisciplinarity Thematic Seminar

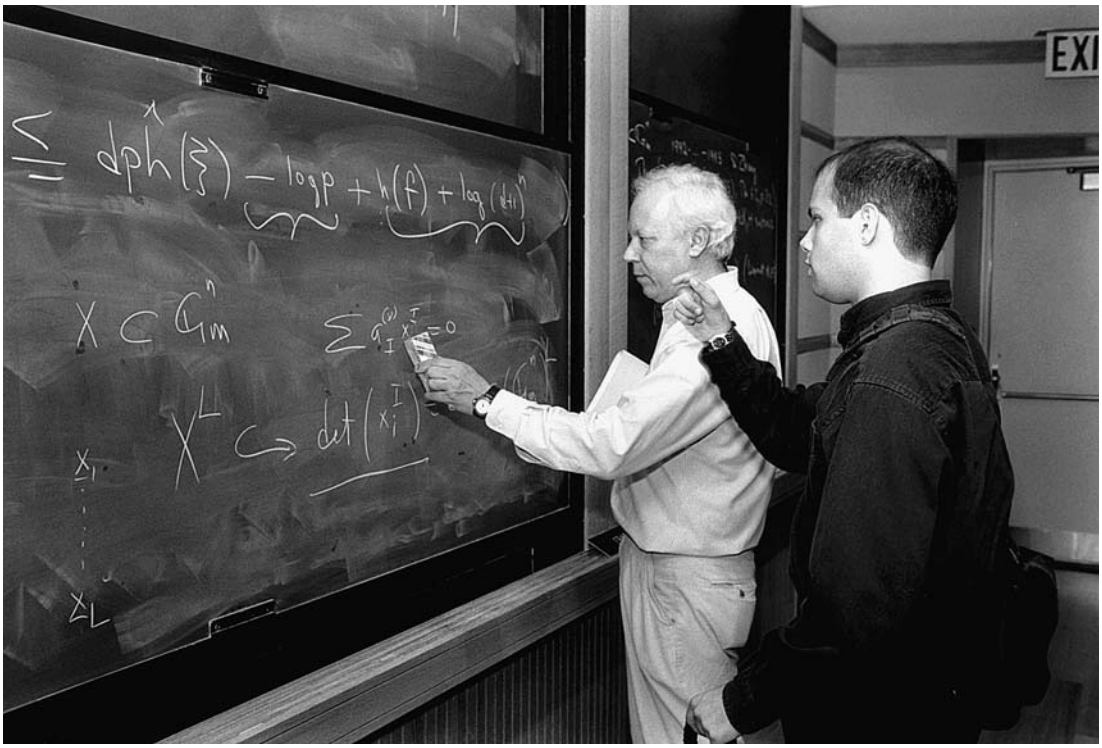
April 28
Social Science Thursday Luncheon Seminar:
"Toughness in Bargaining: Is It a Good Strategy?"
ELLA SEGEV, *Tel Aviv University, Israel*

May 4
Interdisciplinarity Thematic Seminar

May 5
Social Science Thursday Luncheon Seminar:
"Matatu Culture in Nairobi"
KENDA MUTONGI, *Williams College; Member, School of Social Science*

May 12
Social Science Thursday Luncheon Seminar:
"The Theft of History: Humanism, Renaissance and Antiquity"
JACK GOODY, *St. John's College, Cambridge*

May 18
Interdisciplinarity Thematic Seminar



RANDALL HAGADORN

"This year at the IAS opened up a whole new research world to me. In the atmosphere of time and patience I learned to talk and listen to mathematicians from other fields. I learned how to explain and present my work, how to learn from other people's work, and how to approach questions beyond my specialization. Last but not least I had the time, freedom, and fun that I needed to decide on my further space-time trajectory in mathematics."

— Member, School of Mathematics

Member in the School of Mathematics with Enrico Bombieri, IBM von Neumann Professor

SPECIAL PROGRAMS

PROGRAM IN INTERDISCIPLINARY STUDIES

Faculty
PIET HUT

PIET HUT continued to lead the interdisciplinary program, now in its third year. His visitors came from a variety of fields, including physics and astrophysics, mathematics, computer science, cognitive science, psychology, political science, history of science, and philosophy.

In December 2004, Prof. Hut was honored to have a main-belt asteroid named after him: asteroid 17031 Piethut has a diameter of several miles and moves around the sun in an orbit with a semimajor axis of 2.4 AU, an eccentricity of 0.12 and an inclination of 8 degrees.

Professor Hut's main research project in astrophysics is the development of the Kali code, a new software tool for simulations of dense stellar systems, which he is developing in collaboration with Jun Makino, from Tokyo University. This project is based on the philosophy that complete documentation is central for any large-scale software development to succeed. As a side product, Hut and Makino are writing a series of text books titled the *Art of Computational Science*. They have already published several volumes in this series on their web site: www.artcompsci.org.

Professor Hut organized a workshop, MODEST-5d, at the Institute for Advanced Study, with the title "Visualization of Simulations in Dense Stellar Systems." Although the workshop started off with several invited talks, informal discussions and exchanges of ideas formed the core of the meeting. As a result, several new interdisciplinary collaborations were launched, including astrophysicists and computer scientists.

July 2004 saw the publication of the book, *The New Physics and Cosmology* [ed.: A. Zajonc; Oxford University Press], a collection of dialogues between the Dalai Lama and a group of five physicists, including Professor Hut, held in Dharamsala in 1997. Chapter 11 contains the presentation by Professor Hut, entitled "Science in Search of a Worldview." and the discussion that was interwoven with it.

ARTIST-IN-RESIDENCE PROGRAM

Jon Magnussen, Composer

The 2004-05 academic year marked the second year of *Recent Pasts 20/21*, the Artist-in-Residence Program's four-year exploration of music of the past century. The goal of this undertaking is to contribute to a better understanding of the wide variety of aesthetic perspectives in western art music of the 20th and 21st centuries through chamber music concerts and talks.

The 2004-05 music series explored recent currents in contemporary music with the following concerts:

PIANOMORPHOSIS, featuring pianist Bruce Brubaker and designer Ben Kato, challenged and explored the boundary between what we hear and what we see, bringing together minimalist piano music of John Adams, John Cage, Alvin Curran, and Philip Glass; literary texts by authors including T.S. Eliot, Wallace Stevens, and Virginia Woolf; and theatrical lighting, live video and a pair of dancers.

A PRINCETON CONNECTION celebrated the richness and diversity in the work of composers associated with this town by attempting the impossible: to present a representative spectrum of Princeton-associated music spanning three-quarters of a century. The program was divided into two sections: *Music for Voice and Music for Piano*. *Music for Voice*, presented by soprano Judith Bettina and pianist, James Goldsworthy, included music by Milton Babbitt (*Now Evening, After Evening, Pantun*, and both versions of *Phonemena)*; Edward T. Cone (*Three Songs from Pippa Passes* – world premiere); Mario Davidovsky (*Lost*); Tobias Picker (*not even the rain, Half a Year Together, Native Trees and To the Insects*); Mel Powell (*Levertov Breviary*); David Rakowski (*Sara, Georgic, Cassandra, To Be Sung On the Water, and Scatter*); and Roger Sessions (*On the Beach at Fontana*). *Music for Piano* featured pianist Blair McMillen, who performed works by Mario Davidovsky (*Synchronisms No. 6)*; Emily Doolittle (*Minute Etudes, from Books I and II)*); John Harbison (*Gatsby Etudes*); Andrew Imbrie (*Daedalus*); Jon Magnussen (*Toccare!*); Frederic Rzewski (*Dust* – North American premiere); Su Lian Tan (*Invocation* from *Orfeo in Asia* – world premiere); and Barbara White (selections from *Reliquary*).

In *MUSIC OF THE SOUTH CAUCASUS*, the new-music ensemble CONTINUUM® and its co-directors Cheryl Seltzer and Joel Sachs presented music of composers from Armenia, Georgia and Azerbaijan. Works included Alexander Aslamazov's *Napyev* (*Melody*), for clarinet solo; Sulkhan Nasidze's *Four Improvisations*, for violin and piano; Oleg Felzer's *Vestige*, for violin, clarinet and piano; Franghiz Ali-Zadeh's *"Apsheron" Quintet*, for piano and string quartet; Faradzh Karayev's *Postludia II*, for piano, double bass, and string quartet (U.S. Premiere); Suren Zakarian's *In Statu nascendi – Seven Miniatures for String Quartet* (U.S. Premiere); and Giya Kancheli's *Psalm 23*, for soprano, alto flute, viola, cello, double bass, synthesizer, and tape.

Speakers in the series included composer Philip Glass ("Hearing and Seeing: Philip Glass speaks with Bruce Brubaker and Jon Magnussen"); composers Su Lian Tan and Barbara White and pianist Blair McMillen, who discussed the works on the *Princeton Connection* program with Magnussen; composer Paul Lansky ("The Contexts of Musical Technology"); composers Milton Babbit and Andrew Imbrie ("Perspectives"); and conductor/scholar Joel Sachs ("The Musical World of the South Caucasus").

