Institute for Pure and Applied Mathematics, UCLA
Preliminary Report on Funding Year 2014-2015
June 19, 2015

The current funding period ends on August 31, 2015. This is a preliminary report. The full report will be submitted next year.

IPAM held two long programs. Each long program included tutorials, four workshops, and a culminating retreat. Between workshops, the participants planned a series of talks and focus groups.

- Mathematics of Turbulence (fall 2014)
- Broad Perspectives and New Directions in Financial Mathematics (spring 2015)

Workshops in the past year included:
- Multiple Sequence Alignment
- Symmetry and Topology in Quantum Matter
- Computational Photography and Intelligent Cameras
- Zariski-dense Subgroups
- Machine Learning for Many-Particle Systems

IPAM held two diversity conferences in the past year:
- Blackwell-Tapia Conference and Awards Ceremony
- Latinos/as in the Mathematical Sciences Conference

The Blackwell-Tapia Conference was supported by the NSF Math Institutes' Diversity Grant and a grant from the Sloan Foundation. The NSA and Raytheon Corporation sponsored the Latinos in Math Conference.

An undergraduate event entitled "Grad School and Beyond: Advice for the Aspiring Mathematician" was held the day before the Blackwell-Tapia Conference and featured some of the conference speakers and participants.

IPAM held "reunion conferences" for four long programs: Plasma Physics, Materials Defects, Interaction between Analysis and Geometry, and Materials for Sustainable Energy

Three summer research programs will take place this summer: RIPS-Hong Kong, RIPS-LA and Graduate-level RIPS in Berlin.

The graduate summer school "Games and Contracts for Cyber-Physical Security" will take place in July 2015.

The Green Family Lecture Series this year featured Andrew Lo, director of MIT's Laboratory for Financial Engineering. He gave two lectures.

IPAM offered the inaugural national conference of Women in Financial Mathematics (WFM) on May 14, 2015. In addition, we held a women's luncheon during a Mathematics of Turbulence workshop, and a women's breakfast during the Latinos in Mathematics Conference.

With the other NSF math institutes, IPAM co-sponsored the Modern Math Workshop at SACNAS (October 2014) and shared a booth in the exhibit hall.

IPAM was the host of the Transforming Post-Secondary Education in Mathematics (TPSE) meeting.

Leland Wilkinson and Nancy Potok joined the Board of Trustees, and Iain Couzin recently joined the SAB.

IPAM released its new website in September 2014.

IPAM became UCLA's first Zero Waste Pilot Program site in early 2015.

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Annual Progress Report for 2013-2014
Award #0931852
June 19, 2015

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EXECUTIVE SUMMARY

IPAM held two long programs in 2013-2014:

- Materials for a Sustainable Energy Future (fall 2013)
- Interaction Between Analysis and Geometry (spring 2014)

IPAM held the following workshops:

- Semiclassical Origins of Density Functional Approximations
- Social Learning
- Mathematics of Ophthalmology
- Rough Paths: Theory and Applications
- Translating Cancer Data and Models to Clinical Practice
- Stochastic Gradient Methods
- Mathematics of Politics

IPAM held "reunion conferences" for four long programs: Chemical Compound Space, Plasma Physics, Materials Defects, and Genomics.

Three summer research programs were offered in 2014: RIPS-Hong Kong, RIPS-LA, and Graduate-level RIPS-Berlin.

The two-week "Hands-on Summer School: Electronic Structure Theory for Materials and (Bio)molecules," took place in July 2014.

IPAM offered the following public lectures in 2013-14:

- Emily Carter, "Quantum Mechanics and the Future of the Planet," part of the Mathematics of Planet Earth lecture series (Simons Foundation)
- Jon Kleinberg, "Bursts, Cascades, and Hot Spots: A Glimpse of Some On-Line Social Phenomena at Global Scales."
- The third annual Green Family Lecture Series featured Avi Wigderson, who gave two public lectures
- IPAM Associate Director Skip Garibaldi and his collaborators, "Some People Have All the Luck"
- Congressman Jerry McNerney gave a public lecture during the Math of Politics workshop

There were two women's luncheons: one during MSE2013 and another during CCG2014.