In addition to directing *Recent Pasts 20/21,* Magnussen composed two orchestral fanfares for the Hawaii Youth Symphony in celebration of the organization's 40th anniversary, which premiered in Honolulu on December 5, 2005. His ballet score *Psalm,* composed at the Institute during 2001-02, was highlighted at the September 11 commemorative event at Battery Park presented by the Lower Manhattan Cultural Council and the Joyce Theater. *Psalm* was also performed this year in the José Limón Dance Company's New York City season at the Joyce Theater, and on tour in Europe (Italy, Lithuania, Germany) and the U.S. (New York, Kansas, California, Alaska, Florida). Also during the year pianist Blair McMillen performed Magnussen's *Toccare!* for solo piano, in concerts at the Institute's Wolfensohn Hall and at the Italian Academy, Columbia University. Magnussen continued to work with librettist Gavan Daws on their upcoming opera, *The Folding Cliffs*.

DIRECTOR'S VISITORS

Scholars from a variety of fields, including areas not represented in the Schools, Director's Visitors contribute much to the vitality of the Institute. They are invited to the Institute for varying periods of time, depending upon the nature of their work.

PAUL BENACERRAF

Director's Visitor Paul Benacerraf is a faculty member in the Department of Philosophy at Princeton University. He specializes in the Philosophy of Mathematics, especially metaphysical and epistemological issues in connection with mathematics. He spent his year reviewing the philosophical writings of Kurt Gödel with an eye to uncovering connections with views expressed by Gödel in some personal conversations in the spring of 1975, the contents of which never appeared explicitly in Gödel's published writings, or, it seems, in the *nachlass*. Benacerraf plans an essay that relates these remarks and situates them in the body of Gödel's philosophical views.

LOUISE DOLAN

Director's Visitor Louise Dolan is a mathematical physicist and professor of physics at the University of North Carolina at Chapel Hill. She does research in theoretical physics and superstring theory, and is the principal investigator on a Department of Energy grant that funds the string theory program at Chapel Hill. In the summer of 2005 she collaborated on research in superstrings and twistor theory at the Institute for Advanced Study.

GRAHAM FARMELO

Director's Visitor Graham Farmelo is Senior Research Fellow at the Science Museum, London and Associate Professor of Physics at Northeastern University. He contributes widely to UK national media on science issues and was responsible for the vision of the Wellcome Wing at the Museum, the world's first museum display devoted exclusively to contemporary science and technology. He is currently writing a biography of physicist Paul Dirac, and preparing an edition of Dirac's correspondence with leading Russian physicists, including Kapitza, Tamm, Fock and Gamow. During a brief stay in summer 2004, Farmelo produced the outline for his biography of Dirac, and during summer 2005, he completed a substantial fraction of the writing.

WOLF LEPENIES

Director's Visitor Wolf Lepenies is a professor of sociology at the Free University of Berlin

(Germany). He was Rektor of the Wissenschaftskolleg, the German Institute for Advanced Study in Berlin, from 1986 through 2001 where he is now a permanent fellow. Dr. Lepenies first came to the Institute in the Academic Year 1979/80 and has returned many times, as a Member, a long-term Member, and a Visitor in the School of Social Science. In December 2004 he presented a talk on the subject of "German Romanticism, American Democracy, and A Touch of Irony" to the Thursday Luncheon Seminar of the School of Social Science. During his stay at the Institute, Dr. Lepenies completed the manuscript of his first book written in English, "The Seduction of Culture in German History," to be published by Princeton University Press in the spring of 2006.

DAVID OLIVE

Director's Visitor David Olive is an Emeritus Professor at the University of Wales Swansea. He has a long-standing interest in quantum electro-magnetic duality, an unexpected feature of some interesting quantum field theoretic descriptions of elementary particle physics. He was able to pursue new developments that he learnt of at the Institute for Advanced Study.

INSTITUTE FOR ADVANCED STUDY/ PARK CITY MATHEMATICS INSTITUTE

The IAS/Park City Mathematics Institute (PCMI) is an integrated mathematics program sponsored since 1994 by the Institute for Advanced Study. Participants in PCMI include research mathematicians, graduate students, undergraduate students, mathematics education researchers, undergraduate faculty, and high school teachers. The interaction among these diverse groups fosters a stronger sense of the mathematical enterprise as a whole, in that it raises awareness of the roles of professionals with diverse responsibilities in mathematics-based professions.

The annual three-week Summer Session is the flagship activity of PCMI. Additional programs take place throughout the year and include the year-long Secondary School Teacher Program (formerly the High School Teacher Program) and the Lecture Publication Series.

A major development for PCMI in 2003-04 was the receipt of a three-year Math Science Partnership Initiatives grant from the National Science Foundation. Totaling some $5.5 million over three years, the funding provides for an expanded Summer Session High School Teacher Program and for the design and implementation of a comprehensive in-year program of teacher professional development in three school districts in the United States: Cincinnati (Ohio), McAllen (Texas), and Seattle (Washington). The in-year program is known as PD^3, which stands for "PCMI and Districts Partner to Design Professional Development." In each district, the PCMI three-fold model of 1) continuing to do mathematics, 2) analyzing practice, and 3) becoming a resource to one's peers, will be tailored and implemented as the official professional development program for math teachers in selected middle and high schools in each district. Teachers and administrators from each of the three school districts will participate fully in designing professional development offerings that, based on PCMI's three-fold model, will be unique to the needs of their own teachers and curriculum. PCMI's was the only Institute Prototype award given in the Math Science Partnership program's 2003 cohort of grants.

Summer Session
The 15th annual Summer Session of the IAS/Park City Mathematics Institute (PCMI) was held June 26-July 16, 2005, in Park City, Utah. This year's PCMI Summer Session, with a total of 315 participants included the following programs:

Research Program in Mathematics
Graduate Summer School
Undergraduate Summer School
Secondary School Teacher Program
Undergraduate Faculty Program
Mathematics Education Research Program
Mathematician's Standards Study Group
NCTM/ASSM Conference on State Standards

As is the case each year, a specific area of mathematics was chosen to provide the focus for the overall programming. The mathematical topic for the 2005 Summer Session was *Mathematical Biology;* this topic informed the work of the Graduate Summer School, the Research Program and the Undergraduate Summer School. The topic *The Mathematics Education of Mathematics Teachers* provided the focus for the education programs, including the Mathematics Education Research Program and the Secondary School Teachers Program.

Each of the programs met daily for a series of courses and seminars. The groups also met together for an afternoon Cross Program Activity two or three days per week. A complete listing of courses, seminars and activities follows.

Graduate Summer School and Research Program
Organized by James Keener, University of Utah, Mark Lewis, University of Alberta, and Philip Maini, University of Oxford, the Graduate Summer School met for three formal lectures each day. New to the Graduate Summer School experience this year were group projects assigned and mentored by the lecturers and organizers. Small groups of three or four graduate students worked on projects related to the research topic, presenting their work to all participants at the end of the Summer Session.

PCMI was very pleased to have the participation of Clay Mathematics Institute Senior Scholars Simon Levin of Princeton University, and Charles Peskin of the Courant Institute. Both Scholars delivered well-received public lectures (listed under Cross Program Activities) and both participated actively in the Graduate Summer School and Research Program.

Graduate Summer School lecturers and course titles:
Introduction to Biological Dynamics, James Keener and Mark Lewis
Cell and Tissue Physiology, Alexander Mogilner
Epidemiology and Disease, David Earn
Cancer, Helen Byrne
Neurobiology, Paul Bressloff
Ecological Dynamics, J.M. Cushing
Topological Approaches to Biological Dynamics, Leon Glass

There is much anticipation of the set of course lecture notes that are being generated from the Graduate Summer School for publication by the American Mathematical Society (Park City Mathematics Series Volume 15).

The Research Program
The Research Program had approximately 40 participants. This program's main formal activities were seminars, usually two per day during the first two weeks, and one per day during the third week. There was also ample opportunity for less formal interaction in the Research Program. Blackboards in the hallway of the conference center facilitated impromptu conversations, and various seminar rooms with tables and blackboards were available during parts of the day and evenings.

Research Program Seminars:
Balancing the unbalanced: mathematics at the bedside; John Milton
Modeling the Eucaryotic cell cycle; John Tyson
Modeling type 1 diabetes; Leah Keshet
Patterns in oceans and cells: linking global Redfield ratios to cellular machinery; Irakli Loladze
Pattern formation on growing domains; Philip Maini
Spatial ecology: implications for evolutionary theory; Simon Levin
The role of flexibility in the function of biomolecular motors; Charles Peskin
A clock and wavefront mechanism for somite formation; Ruth Baker
Rusty crayfish and smallmouth bass: exciting interactions; Caroline Bampfylde
Modeling HIV infection; Alan Perelson
3D model of cellular electrophysiology; Yoichiro Mori
Individual based modeling of multicellular assemblies: steps toward computational tumors and tissues; Dirk Drasdo
Physical limits to biochemical signaling; Sima Setayeshgar
The ecology and evolution of animal aggregatio; Simon Levin
Flow in collapsible tubes; Xiao Yu Luo
Dpp repression and Wg signaling; Baochi Nguyen
Mechanistic Home Range Analysis; Paul Moorcroft
Reversals of competitive dominance in ecological reserves via external habitat degradation; Stephen Cantrell
Localized activity in neuronal networks; Amitabha Bose
Abdominal Aortic Aneurysm; Nicholas Hill
Propagation failure and success in response to spatial or temporal; Eric Cytrynbaum, Tim Lewis
The role of epidemics in biological invasions; Frank Hilker
A model for the evolution of insect phenology; Christina Cobbold

Undergraduate Summer School
The Undergraduate Summer School for 2005, with 38 students participating, offered three courses rather than the usual two. The motivation for adding the extra course was a desire to include coverage of mathematics relevant to genomic research in addition to courses reflecting the main theme of the Research Program, which was dynamical systems modeling of biological phenomena. Support for this expanded undergraduate program was received from the National Institutes of Health.

The instructors for the Undergraduate Program, and their course titles, were as follows:

- Introductory Course: *Dynamics, Disease and Diversity;* Fred Adler (University of Utah)
- Advanced Course: *Introduction to Cancer Modeling with Optimal Control;* Lisette de Pillis (Harvey Mudd College)
- Supplementary Course: *The Mathematics of Phylogenetic Trees;* Elizabeth Allman (University of Southern Maine) and John Rhodes (Bates College)

Undergraduate Faculty Program
This year's Undergraduate Faculty Program at PCMI was entitled *Introduction to Cell Biology for Mathematicians*. The program offered one formal lecture and one seminar each day. In addition, a series of six lectures entitled *Medical Physiology from a Mathematical Point of View* was offered by Clay Mathematics Institute Senior Scholar-in-Residence, Charles Peskin (Courant Institute).

The organizer and facilitator of the Undergraduate Faculty Program was John Tyson, Virginia Technical University, with assistance from William Barker, Bowdoin College, and Daniel Goroff, Harvey Mudd College. There were 20 participants in the Undergraduate Faculty Program.

The morning course lectures were designed to equip participants, if they wished, to understand some of the Research Program talks. Several participants noted on their exit surveys that they were, indeed, regularly attending one or two other lectures every day in addition to the morning course. The morning course also attracted a mixture of undergraduate and graduate participants as well as a few people from the Research Program.

The Secondary School Teacher Program
Formerly known as "The High School Teachers Program," the new name reflects the participation of middle school teachers through the PCMI's Math Science Partnership Project.

Fifty-four middle school and high school teachers spent a rewarding and challenging three weeks learning mathematics, reflecting on what it means to teach mathematics and working together to produce a product to share with their colleagues both at PCMI and more broadly through the PCMI website. This year presented a particular challenge as the program scaled up to include electronic delivery of the mathematics to five additional teachers from Cincinnati as part of the Math Science Partnership project known as PD^3 *(PCMI and Districts Partner to Develop Professional Development)*.

Twenty-two of the teachers returned for a second year, including 13 PD^3 teachers, and three returned for a third year to work with the staff as leaders and support for the other participants. The other participants came from a variety of geographic locations including Ohio, Washington, Pennsylvania, New Mexico, Washington DC, North Carolina, Minnesota, North Dakota, New Jersey, and California and ranged from teachers with one year of teaching experience to seasoned veterans. The teachers represented Professional Development and Outreach groups from Los Angeles, Seattle, New Jersey, New Mexico, and Minnesota, as well as those who came as individuals.

The mathematics session, *Developing Mathematics: Doing it with Differences,* used materials created, as they have been for the last four years, by Al Cuoco from the Educational Development Corporation, and alumni of the *PROMYS* for Teachers program from Boston University. Under the leadership of two *PROMYS* teachers, participants explored numerical methods such as iteration, fixed points, eigenvectors and algebraic methods

such as closed form solutions, different, ways to solve recurrences, using matrices). Akihiko Takahashi from DePaul University designed and presented the *Reflecting on Practice* sessions, which were focused on the Japanese concept of open-ended problems and what they bring to teaching and learning mathematics. Participants examined tasks, created and evaluated their own open-ended problems, and explored how these would fit into the mathematics curriculum and their own classrooms.

For two hours each afternoon, participants took part in one of six working groups - data analysis, functions, geometry, lesson study, discrete mathematics, and observation of teaching. The observation of teaching working group was a highly successful new group designed to take advantage of the PCMI teaching laboratory for fifth grade students taught by Deborah Ball. Another innovation was organizing the discrete mathematics working group, led by mathematician Brian Hopkins, around undergraduate-level mathematics courses, *Phylogenetic Trees*, offered by Elizabeth Allman and John Rhodes. The interaction with the undergraduate program and faculty led to productive conversations about how this mathematics might appear in high school classes. The working groups explored technology, developed lessons, classroom activities, organized a website, and created drafts of potential articles on interesting and useful mathematics that will be tested in classrooms when appropriate, reviewed during the coming year, revised as necessary, and posted on the PCMI website.

Another innovation was to bring together during the first week of the program five mathematics supervisors/educators and PCMI Professional Development and Outreach (PDO) Groups leaders from Los Angeles, New Mexico, New Jersey, Washington and Michigan. They attended morning sessions of the SSTP and spent the afternoon as a separate working group, considering ways for schools and the PDOs to collaborate on professional development initiatives and suggestions to strengthen and shape PDO programs. During the second week of the SSTP, the district and university representatives from the three PD^3 sites (Seattle, Cincinnati, and McAllen TX) took part in the sessions for the high school teachers, met with their PD^3 teachers and as a group to hear a report from the PD^3 evaluator and to work through issues related to PD^3 goals.

Overall the summer was very successful, with extremely high ratings from the participants on nearly every element of the program. The participation of the PD^3 teachers was in keeping with the project goals, interaction with the other PCMI programs was increased, and several new universities are interested in instituting PDO groups. Challenges remain in finding ways to maximize the opportunities offered by the supervisor/PDO leader sessions and in getting the working group products reviewed, revised, and made public in a timely manner.

International Seminar
Mathematics Education Around the World, Bridging Policy and Practice: A Focus on Standards and Mathematics. Begun in 2001, the annual PCMI International Seminar on Mathematics Education brings diverse perspectives and practices to the U.S. national dialogue on mathematics education. The 2005 International Seminar brought six new teams into the dialogue on the preparation of teachers of mathematics in various countries and cultures. The new countries represented were Cameroon, Chile, Uganda, Singapore, Germany, and Russia, each with the customary team of two participants, one a currently practicing teacher and one an educational policy person. Reports were prepared prior to the seminar by each team, and these reports were presented, analyzed and responded to dur-

ing the four-day seminar. The proceedings of the 2002 and 2003 seminars on teacher education are posted on PCMI's web site at the Math Forum at Drexel University, and a volume is being prepared for publication. The volume will give the wider education community the opportunity to learn of common problems and promising practices coming from diverse cultural and intellectual traditions.

With the addition of Uganda to the seminar, PCMI marks a new collaboration with The World Bank. It is anticipated that this collaboration will result in the establishment of a PCMI-like institute in Uganda and the sub-Sahara Africa region in the future.

Mathematics Education Research Program: Elementary Mathematics Laboratory
The Elementary Mathematics Laboratory (EML) was developed to provide a data-rich environment in which the perspectives and expertise of mathematicians, mathematics educators, and K-12 teachers can be brought to bear on problems of teaching and learning elementary mathematics. At the core of the lab is a summer school course for fifth grade students from Park City Schools: participants engage in the design and analysis of the lessons, and observe an experienced classroom teacher teaching the lesson. The goal of the Elementary Mathematics Laboratory is to investigate how essential ideas and ways of working that characterize mathematics at advanced levels might be made accessible to young students, and how students might learn practices essential to mathematical work. A corollary problem focuses on the mathematical knowledge needed for teaching - What do teachers have to do and "be" mathematically in order to engage students in such mathematical work?

This year, the summer school course met for five days and enrolled nineteen students in the class. Classes were held from 10:00a.m.-12:15p.m., with an additional 30 minutes of homework each day. Elementary Mathematics Laboratory participants attended the class sessions and were involved in the planning and analysis of the class both before and after the lessons. Participants discussed the mathematical ideas and skills in which the students were engaged, and the sorts of mathematical moves and habits that they were developing. Parallel to this was an analysis of the mathematical problems faced by the teacher, and the mathematical moves needed to teach the class. Observations and artifacts gathered from the lab class each day provided resources for this investigation and analysis.