With the other NSF math institutes, IPAM co-sponsored the Modern Math Workshop at SACNAS (October 2013).

IPAM continues to raise private funds through its membership society and held a donor event at a private home in November 2013.

IPAM published its fifth annual newsletter on September 1, 2013.

IPAM continues to work with an evaluation consultant to help us improve our program evaluation methods and provide analysis.

During this reporting period, Robert Calderbank, Emmanuel Candes, Cynthia Dwork and Alexei Borodin joined the Science Advisory Board. Sallie Keller, Karina Edmonds, Bill Coughran, and Tanya Beder joined the Board of Trustees. Al Hales began a second term as chair of the Board of Trustees.

IPAM renovated its lecture hall and introduced a new logo and slogan ("Math Changes Everything") in early 2014.

A. PARTICIPANT LIST

A list of all participants in IPAM programs will be provided in electronic form (Excel). The list includes participant lists for programs whose start dates fall between September 1, 2013 and August 31, 2014. This list includes our summer 2014 programs. It includes programs that were supported by other sources.

B. FINANCE SUPPORT LIST

A list of participants that received support from IPAM is provided in electronic form (Excel). The list includes all funded participants of programs that occurred between September 1, 2013 and August 31, 2014. It does not include programs whose participants were entirely supported by other sources.

C. INCOME AND EXPENDITURE REPORT

This table covers years 1 through 4 of grant #0931852.

	A	B	C	D	E	F
			A-B=C		B+D=E	A-E=F
Budget Category	**Appropriations Year 1 thru 4**	**Actual Expenses through August 2014**	**Current Balance as of August 2014**	**Encumbered Expenses as of August 201$**	**Total & Encumbered Expenses at August 2014**	**Encumbered Balance as of August 2014**
A. Operations Fund	$9,080,000	$8,995,886	$84,114	$259,925	$9,255,811	$<175,811>
B. Participant Costs	$8,920,000	$7,276,214	$1,643,786	$11,537	$7,287,751	$1,632,249
4-Year Total Budget	$18,000,000	$16,272,100	$1,727,900	$271,462	$16,543,562	$1,456,438

IPAM received funding of $18,000,000 for the first four years of this grant. Expenditures in years 1 through 4 totaled $16,272,100 and $271,462 is encumbered for a total of $16,543,562 in expenses. The encumbered Grant balance is $1,456,438 at the end of year 4.

Expenditures for the four years ended August 31, 2014:

A. The Operational Fund (salaries, benefits, equipment, supplies, and travel including overhead) for first four years budget has an appropriation of $9,080,000 with total expenditures of $9,255,811. Included in the encumbered expenses is $259,133 for Associate Director Skip Garibaldi's subaward with Emory University for duties to be performed in year 5.

B. Participant Support Costs for the first four years budget has an appropriation of $8,920,000 with total expenditures of $7,287,751.

The balance of $1,456,438 as of August 31, 2014 is due to the nature of the budget. The budget is funded at constant annual increment of $4,500,000 per year for five years. During the first year IPAM was spending down the carryforward from Grant #0439872-01315100. IPAM manages its constant annual increments of $4,500,000 in a non-constant manner over the life of the grant. We expect our participant and operational expenses to increase over the last year of the grant.

D.POSTDOCTORAL PLACEMENT LIST

IPAM did not appoint postdoctoral fellows in 2013-2014, so we have no data to report in this section.

E. MATH INSTITUTE DIRECTORS' MEETING REPORT

You will find the minutes from this meeting (May 2-3, 2014) in **Appendix 1.**

F. PARTICIPANT SUMMARY

In fiscal year 2013-2014, 1,656 participants enrolled in two long programs, 20 workshops, four reunion conferences, four summer programs for students, and one public event (a public lecture that was not part of a workshop). IPAM actively seeks women and members of underrepresented ethnic groups to participate in its programs as organizers, speakers and participants. While most participants report their gender and ethnicity, some choose not to do so, and some did not respond to our request for the data. In this year, 6.9% of IPAM participants were members of an underrepresented minority group (combined), and 21.5% were women. See table F-1, below.

Table F-1: All Participants' Gender and Ethnicity by Program Type (2013-2014)

		Gender		Underrepresented Ethnic Groups*			
Program Type	Total Participants	Female*	No. Reporting Gender	American Indian	Black	Hispanic	No. Reporting Ethnicity
Long Programs	115	24	110	0	0	3	94
Workshops	1281	255	1248	3	12	55	1122
Summer Programs	175	55	173	2	5	15	162
Public Event	3	0	3	0	0	0	3
Reunion Conferences	82	14	81	0	2	3	74
Total	1656	348	1615	5	19	76	1455
Percent of No. Reporting		21.5%		0.3%	1.3%	5.2%	
all members of underrepresented groups				100	6.87%		
*gender and ethnicity is self-reported							

IPAM also looked at unique participants for 2013-2014. (Some of our participants attended more than one program—usually multiple workshops within a long program.) There were 1,026 unique participants. Out of those reporting gender, 20.4% were women. Out of those reporting ethnicity, 7.6% reported that they are a member of an underrepresented ethnic group.

IPAM tries to balance the expectation that we primarily serve the U.S. community (citizens and permanent residents) with the goal of attracting the best organizers, speakers and participants in the relevant fields. See Table F-2.

Table 2: All Participants' Citizenship by Program Type (2013-2014)

Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent
Long Programs	46	111	41%
Workshops	601	1219	49%
Summer Programs	93	173	54%
Reunion Conferences	52	82	63%
Total	792	1585	50%

The majority (93%) of the year's participants of IPAM programs hold academic positions (faculty, postdoc, graduate student, or undergraduate student). Out of the remaining participants, 34 held positions in government or military, and 52 worked in industry. The following sections provide summary data for the requested sub-groups: postdocs, graduate students, and undergraduate students.

G. POSTDOCTORAL PROGRAM SUMMARY

Postdocs attend IPAM's workshops, long programs, reunion conferences, and summer school, and a few serve as academic mentors in RIPS, our undergraduate summer program. See tables G-1 and G-2.

Table G-1: Postdocs' Gender and Ethnicity by Program Type (2013-2014)							
		Gender		Underrepresented Ethnic Groups*			
Program Type	Total Participants	Female*	No. Reporting Gender	American Indian	Black	Hispanic	No. Reporting Ethnicity
Long Programs	16	4	16	0	0	0	14
Workshops	187	46	182	1	1	6	164
Summer Programs	11	3	10	0	0	0	7
Reunion Conferences	16	3	15	0	0	0	13
Total	230	56	223	1	1	6	198
Percent of No. Reporting		25.1%		0.5%	0.5%	3.0%	
all members of underrepresented groups				8	4.04%		
*gender and ethnicity is self-reported							

Table G-2: Postdocs' Citizenship by Program Type (2013-2014)			
Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent
Long Programs	6	16	38%
Workshops	76	186	41%
Summer Programs	4	11	36%
Reunion Conferences	10	16	63%
Total	96	229	42%

H. GRADUATE STUDENT PROGRAM SUMMARY

Graduate students participate in IPAM's workshops, long programs, reunion conferences, and summer school, and a few serve as academic mentors in our undergraduate summer programs. Graduate students often find a compelling thesis topic at an IPAM program, and also frequently make contacts that lead to their first job. See tables H-1 and H-2.