Mathematicians' Standards Study Group II
A distinctive feature of PCMI 2004 was the concurrent workshop to compare the Mathematics Standards documents of the 50 states, in an attempt to determine the extent to which a national curriculum can be said to exist. Working beside the participants of the National Math View workshop (leaders from the National Council of Teachers of Mathematics and the Association of State Supervisors of Mathematics) was a group of approximately a dozen university mathematicians.

During the 2004-2005 academic year, this group continued reviewing the Standards of the various states and then crafted responses in the form of essays geared to specific topics. The essays are available in draft form on the PCMI web site. This year-long activity culminated in a second meeting of the group at the 2005 PCMI Summer Session where they continued the dialog begun last year with a subset of the National Math View participants (also meeting for a follow-up to their activity of last year).

A National Math View II
Begun last summer as a three-day workshop jointly sponsored by the National Council of Teachers of Mathematics (NCTM) and the Association of State Supervisors of Mathe-

matics (ASSM), the National Math View met to analyze and collect data about the Mathematics Standards of the 50 United States. The group produced an analysis that was presented to the National Council of Teachers of Mathematics and other policy groups in the United States in the spring of 2005. In the summer of 2005, a subset of this group met again at the PCMI Summer Session in order to dialog with the Mathematicians' Standards Study Group (see below) regarding the essays that group had drafted over the course of the 2004-2005 academic year in response to the contents of the States' Standards.

Cross Program Activities
A defining feature of PCMI is its focus on building understanding, professional respect and a sense of shared purpose among all the various constituents of the mathematical enterprise. To that end, formal Cross Program Activities were held two or three afternoons each week as well as various evening activities and participant-coordinated weekend trips.

For the second year, two evenings of "Pizza and Problem Solving," were organized and presented by two faculty members from Harvey Mudd College: Andrew Bernoff and Francis Su. On each of these two evenings, between 200 and 250 participants attended, representing all the programs at PCMI. The participants appreciated the opportunity to tackle brain-teasers together, which seemed to "level the playing field" among the participants in a healthy way. And participants from all the programs were represented among those who presented solutions at the end of the evening.

Other evening activities included the opening and closing barbecue dinners for participants and their families.

Cross Program Activities Lectures:
Chaotic music and fractal art: a glimpse into the neurophysiology of aesthetics; Leon Glass
Mathematics in Africa; participants of the International Seminar on Mathematics Education
Opportunities for Mathematicians at NSA; Barbara Deuink
Panel discussion by the National Math View 2; participants of the Mathematicians' Standards Study Group II and the PMET workshop
The Elementary Mathematics Teaching Lab; Deborah Ball
Coping with Complexity, John Tyson

Clay Mathematics Institute Public Lectures:
Cardiac mechanics and electrophysiology by the immersed boundary method; Charles Peskin
Game theoretic problems in evolutionary ecology and economics; Simon Levin

Publication Series
PCMI is very pleased to make the proceedings of its Summer Session available to the public. The full series, which comprises nearly all of the lectures ever given in PCMI's Graduate Summer School, now includes the following titles:
Volume 1: *Geometry and Quantum Field Theory*
Volume 2: *Nonlinear Partial Differential Equations in Differential Geometry*
Volume 3: *Complex Algebraic Geometry*
Volume 4: *Gauge Theory and Four Manifolds*
Volume 5: *Hyperbolic Equations and Frequency Interactions*
Volume 6: *Probability Theory and Applications*
Volume 7: *Symplectic Geometry and Topology*

Volume 8: *Representation Theory of Lie Groups*
Volume 9: *Arithmetic Algebraic Geometry*
Volume 10: *Computational Complexity Theory*

Volume 11 will be published by the end of 2005, with Volumes 12-13 following in 2006. All volumes are available either from the American Mathematical Society or through popular bookstores such as Barnes and Noble.

Also published are three volumes in the *Park City Mathematics Institute Subseries*, which is a subsection of the AMS *Student Mathematics Series*. These volumes are aimed at undergraduate students and are published independently of the Park City Mathematics Series mentioned above. Published thus far are:

Lectures on Contemporary Probability by Gregory F. Lawler and Lester N. Coyle
An Introduction to the Mathematical Theory of Waves by Roger Knobel
Codes and Curves by Judy L. Walker.

The Secondary School Teachers Program disseminates its teacher-created materials and other resources via a special website created by the Math Forum at Drexel University.

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The Wolfensohn Family Foundation
The National Institute of Health
The Clay Mathematics Institute
Chautauqua Workshop Programs

Appreciation is also extended to the Department of Mathematics at the University of Utah for providing office space for PCMI administration during the academic year.

Board Members:
Hyman Bass, Professor, University of Michigan
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Elaine B. Wolfensohn, New York, New York

Steering Committee
Members of the Steering Committee plan and manage the activities of the PCMI as follows:

Chair:
C. Herbert Clemens, Professor, University of Utah

2005 Graduate Summer School/Research Program Organizers:
James Keener, Professor, University of Utah
Mark Lewis, Professor, University of Alberta
Philip Maini, Professor, University of Oxford

Graduate Summer School:
John Morgan, Columbia University

Lecture Series:
John Polking, Rice University

Mathematics Education Research Program:
Joan Ferrini-Mundy, Associate Dean for Science and Mathematics Education, College of Natural Science of Michigan State University

Recruitment:
Nathaniel Whitaker, Professor, University of Massachusetts at Amherst

Research Program:
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Secondary School Teachers Program:
Gail Burrill, Instructor, Michigan State University
James R. King, Professor, University of Washington
Carol Hattan, Teacher, Skyview High School

Undergraduate Faculty Program:
Daniel Goroff, Professor, Harvard University

Undergraduate Program:
William Barker, Professor, Bowdoin College
Roger Howe, Professor, Yale University

The research topic for the summer of 2006 will be Low Dimensional Topology, organized by Thomas Mrowka, Massachusetts Institute of Technology, and Peter Ozsvath, Columbia University.

PROGRAM FOR WOMEN IN MATHEMATICS

The twelfth annual Program for Women in Mathematics was held at the Institute for Advanced Study from May 16-27, 2005, and the research topic was the geometry of groups. The program was sponsored by the Institute for Advanced Study and Princeton University and generously supported by the National Science Foundation and The Starr Foundation.

The goal of the program is to bring together research mathematicians with women undergraduate and graduate students for an intensive eleven-day workshop and to encourage the students to continue their mathematics education by offering lectures and seminars on a focused topic, mentoring, discussions on peer relations and an introduction to career opportunities.

Ruth Charney of Brandeis University was the organizer of this year's program. Including teacher assistants and lecturers, there were 11 postdoctoral mathematicians, 19 graduate students, and 28 undergraduate students. Both students and mentors were accommodated in the Institute's housing complex giving them an opportunity to meet School Members and mathematicians from neighboring institutions.

The first half of the advanced course was given by Ruth Charney and the second half by Karen Vogtman of Cornell University. The first part of the course discussed classical problems in geometric group theory which include algorithmic problems, such as the word and conjugacy problem, and questions about the structure of subgroups. Other problems in the context of CAT(0) spaces and particularly CAT(0) cube complexes were also covered. The second part of the course explored groups acting on trees and spaces of trees. Teacher assistants for the course were Angela Barnhill from Ohio State University and Emina Alibegovic from the University of Michigan. A suggested advanced course reading list was provided to the participants prior to the beginning of the program.

Tara Brendle and Indira Chatterji, both of Cornell University, shared responsibility for the beginning lecture course. The course began with an introduction to the fundamentals of metric spaces and groups and explored specific examples with an eye on so-called word hyperbolic groups. Another focus was braid groups, which carry a rich geometrical structure as well as related groups such as Artin groups, Coxeter groups and mapping class groups. Teacher assistants were Pallavi Dani of the University of Chicago and Talia Fernos of the University of Illinois at Chicago. Some background reading was suggested to the participants as preparation for the course.

Research seminars were organized by Woonjung Choi of the Translational Genomics Research Institute. Seminars were as follows: Anne Thomas of the University of Chicago, "Uniform Lattices Acting on Hyperbolic Buildings;" Michelle Karlsson of Yale University, "Bounded Cohomology and Characteristic Classes;" Kariane Calta of Cornell University, "Moduli Space of Abelian Differentials and Billiards;" Diane Vavrichek of the University of Michigan, "Topological Methods in Group Theory;" Hyun Jeong Kim of Penn State University, "Course Equivalence of Warped Cones;" and Aditi Kar of the University of Nebraska at Lincoln, "Finite Subgroups of d-Hyperbolic Groups."