Table H-1: Graduate Students' Gender and Ethnicity by Program Type (2013-2014)							
		Gender		Underrepresented Ethnic Groups*			
Program Type	Total Participants	Female*	No. Reporting Gender	American Indian	Black	Hispanic	No. Reporting Ethnicity
Long Programs	42	12	42	0	0	1	36
Workshops	423	96	421	1	0	13	384
Summer Programs	74	20	74	1	1	5	70
Reunion Conferences	16	2	16	0	1	1	16
Total	555	130	553	2	2	20	506
Percent of No. Reporting		23.5%		0.4%	0.4%	4.0%	
all members of underrepresented groups				24	4.74%		
*gender and ethnicity is self-reported							

Table H-2: Graduate Students' Citizenship by Program Type (2013-2014)			
Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent
Long Programs	10	42	24%
Workshops	132	417	32%
Summer Programs	34	74	46%
Reunion Conferences	8	16	50%
Total	184	549	34%

I. UNDERGRADUATE STUDENT PROGRAM SUMMARY

Undergraduate students participate in our summer programs, Research in Industrial Projects for Students (RIPS) in Los Angeles and Hong Kong. RIPS Projects Day is counted as a workshop, because it is open to the public and some local undergraduate students (and others interested in the results of their research) attended. A detailed description of RIPS-LA and Hong Kong, including Projects Day, is available in section J of this report.

Table I-1: Undergraduate Students' Gender and Ethnicity by Program Type (2013-2014)							
		Gender		Underrepresented Ethnic Groups*			
Program Type	Total Participants	Female*	No. Reporting Gender	American Indian	Black	Hispanic	No. Reporting Ethnicity
Workshops	36	20	36	1	3	7	36
Summer Programs	43	24	43	1	2	7	43
Total	79	44	79	2	5	14	79
Percent of No. Reporting		55.7%		2.5%	6.3%	17.7%	
all members of underrepresented groups				21	26.58%		
*gender and ethnicity is self-reported							

Table I-2: Undergraduate Students' Citizenship by Program Type (2013-2014)			
Program Type	U.S. Citizens & Permanent Residents	No. Reporting Citizenship & Residency	percent
Workshops	24	36	67%
Summer Programs	31	43	72%
Total	55	79	70%

J. PROGRAM DESCRIPTION

The programs are listed in chronological order by start date. The list includes all IPAM programs from September 1, 2013 through August 31, 2014, which includes:

- Two long programs, and the workshops associated with each
- Eight IPAM independent workshops, between 1 and 5 days in length
- Four summer programs
- Four reunion conferences of long programs held at IPAM in previous years
- Six public lectures, including the Green Family Lecture Series

Public lectures feature a speaker with a national reputation who speaks on a topic of broad interest to an audience that includes non-scientists. Most of the speakers giving public lectures also gave research lectures during the workshop held the same week. There was just one exception: the public lecture “Some People Have All the Luck” was independent of any workshop, so the event is listed as a separate program, and the three presenters appear on the participant list and the finance support list.

Most IPAM workshops include poster sessions; all participants are invited to present a poster, but graduate students are especially encouraged to participate.

WORKSHOP: Semiclassical Origins of Density Functional Approximations. September 4 - September 6, 2013

Organizing Committee:

Kieron Burke (University of California, Irvine (UCI)
Eric Cances (École Nationale des Ponts-et-Chaussées, Applied Mathematics)
Hardy Gross (Max Planck Institute of Microstructure Physics)
Igor Rodnianski (Massachusetts Institute of Technology)

Scientific Overview:

Density functional theory (DFT) has become an enormously successful tool for electronic structure calculations. The Kohn-Sham scheme is now used in over 10,000 papers per year. Literally hundreds of distinct approximations are now available in modern electronic structure codes in both chemistry and materials science. The best of these are non-empirical interpolations among known limits of quantum mechanics; the worst are mere fits of empirical data.

Up to and beyond the middle of last century, strong connections were developed between density functional approximations and semiclassical methods. The original work of Thomas and Fermi has this flavor, as do early attempts to derive the gradient expansion corrections to both the kinetic and exchange energies. But this connection became somehow more obscure with the introduction of the Kohn-Sham scheme.

Along different lines, the direct approximation of the functional, such as in Thomas-Fermi theory and its extensions, proved very amenable to methods of functional analysis. This approach was championed by Lieb and many others, and is still producing useful results today. But such works are largely disconnected from modern DFT practice, again due to the difficulties in dealing with the Kohn-Sham scheme. Occasional results, such as the Lieb-Oxford bound, have crossed this divide.

Recent work has sought to re-examine the link between DFT, semiclassical approximations, and functional analysis. Numerical and heuristic results suggest a close (but subtle) underlying link. Understanding of these links, and using them to build new and more powerful approximations, could have tremendous impact in modern electronic structure calculations. The aim of this workshop is to reunite these disparate strands and begin a conversation among the different communities, including researchers from mathematics, physics, and theoretical chemistry.

LONG PROGRAM: Materials for a Sustainable Energy Future. September 9 - December 13, 2013

Organizing Committee:

Martin Bazant (Massachusetts Institute of Technology)
Giulia Galli (University of California, Davis (UC Davis), PAT)
Graeme Henkelman (University of Texas at Austin, Department of Chemistry)
Keith Promislow (Michigan State University, Mathematics)
Matthias Scheffler (Fritz-Haber-Institut der Max-Planck-Gesellschaft, Theory Department)

Scientific Overview:

A secure and sustainable energy future that is not based on a fossil-fuel based infrastructure requires the design of new materials for efficient energy conversion, transport, and storage. Indeed, materials development is a rate limiting step in many potential new energy conversion strategies, impacting the efficiency of photovoltaic solar cells, the storage capacity and power density of batteries for automobile applications, the synthesis of liquid fuels, and the catalysis and durability of energy conversion in fuel cells.

A key bottle-neck in this historic transition is the wide range of length scales present in the morphology and time scales in the transport phenomena. Serious progress in the development of new materials requires predicative modeling which surmounts the particle-continuum divide. Recent developments in macro-micro modeling, incorporating machine and manifold learning, combined with new classes of continuum models and increases in computational resources, provide a new framework with which to develop a fundamental understanding of complex materials; it is becoming possible to design new materials from first principles.

Creating interactions between people with different expertise and a common goal will facilitate breakthroughs in predictive materials design. This program will bring together researchers from mathematics, physics, materials science, engineering, chemistry, biology, computer sciences, and other sciences with the goal to understand the mathematical structure of continuum models governing material properties as well as the electronic, atomic, and molecular structure of such new materials.

This program was part of the initiative "Mathematics of Planet Earth" which is an international endeavor involving a wide range of partners and activities.

These statements from participants of the program demonstrate the impact of the program:

"IPAM has continued to facilitate collaborations with researchers in applied mathematics. In many cases, my group has simulations that we would like to be able to do but we benefit greatly by incorporating new ideas from the mathematics community. These collaborations have led to a number of new computational methods as well as providing a foundation for making our

methods more rigorous." - Graeme Henkelman, Department of Chemistry, University of Texas at Austin

"My participation in IPAM long program in 2013 has been very fruitful for my research. I got the chance to interact with the leading scientists of world working from different perspectives in the field of sustainable energy. Even the workshops were well organized with very nice lectures. The program also helped me to know in deep about different research areas, different from my PhD project, which will be very helpful for my career." - Ankita Katre, Department of Atomistic Modelling and Simulation, Interdisciplinary Centre for Advanced Materials Simulation (ICAMS)

WORKSHOP: Materials for a Sustainable Energy Future Tutorials. October 10 - 13, 2013

Organizing Committee:

Martin Bazant (Massachusetts Institute of Technology)
Giulia Galli (University of California, Davis (UC Davis), PAT)
Graeme Henkelman (University of Texas at Austin, Department of Chemistry)
Keith Promislow (Michigan State University, Mathematics)
Matthias Scheffler (Fritz-Haber-Institut der Max-Planck-Gesellschaft, Theory Department)