Katy Bold of Princeton University and Cynthia Rudin of the Courant Institute of Math-

ematical Sciences were the organizers of the Women in Science seminar. They invited two outside speakers, Dr. Shelly Costa from Swarthmore College whose lecture, "Polytopes and Petticoats," talked about the mathematical women in George Boole's family, and Dr. Vita Rabinowitz of Hunter College spoke on the "Gender Equity Project." There were panel discussions about how to survive graduate school, a day in the life of a mathematician, a discussion from graduate students on the sub-fields of mathematics they work on and an open discussion on "Women and Science and the Media."

Colloquia were given by Rob Ghrist of the University of Illinois, Champaign-Urbana and Joan Birman of Columbia University. Ghrist's talk, "The Geometry and Topology of Reconfiguration," was on the connection with robotics and Birman talked on "The Conjugacy Problem in the Braid Groups."

The usual schedule for program at the Institute each day was:

8:00 a.m. – 10:00 a.m.	Breakfast in the Institute's dining hall
9:30 a.m. – 10:30 a.m.	Beginning course lecture
10:45 a.m. – 11:45 a.m.	Advanced course lecture
12:00 p.m. – 1:15 p.m.	Lunch in IAS dining hall
1:45 p.m. – 2:15 p.m.	Review session for beginning course
2:30 p.m. – 3:30 p.m.	Review session for advanced course
3:30 p.m. – 4:00 p.m.	Afternoon tea
4:00 p.m. – 5:00 p.m.	Colloquium or research seminar
5:15 p.m.	Women in Science Seminar
7:00 p.m.	Dinner (informal, usually take-out except for one official closing dinner on the last night).

The connections with Princeton University were continued with Princeton Day on Friday, May 20, in which the entire program moved to the campus of Princeton University where a series of lectures and discussions were held. Four of the graduate students and three of the undergraduate students in the program were from Princeton University.

Chuu-Lian Terng of the University of California, San Diego and Karen Uhlenbeck of the University of Texas, Austin, were in residence for the entire program. Sun-Yung Alice Chang of Princeton University, Antonella Grassi of the University of Pennsylvania and Nancy Hingston of The College of New Jersey were in attendance for a number of the activities.

The Institute of Advanced Study and the School of Mathematics appreciate the dedication of the senior women who have graciously given of their time and talents since the inception of the program in 1994. Organizers, program committee members and lecturers have all contributed without compensation to the growth and success of the women's program. In the past eleven years many young women in the field of mathematics, or contemplating entering the field, were encouraged and supported by Karen Uhlenbeck, the program founder and her collaborator and co-organizer Chuu-Lian Terng. Their commitment to the goals of the program has been unparalleled.

On the last day of the program, questionnaires were passed out to the participants in order to gain feedback about the structure and quality of the program. Both undergradu-

ate and graduate students were happy with and greatly energized by the program activities. Several of the graduate students commented on the constructive and non-competitive environment during the course of the program and seemed to enjoy working on problems all together rather than alone or in small groups. The questionnaire confirmed the success of this year's program, and we look forward to hosting the 2006 program.

PROSPECTS IN THEORETICAL PHYSICS

Prospects in Theoretical Physics (PiTP) is an intensive two-week summer program designed for graduate students considering a career in theoretical physics. First held by the School of Natural Sciences in the summer of 2002, the program provides lecture courses and informal sessions on the latest advances and open questions in various areas of theoretical physics. The participation of women, minorities, and students from institutions that do not have extensive programs in theoretical physics or access to research universities, is especially encouraged.

The 2005 Prospects in Theoretical Physics program, "Introduction to Collider Physics," was held from July 18 to July 29 on the campus of the Institute for Advanced Study. PiTP 2005, intended for graduate students and postdoctoral fellows in theoretical particle physics, was designed to be an introduction to LHC (Large Hadron Collider) physics. The Large Hadron Collider currently under construction at CERN (Geneva, Switzerland), is a powerful new accelerator that is expected to discover the mysterious Higgs particle and supersymmetry. The course was specifically designed to introduce collider phenomenology to young theorists who were not specialists in this subject, in order to help them prepare for the physics that will emerge from the LHC. The scientific program was comprised of three morning lectures, an afternoon practicum on simulations, and a question and answer session. Special guest lecturers gave presentations on several afternoons, as well.

A total of 104 individuals were officially enrolled in the program, with a majority of visiting students living in the Institute's housing complex during the two-week program. Moreover, the program lectures attracted many students, post-docs and professors from nearby institutions.

Prospects in Theoretical Physics builds on the strong relationship of the research groups at the Institute for Advanced Study and at Princeton University. Many Faculty members from the physics and astrophysics departments at both institutions are actively involved in the program along with scientists from neighboring institutions. PiTP is under the direction of Chiara R. Nappi, Princeton University Physics Professor, and an organizing committee of local physicists. In addition, Michael Peskin from Stanford University participated in the organization of the 2005 program. An alphabetical listing of 2005 lecturers and their topics follows:

Jonathan A. Bagger, The Johns Hopkins University
General Orientation to Beyond the Standard Model

Lance Dixon, SLAC, Stanford University
QCD at Colliders and Twistors and Perturbative QCD

Jonathan L. Feng, University of California, Irvine
Implications of Particle Physics for Cosmology

Ian Hinchliffe, Lawrence Berkeley National Laboratory
Signatures of Physics Beyond the Standard Model

Igor Klebanov, Princeton University
Perspective on QCD from String Theory

Konstantin Matchev, University of Florida
Practicum on Simulations

Hitoshi Murayama, University of California, Berkeley
Supersymmetry

Michael Peskin, SLAC, Stanford University
Introduction to the Standard Model

Heidi Schellman, Northwestern University
Collider Detectors

Nathan Seiberg, Institute for Advanced Study
Dynamical SUSY Breaking

Scott Thomas, Stanford University
Exotic Signatures of New Physics at the LHC

Christopher G. Tully, Princeton University
Experimental Study of Higgs Bosons

Edward Witten, Institute for Advanced Study
Axions in String Theory

Dieter Zeppenfeld, University of Karlsruhe
Standard Model at Colliders

Prospects in Theoretical Physics is one of the first outreach activities the Institute for Advanced Study has created specifically for graduate students. Because of its strength as a center for research in theoretical physics, the Institute is uniquely positioned to contribute to efforts to attract and retain this next generation of young theoretical physicists, thereby providing an important service to the field.

Prospects in Theoretical Physics 2005 was supported by The Concordia Foundation and the National Science Foundation.

BENJAMIN DITTO

"I have been challenged mathematically and supported as I reached my goals."

— Program Participant,
IAS/Park City Mathematics Institute
Summer Program, 2005

Graduate student participants of the IAS/Park City Mathematics Institute program at work on a group project with Philip Maini of Oxford University, one of the program's organizers

THE LIBRARIES

The Historical Studies-Social Science Library (Marcia Tucker, Librarian) contains some 100,000 volumes and has subscriptions to about 1,000 journals. The library is strongest in classical studies, ancient history, and archaeology, but it contains basic document collections, reference works, and important secondary works of scholarship in most fields of history and the social sciences. The journal collection is extensive, and fairly complete back runs exist to the founding of the Institute. The library has occupied its present building since 1964.

The Institute's rare book collection, the gift of Lessing J. Rosenwald, consists of about 2,000 volumes on the history of science and was compiled by Herbert M. Evans in the 1930s. The collection, which is housed in a special room, includes numerous first editions of important scientific works in mathematics, astronomy, physics, and the life sciences.

The library has an extensive collection of offprints including those received by Professors Andrew E.Z. Alföldi, Kurt Gödel, Ernst H. Kantorowicz, Elias Avery Lowe, Millard Meiss, Erwin Panofsky, and former Members Robert Huygens and Walther Kirchner.

The microfilm collections of the library include a large selection from Manuscripta, a collection of several thousand fifteenth- to nineteenth-century printed books from the Vatican Library. The Bavarian Academy has given the Institute a microfilm copy of slips presented for the Thesaurus Linguae Latinae along with additional material on CD. The library has microfilm copies of the papers of Kurt Gödel and Simone Weil.

The Historical Studies-Social Science Library houses the Institute archives. The papers in the collection date from the 1930s and include official correspondence of the Director's Office, minutes of meetings of the Faculty and the Board of Trustees, miscellaneous correspondence concerning past Faculty members, records of the Electronic Computer Project, and other documents. The archives also include the Institute's photograph collection.

The Mathematics-Natural Sciences Library (Momota Ganguli, Librarian) is located on the second floor of Fuld Hall and contains some 30,000 volumes (bound periodicals and monographs) and subscribes to nearly 175 journals. The Astrophysics collection (books and journals) is located in Bloomberg Hall. The subject areas covered by the library are pure and applied mathematics, astrophysics, and theoretical, particle, and mathematical physics.

Both of the Institute's libraries participate in the shared cataloging system of the Research Libraries Group, which gives Institute scholars computerized access to a database that contains more than twenty-two million records. Searches of this database retrieve bibliographic information and identify the location of materials in all participating libraries.