Scientific Overview:
The long program opened with four days of tutorials that provided an introduction to major themes of the entire program and the four workshops with the goal of building a foundation for the participants of this program who have diverse scientific backgrounds. Topics discussed during the tutorials included:

- Electronic Structure Theory
- Mathematical foundations of density-functional theory
- Introduction to Solid State electron transport
- Introduction to phonon transport
- Atom transport and transition paths for rare events
- Sampling Techniques and Molecular Dynamics
- Continuum level transport and morphology
- Fluctuating hydrodynamics
- Machine Learning

WORKSHOP: Solar Cells (Materials for a Sustainable Energy Future Workshop I).
September 23 - 27, 2013

Organizing Committee:

Claudia Draxl, Chair (Humboldt-Universität)
Jeff Neaton (Lawrence Berkeley Laboratory)

Keith Promislow (Michigan State University, Mathematics)

Scientific Overview:

While the sun provides enough total energy to power our society, the efficient capture and conversion of solar photons into a more useful form of energy still eludes us. There are two fundamental challenges here: charge separation and transfer. When a photon induces an electrical excitation in a material, great care is required to keep this excitation from degrading into thermal energy. Inorganic (e.g. Si) solar cells have the advantage of being crystalline so that delocalized charges can be separated by electric fields at junctions created by doping. Their application, however, is limited by production costs and an efficiency on the order of 10%. Part of the problem is that silicon has an indirect band gap so that cells must be made thick enough to capture photons. Understanding how band structure and carrier mobility are controlled by material composition will guide the search for new inorganic photo-active materials.

Organic solar cells have great promise for the future, but they also have greater limitations in their current form. While flexible cells or solar paint could significantly reduce costs, the conversion efficiency in organic cells is still very low, reaching only a few percent. The polymers in organic cells are excellent for manufacturing cells, but the molecular disorder in the material leads to charge trapping. Excitations are relatively localized and are difficult to separate on the time scale of their recombination. Research into new materials may be helpful, but an even more basic model for the motion of energy and charge in such a device is essential.

WORKSHOP: Fuels from Sunlight (Materials for a Sustainable Energy Future Workshop II). October 22 - 26, 2012

Organizing Committee:

Rupert Klein (Freie Universität Berlin, Mathematics)
Jens Norskov (Stanford University)
Matthias Scheffler (Fritz-Haber-Institut der Max-Planck-Gesellschaft, Theory Department)

Scientific Overview:

Essentially all sustainable energy systems rely on the energy influx (direct or indirect) from the sun. This includes photons, wind, tides, and more. All these modes are intermittent, and the best way to bridge irregularities is to store energy by transforming it into a chemical form: fuels such as methane, methanol, ethanol or other (oxygenated) hydrocarbons. Chemical fuels have high volumetric and gravimetric energy density, and, very importantly, a well-established infrastructure. A sustainable chemical industry would also be based on sustainable fuels. The key technology for creating such fuels is catalysis; however, efficient catalysts for the relevant processes still need to be developed. (Other options of energy storage and transport, such as

batteries and phase-change materials, are being discussed in other workshops of the long program.)

This is a significant challenge, and novel ideas are needed. A key bottleneck that has impeded progress is the wide range of length scales present in catalyst morphology and time scales in the transport phenomena. Serious progress in the development of new materials requires predicative modeling which surmounts the particle-continuum divide. This requires bringing people from different disciplines together, in particularly colleagues from theoretical chemistry, soft and hard condensed-matter physics, chemical engineering, applied mathematics and statistics, and computer science, as well as industrial experts from fluid dynamics and molecular and rate-equation modeling. What they should have in common is knowledge in coarse graining and dealing with high-dimensional energy landscapes. Validation of the underlying energetics is as important as verification of the simulation tools.