The Institute is a member of the Research Libraries Group SHARES partnership, a resource-sharing program. Access to electronically cataloged titles is available via Horizon, the Institute's web-accessible online catalog. The Institute's libraries are participants in the JSTOR project, which makes available archival electronic versions of many core journals in mathematics and the humanities.

The Historical Studies-Social Science Library maintains a computer center with access to a variety of word processing packages for both PCs and Macintoshes, and access to databases in the fields of Classical Studies, the History of Science, Islamic and French studies. The Mathematics-Natural Sciences Library's electronic resources include access to Math-SciNet, an online catalog, a variety of indexes, and a growing collection of full-text journals.

All scholars affiliated with the Institute enjoy the same privileges as Princeton University faculty in the Harvey S. Firestone Memorial Library and the nineteen special-subject libraries in the Princeton University Library system and also in the Robert E. Speer Library of the Princeton Theological Seminary.

The librarians and the faculties of all four Schools at the Institute warmly appreciate gifts of books and publications from former and current Members of the Institute.

BRUCE M. WHITE

"The School of Historical Studies-Social Science Library is superb. Almost everything I wanted was readily available. Staff were attentive and unfailingly supportive and helpful."

— Member, School of Historical Studies

INDEPENDENT AUDITORS' REPORT

The Board of Trustees,
Institute for Advanced Study -
Louis Bamberger and Mrs. Felix Fuld Foundation

We have audited the accompanying balance sheets of Institute for Advanced Study—Louis Bamberger and Mrs. Felix Fuld Foundation (the "Institute") as of June 30, 2005, and the related statements of activities and cash flows for the year then ended. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our audit. The prior year's summarized comparative information has been derived from the Institute's June 30, 2004, financial statements, and in our report dated October 1, 2004, we expressed an unqualified opinion on those financial statements.

We conducted our audit in accordance with auditing standards generally accepted in the United States of America. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes consideration of internal control over financial reporting as a basis for designing audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control over financial reporting. Accordingly, we express no such opinion. An audit also includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements, assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

In our opinion, such financial statements present fairly, in all material respects, the financial position of the Institute at June 30, 2005, and the changes in its net assets and its cash flows for the year then ended in conformity with accounting principles generally accepted in the United States of America.

September 23, 2005

BALANCE SHEETS
AS OF JUNE 30, 2005 (WITH COMPARATIVE TOTALS FOR 2004)

ASSETS	2005	2004
CASH	$ 1,670,531	$ 1,241,115
SHORT-TERM INVESTMENTS - Held by Trustee	2,772,121	2,746,268
ACCOUNTS RECEIVABLE	276,438	227,871
GOVERNMENT GRANTS AND CONTRACTS RECEIVABLE	2,325,625	2,540,437
ACCRUED INVESTMENT INCOME	364,213	358,836
PREPAID AND OTHER ASSETS	557,901	560,683
CONTRIBUTIONS RECEIVABLE - Net	415,583	846,899
UNAMORTIZED DEBT ISSUANCE EXPENSE - Net	580,594	630,239
LAND, BUILDINGS AND IMPROVEMENTS, EQUIPMENT AND RARE BOOK COLLECTION - Net	49,997,653	49,751,068
INVESTMENTS	510,729,683	475,759,963
TOTAL	$569,690,342	$534,663,379

See notes to financial statements.

LIABILITIES AND NET ASSETS	2005	2004
LIABILITIES:		
Accounts payable and accrued expenses	$ 6,609,788	$ 5,503,474
Postretirement benefits	15,172,955	9,719,668
Refundable advances	4,850,220	4,865,645
Liabilities under split-interest agreements	2,191,339	2,286,775
Note payable	805,005	863,811
Long-term debt	45,606,837	47,155,691
Total liabilities	75,236,144	70,395,064
NET ASSETS:		
Unrestricted	322,072,455	307,523,897
Temporarily restricted	124,358,400	110,649,123
Permanently restricted	48,023,343	46,095,295
Total net assets	494,454,198	464,268,315
TOTAL	$ 569,690,342	$ 534,663,379

STATEMENT OF ACTIVITIES
FOR THE YEAR ENDED JUNE 30, 2005 (WITH COMPARATIVE TOTALS FOR 2004)

	UNRESTRICTED	TEMPORARILY RESTRICTED
REVENUES, GAINS AND OTHER SUPPORT:		
Private contributions and grants	$ 1,774,690	$ 3,551,508
Government grants		6,253,542
Income on long-term investments	91,151	(24,698)
Net realized and unrealized gains on long-term investments (includes $42,257,236 and $37,709,828 in unrealized gains in 2005 and 2004, respectively)	40,109,980	21,137,602
Gain on sale of capital assets	(3,603)	
Net assets released from restrictions - satisfaction of program restrictions	17,208,677	(17,208,677)
Total revenues, gains and other support	59,180,895	13,709,277
EXPENSES:		
School of Mathematics	7,925,171	
School of Natural Sciences	6,881,927	
School of Historical Studies	4,953,741	
School of Social Science	3,131,366	
Libraries and other academic expenses	7,079,691	
Administration and general	8,739,394	
Postretirement benefits	5,453,287	
Auxiliary activity - tenants' housing expenses, net of unrestricted revenue	467,760	
Total expenses	44,632,337	
CHANGE IN NET ASSETS	14,548,558	13,709,277
NET ASSETS, BEGINNING OF YEAR	307,523,897	110,649,123
CHANGE IN ACCOUNTING (Note 1)		
NET ASSETS, END OF YEAR	$322,072,455	$124,358,400

See notes to financial statements.

2005

PERMANENTLY RESTRICTED	TOTAL 2005	TOTAL 2004
$ 1,928,048	$ 7,254,246	$ 8,312,424
	6,253,542	4,535,133
	66,453	3,678,244
	61,247,582	55,508,747
	(3,603)	173,921
		-
1,928,048	74,818,220	72,208,469
	7,925,171	7,255,202
	6,881,927	6,250,711
	4,953,741	5,059,623
	3,131,366	3,187,343
	7,079,691	6,154,379
	8,739,394	7,954,929
	5,453,287	4,724,605
	467,760	504,451
	44,632,337	41,091,243
1,928,048	30,185,883	31,117,226
46,095,295	464,268,315	364,958,045
		68,193,044
$ 48,023,343	$ 494,454,198	$ 464,268,315

STATEMENT OF CASH FLOWS
FOR THE YEAR ENDED JUNE 30, 2005 (WITH COMPARATIVE TOTALS FOR 2004)

	2005	2004
CASH FLOWS FROM OPERATING ACTIVITIES:		
Change in net assets	$ 30,185,883	$ 31,117,226
Adjustments to reconcile change in net assets to net cash used in operating activities:		
Depreciation	3,706,923	3,743,418
Gain (loss) on sale of capital assets	3,603	(173,921)
Contributions restricted for long-term investments	(2,845,316)	(2,892,059)
Net realized and unrealized gains on long-term investments	(61,247,582)	(55,508,747)
Amortization of debt issuance expense	49,645	51,409
Amortization of bond discount	35,786	37,384
Changes in assets/liabilities:		
Decrease (increase) in accounts receivable, and grants and contracts receivable	166,245	(280,328)
(Increase) decrease in accrued investment income	(5,376)	500,813
Decrease in prepaid and other assets	2,783	48,456
Decrease (increase) in contributions receivable	431,316	(196,825)
Increase in accounts payable and accrued expenses	1,106,313	293,986
Increase in postretirement benefits	5,453,287	4,724,605
(Decrease) in refundable advances	(15,425)	(890,811)
Net cash used in operating activities	(22,971,915)	(19,425,394)
CASH FLOWS FROM INVESTING ACTIVITIES:		
Proceeds from sale of capital assets	30,364	2,266,440
Purchase of capital assets	(3,987,474)	(6,309,034)
Proceeds from sale of investments	571,594,396	1,248,052,752
Purchase of investments	(545,316,536)	(1,225,071,806)
Net cash provided by investing activities	22,320,750	18,938,352
CASH FLOWS FROM FINANCING ACTIVITIES:		
Proceeds from contributions restricted for:		
Investment in endowment	2,566,350	1,357,100
Investment in plant	278,966	1,534,959
	2,845,316	2,892,059
Other financing activities:		
(Decrease) increase in liabilities under split-interest agreements	(95,436)	27,851
Repayment of long-term debt	(1,584,640)	(1,515,000)
Repayments of note payable	(58,806)	(57,646)
Decrease in investments held by trustee	(25,853)	(46,124)
Total other financing activities	(1,764,735)	(1,590,919)
Net cash provided by financing activities	1,080,581	1,301,140
NET INCREASE (DECREASE) IN CASH	429,416	814,098
CASH, BEGINNING OF YEAR	1,241,115	427,017
CASH, END OF YEAR	$ 1,670,531	$ 1,241,115
SUPPLEMENTAL DATA:		
Interest paid	$ 2,729,373	$ 2,802,393

See notes to financial statements.