This workshop seeks to enhance the quality of research on chemical energy conversion and open new directions. This includes identifying and developing broad qualitative and semi-quantitative concepts that will speed up catalyst design, using computations to accelerate the discovery of new and better catalysts, exploring new classes of catalysts, identifying the flaws of the existing methodologies, and defining strategies for doing useful work in catalysis in spite of these imperfections. The workshop will survey emerging computational methods to decide which have promise for application to catalysis problems, and identify the most promising new areas in catalysis and using computations to help their progress. It will also seek to develop ways of increasing the contacts between people who do “computational catalysis”, colleagues who develop new simulation concepts and tools, and people who develop and test new catalysts in academia or in industry. In addition, besides electronic structure theory, real catalysts may be limited by heat and mass transport, which require more attention than previously appreciated. With respect to applications and specific reactions we may, for example, consider water splitting, carbon dioxide reduction to hydrocarbons (fuels, as e.g. methane, methanol, ethanol, etc.), and biomass transformation reactions.

We invite colleagues from material science, physics, chemistry, chemical engineering, applied mathematics and statistics, and computer science. Indeed, to bring these communities together is key to the success of the workshop topic as it is for any novel materials discovery project.

WORKSHOP: Batteries and Fuel Cells (Materials for a Sustainable Energy Future Workshop III). November 4 - 8, 2013

Organizing Committee:

Martin Bazant (Massachusetts Institute of Technology)
Graeme Henkelman (University of Texas at Austin, Department of Chemistry)
Kristin Persson (Lawrence Berkeley Laboratory, EETD)
Keith Promislow (Michigan State University, Mathematics)

Scientific Overview:

An energy economy fueled by renewable resources will require significant improvement in existing materials for energy conversion and storage. Optimization of battery and fuel cell technologies requires a detailed understanding of the underlying physics and the associated limiting processes; in many cases this knowledge is sorely lacking. As a result, current practice in the fabrication of functional materials and devices follows a trial-and-error approach closer to a magic recipe than to scientific practice.

For example, today's lithium ion batteries, as well as future energy storage and conversion such as multi-valent intercalation, fuel cells, Li-air and Li-S batteries are dependent on complex solid-liquid and interfacial reactions. Knowledge of how the solid electrode materials behave may be available on an atomistic level, but that knowledge is rarely transferred to higher length-scale modeling or device optimization. There is an urgent need to develop new models at the continuum length-scale and to develop efficient multiscale modeling and computational techniques. Indeed, feed-back between length scales is virtually non-existent, and the electrode making of today follows largely the same slurry and coating procedure irrespective of the inherent properties (anisotropy, phase behavior etc) of the electrode material.

At the same time, highly engineered materials, such as porous networks or nano-materials, play increasingly important roles in the improved performance of energy conversion devices. Porous network structures are utilized in polymer electrolyte membrane fuel cells, redox flow batteries, bulk hetero-junction or dye-sensitized solar cells, super-capacitors, and as separators for lithium ion batteries. These applications demand charge separators and high surface area catalyst layers whose robust network structures segregate and selectively transport ions and other charged entities while inhibiting back reactions and parasitic recombination. Many of the components of these devices are created in a casting process, relying upon phase separation to obtain the desired morphologies. Optimization of these complex materials requires predictive models for the impact of dispersion of functional groups, varying solvent polarity and volatility, and external fields on the resultant nano-morphology. However overcoming the time and length scale dichotomy inherent in casting processes requires novel multiscale modeling approaches.

It is the goal of this workshop to bring together mathematicians, physicists, computer scientists, materials scientists and engineers who work in the area of batteries and fuel cells to spark collaborations across disciplines and seed new interdisciplinary research directions. We expect this workshop will attract junior as well as senior participants. This workshop will include a

poster session; a request for posters will be sent to registered participants in advance of the workshop.

PUBLIC LECTURE: "Quantum Mechanics and the Future of the Planet" by Emily Carter. November 4, 2013

This lecture is part of a series of lectures around the world associated with Math for Planet Earth (MPE), with support from the Simon's Foundation.