NOTES TO FINANCIAL STATEMENTS
AS OF AND FOR THE YEAR ENDED JUNE 30, 2005

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

The Institute for Advanced Study-Louis Bamberger and Mrs. Felix Fuld Foundation (the "Institute"), an independent, private institution devoted to the encouragement, support, and patronage of learning, was founded in 1930 as a community of scholars where intellectual inquiry could be carried out in the most favorable circumstances.

Focused on mathematics and classical studies at the outset, the Institute today consists of the School of Historical Studies, the School of Mathematics, the School of Natural Sciences, and the School of Social Science. Each school has a small permanent faculty, and some 190 fellowships are awarded annually to visiting members from other research institutions and universities throughout the world.

The objectives of the Institute were described as follows in the Founders' original letter to the first Trustees: "The primary purpose is the pursuit of advanced learning and exploration in fields of pure science and high scholarship to the utmost degree that the facilities of the institution and the ability of the faculty and students will permit."

Basis of Presentation – The accompanying financial statements are prepared on the accrual basis and are presented in accordance with recommendations contained in *Not-for-Profit Organizations* issued by the American Institute of Certified Public Accountants.

The reporting of contributions and pledges distinguishes between contributions received that increase permanently restricted net assets, temporarily restricted net assets, and unrestricted net assets. Recognition of the expiration of donor-imposed restrictions occurs in the period in which the restrictions expired.

Net assets and revenue, gains and losses are classified based on the existence or absence of donor-imposed restrictions. Amounts for each of the three classes of net assets—permanently restricted, temporarily restricted, and unrestricted—are displayed in the statement of activities.

True endowment funds are subject to the restrictions of the gift instruments, which require that the principal be invested in perpetuity; only income earned and gained on such funds may be utilized. Quasi-endowment funds have been established by the governing board to function as endowment funds and any portion of these funds may be expended. Unrestricted quasi-endowment funds have no external restrictions. However, certain of these funds have been internally designated to support specific needs of the Institute.

All gains and losses arising from the sale, collection, or other disposition of investments and other noncash assets are accounted for in the fund that owned such assets. Ordinary income earned on investments and receivables is generally accounted for in the fund owning such assets. However, unrestricted income earned on investments of endowment and similar funds is accounted for as revenue in unrestricted operating funds, and restricted income is accounted for as deferred restricted revenue until used in accordance with the terms of the restriction or transferred to endowment and similar funds.

Restricted Net Assets – The Institute has classified gifts of cash and other assets as restricted net assets, if they are received with donor specifications, as either temporarily restricted or permanently restricted net assets. Temporarily restricted net assets are amounts that have been restricted in purpose and/or time by donor specification. Permanently restricted net assets have resulted from donors' specifications that contributions be invested in perpetuity and that, generally, only the income generated on such amounts be used. When a donor restriction expires, that is, when a stipulated time restriction ends or purpose restriction is accomplished, temporarily restricted net assets are reclassified to unrestricted net assets and reported in the statement of activities as net assets released from restrictions.

Use of Estimates – The preparation of financial statements in conformity with generally accepted accounting principles requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements. Estimates also affect the reported amounts of revenues and expenses during the reported period. Actual results could differ from those estimates.

Cash and Cash Equivalents –The Institute considers all highly liquid short-term investments purchased with an original maturity of less than three months to be cash equivalents. The Institute maintains demand deposits with major banks, the majority of which are held in one bank.

Contributions Receivable – The Institute records unconditional promises to give (pledges) at the fair value on the date received. The Institute's policy regarding the recording of promises to give is to include all promises received during the last five years as pledges receivable. A reserve for uncollectible promises is recorded to reduce the total pledge amount to its realizable value. Pledges are recorded at the present value of their expected future cash flows, net of allowance for doubtful accounts. The discount rates used for multi-year pledges are based on treasury bond rates which, commensurate to the term that the pledges are due. The discount rates range from 1.09% to 5.65%. Amortization of the discount is included in gifts and donation revenue.

Investments – All investments, including short-term investments, investments in marketable securities, limited partnerships and hedge and offshore funds, are reported in the financial statements at fair value, based upon quoted market price. Net asset value, as determined by the Funds, reflects the underlying assets held by the Funds and any investment gain or loss.

The statement of activities recognizes unrealized gains and losses on investments as increases and decreases, respectively, in unrestricted net assets unless their use is temporarily or permanently restricted by explicit donor stipulation. Purchase and sale transactions are recorded on a settlement date basis. Gains and losses on the sale of investment securities are calculated using the specific identification method.

The Institute regularly offers first mortgages on primary residents to full-time faculty and senior administrative employees who have met certain requirements stipulated by the Board.

Plant Assets and Depreciation – Proceeds from the sale of plant assets, if unrestricted, are

transferred to the unrestricted fund, or, if restricted, to amounts temporarily restricted for plant acquisitions. Depreciation is provided over the estimated useful lives of the respective assets on a straight-line basis (buildings and capital improvements 20 to 40 years, equipment 3 to 6 years).

Refundable Advances – Conditional amounts are recorded initially as deferred restricted revenue, and are reported as revenues when expended in accordance with the terms of the condition or transferred to the quasi-endowment funds.

Split Interest Agreements – The Institute is the beneficiary of various unitrusts and pooled income funds. The Institute's interest in these split interest agreements is reported as a contribution in the year received and is calculated as the difference between the fair value of the assets contributed to the Institute, and the estimated liability to the beneficiary. This liability is computed using actuarially determined rates and is adjusted annually. The assets held by the Institute under these arrangements are recorded at fair value as determined by quoted market price and are included as a component of investments.

Unamortized Debt Issuance Costs – Debt issuance costs represent costs incurred in connection with debt financing. Amortization of these costs is provided on the effective interest method extending over the remaining term of the applicable indebtedness. Deferred financing costs at June 30, 2005, were net of accumulated amortization of $386,195 and $336,550, respectively.

Tax Status – The Institute is exempt from Federal income taxes pursuant to Section 501(c)(3) of the Internal Revenue Code and is listed in the Internal Revenue Service Publication 78.

At June 30, 2005, the Institute incurred prior year and current year carryforward losses resulting in a deferred tax asset of approximately $225,000. The carryforward losses are generated by investments in partnership interests held by the Institute.

The Institute, however, believes that it is more likely than not that its deferred tax asset will not be realized; accordingly a full valuation allowance was provided at June 30, 2005, against the deferred tax asset associated with the loss carryforward.

Reclassification – Certain reclassifications have been made in the 2004 financial statements to conform to the 2005 presentation.

2. CONTRIBUTIONS RECEIVABLE

Unconditional promises to give at June 30, 2005 were as follows:

	2005	2004
Unconditional promises to give:		
Less than one year	$342,000	$ 440,000
One to five years	82,000	437,457
	424,000	877,457
Discount on promises to give	(8,417)	(30,558)
Total	$415,583	$ 846,899

3. INVESTMENTS

Investments at June 30, 2005, comprised of the following:

	2005	2004
Limited partnerships	$ 92,689,761	$ 94,871,340
Hedge and offshore funds	347,487,378	300,523,026
Debt securities	62,591,567	72,949,455
Mortgages from faculty and staff	4,310,750	3,750,653
Total pooled investments	507,079,456	472,094,474
Funds invested separately:		
Charitable remainder and pooled income trusts	3,650,227	3,665,489
Total	$ 510,729,683	$ 475,759,963

The Institute's proportionate share of ordinary expense and net realized losses attributed to its limited partnership investments was $1,816,205 and $2,358,306, for the year ended June 30, 2005, respectively.

The Institute's interests in limited partnerships and offshore funds represent 18% and 68%, respectively, 86% collectively of total investments held by the Institute at June 30, 2005. These instruments may contain elements of both credit and market risk. Such risks include, but are not limited to, limited liquidity, absence of regulatory oversight, dependence upon key individuals, emphasis on speculative investments (both derivatives and non-marketable investments), and nondisclosure of portfolio composition.

Substantially all of the investments are pooled with each individual fund subscribing to or disposing of units on the basis of the market value per unit, determined on a quarterly basis.

The following table summarizes the investment return and its classification in the statement of activities for the year ended June 30, 2005:

	UNRESTRICTED	TEMPORARILY RESTRICTED	TOTAL
Dividends and interest	$ 91,151	$ (24,698)	$ 66,453
Realized gain on investments reported at fair value	12,325,803	6,664,543	18,990,346
Unrealized gain	27,784,177	14,473,059	42,257,236
Total realized and unrealized gain	$40,109,980	$ 21,137,602	$61,247,582

Short-term investments held by trustee represent the balance of the proceeds from the 1997 and 2001 NJEFA bonds that have not yet been expended for construction purposes. These funds are being held in trust by The Bank of New York. Such funds are invested in U.S. government obligations with maturities of less than one year. At June 30, 2005, the market value of such securities approximates their carrying value.

4. PHYSICAL PLANT

Physical plant and equipment are stated at cost at date of acquisition, less accumulated depreciation. Library books, other than rare books, are not capitalized.

A summary of plant assets at June 30, 2005 is as follows:

Land and improvements	$ 1,352,744
Buildings and improvements	72,605,423
Equipment	20,608,920
Rare book collection	203,508
Joint ownership property	1,857,530
Total	96,628,125
Less accumulated depreciation	(46,630,472)
Net book value	$49,997,653

During 1997, the Institute entered into a Deed of Pathway and Conservation Easement (the "Easement") whereby the Institute received $11,794,600 in cash and $1,274,196 in contributions receivable at June 30, 1997, in consideration for the sale of land development rights for certain Institute properties. The Easement requires that those properties, set forth therein, be preserved to the greatest extent possible in their existing natural, scenic, open, wooded, and agricultural state and be protected from uses inconsistent therewith.

Of the $11,794,600 in cash received by the Institute, $5,625,000 represents monies received from the New Jersey Green Acres Fund to be repaid by the parties to the Easement. The Institute's pro rata share of $805,005 has been recorded as a note payable in the accompanying statement of financial position at June 30, 2005. The note payable bears interest at a rate of 2% and require semi-annual payments through January 8, 2017.

The note is payable as follows at June 30, 2005:

2006	$ 59,987
2007	61,193
2008	62,423
2009	63,678
2010	64,958
Through 2017	492,766
Total note payable	$ 805,005

5. LONG-TERM DEBT

A summary of long-term debt at June 30, 2005 is as follows:

Series F & G 1997 - NJEFA	$ 35,650,000
Series A 2001 - NJEFA	10,390,000
Less unamortized bond discount	(433,163)
Total long-term debt	$ 45,606,837

Interest expense on long-term debt for the year ended June 30, 2005 was $2,437,725.

In November 1997, the Institute received proceeds of the New Jersey Educational Facilities Authority (the "Authority") offering of $16,310,000 Revenue Bonds, 1997 Series F and $26,565,000 Revenue Bonds, and 1997 Series G of the Institute for Advanced Study Issue. A portion of the proceeds ($16,969,355) was used to retire the existing Revenue Bonds, 1991 Series. The remainder of the proceeds was used for renovations of members housing. In May 2001, the Institute received proceeds of the New Jersey Educational Facilities Authority offering of $11,000,000 Revenue Bonds, 2001 Series A of the Institute for Advanced Study issue. Proceeds were used for the construction of Bloomberg Hall and additional capital projects.

The bonds bear interest at rates ranging from 4% to 5%, payable semi-annually, are subject to redemption at various prices and require principal payments and sinking fund installments through July 1, 2031. The obligation to pay the Authority on a periodic basis, in the amounts sufficient to cover principal and interest due on the bonds, is a general obligation of the Institute.

The bonds are repayable as follows at June 30, 2005:

2006	$ 1,665,000
2007	1,745,000
2008	1,825,000
2009	1,915,000
2010	2,005,000
Through 2031	36,885,000
Total	$ 46,040,000

6. PENSION PLANS AND OTHER POSTRETIREMENT BENEFITS

Separate voluntary defined contribution retirement plans are in effect for faculty members and eligible staff personnel, both of which provide for annuities, which are funded, to the Teachers Insurance and Annuity Association and/or the College Retirement Equities Fund. Contributions are based on the individual participants' compensation in accordance with the formula set forth in the plan documents on a nondiscriminatory basis. Contributions for the year ended June 30, 2005, totaled approximately $1,613,060.

In addition to providing pension benefits, the Institute provides certain health care and life insurance benefits for retired employees and faculty. Substantially, all of the Institute's employees may become eligible for these benefits if they meet minimum age and service

requirements. The Institute accrues these benefits over a period in which active employees become eligible under existing benefit plans.

The components of the periodic expense for these postretirement benefits for 2005 are as follows:

Postretirement Benefit Costs:	
Service Cost - benefits attributable to service during the year	$ 509,395
Interest Cost on Accumulated Postretirement Benefit Obligation	782,084
Total	$ 1,291,479

The actuarial and recorded liabilities for these benefits, none of which have been funded, are as follows at June 30, 2005:

Accumulated postretirement benefit obligation:	
Retirees	$ 6,786,758
Fully eligible active plan participants	3,274,954
Other active plan participants	5,111,243
Total	$15,172,955

For measurement purposes, a 10.0% trend rate was used for 2005 health care costs, with the rate decreasing ratably until the year 2013, and then remaining constant at 5.0% thereafter. The health care cost trend rate assumption has a significant effect on the amounts reported. For example, a 1% increase in the health care trend rate would increase the accumulated postretirement benefit obligation by approximately $2,390,000 at June 30, 2005, and the net periodic cost by approximately $281,000 for the year. The weighted average discount rate used in determining the accumulated postretirement benefit obligation was 5.25%.

7. FUNDS HELD IN TRUST BY OTHERS

The Institute is the residuary beneficiary of a trust and, upon the death of the life tenant, will be entitled to receive the corpus thereof. The approximate market value of the trust's assets, as reported by the administrator of the trust, aggregated $3,401,274 as of June 30, 2005, and is not included in the accompanying financial statements.

8. FUNCTIONAL ALLOCATION OF EXPENSES

The costs of providing the various programs and other activities have been summarized on a functional basis in the statement of activities and cash flows. Accordingly, certain costs have been allocated among the programs and supporting services benefited. The net costs incurred by the Institute in operating both the Dining Hall ($391,829 net of $875,366 in revenues) and members' housing ($1,544,612 net of $1,652,138 in revenues) have been allocated among the programs and supporting services benefited. Included in the net costs incurred by the Institute that are allocated among the programs is $1,013,427 of depreciation expense. An overhead charge is allocated to certain schools generally based upon their ability to recover such costs under the terms of various grants and contracts. Overhead allocated from administration and general expenses to various programs totaled $5,141,295 for the year ended June 30, 2005.

Interest expense on outstanding debt, net of interest income on short-term investments, is allocated to schools based upon their occupancy of academic buildings funded with such debt. Allocated interest expense totaled $2,437,725 for the year ended June 30, 2005.

The Institute provides academic services to a community of scholars, including permanent faculty and visiting members. Expenses related to providing these services are as follows:

	2005
Expenses incurred were for:	
Salaries, wages, and benefits	$ 24,912,106
Stipends	6,465,564
Honoraria	412,368
Grants to other organizations	940,136
Supplies and travel	3,136,128
Services and professional fees	4,619,099
Depreciation	2,693,499
Interest	1,453,437
Total expenses	$ 44,632,337

9. TEMPORARILY AND PERMANENTLY RESTRICTED ASSETS

Restricted net assets are available for the following purposes at June 30, 2005:

Temporarily restricted net assets are restricted to:	
Academic Services:	
Educational Programs	$124,358,400
Permanently restricted net assets are restricted to:	
Investments to be held in perpetuity, the income from which is expendable to support academic services	$ 48,023,343

Net assets were released from donor restrictions by incurring expenses satisfying the restricted purposes or by occurrence of other events specified by donors.

10. DISCLOSURES ABOUT FAIR VALUE OF FINANCIAL INSTRUMENTS

The Institute is required by SFAS No. 107, *Disclosure About Fair Value of Financial Instruments*, to disclose the estimated fair value of financial instruments, both assets and liabilities recognized and not recognized in the balance sheet, for which it is practicable to estimate fair value.

The estimated fair value amounts in the following disclosure have been determined by the Institute using available market information and appropriate valuation methodologies. The estimates are not necessarily indicative of the amounts the Institute could realize in a current market exchange, and the use of different market assumptions or methodologies could have a material effect on the estimated fair value amounts.

June 30, 2005	ESTIMATED FAIR VALUE
Assets:	
Cash	$ 1,670,531
Investments	510,729,683
Grant/contributions receivable	2,325,625
Liabilities:	
Long-term debt	45,606,837
Note payable	805,005

The fair value of investments is based on fair market prices. The fair market valuation of grant/contributions receivable was estimated based on past cash collection experience. For long-term debt, the fair values are estimated using the interest rates currently offered for debt with similar terms and remaining maturities. The estimated fair value of mortgages for faculty and staff is based upon similar terms at which similar institutions would provide as part of an overall compensation package to such individuals. The estimated fair value of the note payable is based on the discounted value of the future cash flows expected to be received from the note.

The fair value estimates presented are based on information available to the Institute as of June 30, 2005, and have not been revalued since that date. While the Institute is not aware of any significant factors that would affect the estimates since that date, current estimates of fair value could differ significantly from the amounts disclosed.

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