Abstract:

An alarming milestone was reached this past spring: the amount of carbon dioxide in the atmosphere exceeded 400 ppm for the first time in human history. The reason is clear: humans have been burning fossil fuels at an ever-increasing rate and those carbon-based, non-renewable fuels are producing the CO2 that in turn warms the earth and causes climate change. About seven years ago, when the CO2 atmospheric concentration was "only" 380 ppm – way above the pre-industrial revolution historical average of ~280 ppm – I began a deliberate re-orientation of all of my research to do whatever I could to help move the planet onto a sustainable energy path. How? And what does quantum mechanics have to do with the future of the planet? The foundational theory behind of all my research is quantum mechanics, which accounts for the fundamental physics governing the energy and spatial distributions of electrons in matter. I develop mathematical and physical approximations to the Schrödinger wave equation (SWE), whose eigenvalues and eigenfunctions delineate the distribution of electrons in energy and space, respectively. The SWE cannot be solved exactly except in the limit of a single electron; hence the need for approximations that still contain the essential physics of the phenomenon or matter under investigation. I will touch on such approximations but will primarily give examples of how these powerful methods can be used to study systems that aim to render sustainable energy a reality: from biodiesel fuel combustion to solar energy conversion to electricity and fuels to fuel cells to fusion reactors. I aim to give you a taste of what is possible, given proper attention and investment, for the future of the planet.

Speaker Bio:

Professor Carter is Founding Director of the Andlinger Center for Energy and the Environment at Princeton University and the Gerhard R. Andlinger Professor in Energy and the Environment, as well as Professor of Mechanical and Aerospace Engineering and Applied and Computational Mathematics. She received her Ph.D. in Chemistry from Caltech. After a year as a postdoctoral researcher at the University of Colorado, she spent the next 16 years on the faculty of UCLA before moving to Princeton. The 2007 ACS Award for Computers in Chemical and Pharmaceutical Research and the August Wilhelm von Hoffmann Lecture of the German Chemical Society in 2011 are a few of her many honors. She was elected to the American Academy of Arts and Sciences, the National Academy of Sciences, and the International Academy of Quantum Molecular Science.

WORKSHOP: Energy Conservation and Waste Heat Recovery (Materials for a Sustainable Energy Future Workshop IV). December 18 - 22, 2013

Organizing Committee:

Giulia Galli (University of California, Davis (UC Davis), PAT)
Richard James (University of Minnesota, Twin Cities)
Jennifer Lukes (University of Pennsylvania)
Matthias Scheffler (Fritz-Haber-Institut der Max-Planck-Gesellschaft, Theory Department)

Scientific Overview:

A most effective, though still underestimated, issue in dealing with the energy requirements of modern societies concerns the conservation of energy. This concerns, for example, building houses with better insulation and intelligent (coated) windows (keeping IR photons outside when the sun is burning, and keeping them inside, when the weather is cool), improving the efficiency of electricity-producing turbines or of airplane jet engines (e.g. by better thermal-barrier coatings), using more efficient light sources (solid state or organics), etc.

Furthermore, we note that a significant part of the consumed energy is transformed into "waste heat". For computers and combustion engines this is very obvious. At this point, heat is usually cooled away (with noticeable costs) and not transformed back into a useful energy.

These issues are at the heart of materials science. We need better theories and modeling methods that help us to screen materials with respect to their specific function, such as electron-phonon coupling, heat transport and Seebeck coefficients in nanostructures, or carrier transport in organic LEDs. Parallel to these issues is the materials informatics challenge: how can we efficiently screen materials, what are the proper descriptors of a large theoretical materials library, and what is the accuracy (and reliability) of present day theories? Some concepts along these lines have been developed already, and bio-informatics has developed several tools that the materials community may well adjust and adopt.

It is the goal of this workshop to bring together mathematicians, physicists, computer scientists, materials scientists and engineers who work in the area of energy conservation and waste heat recovery. We expect this workshop will attract junior as well as senior participants.
This workshop will include a poster session; a request for posters will be sent to registered participants in advance of the workshop.

WORKSHOP: Culminating Workshop, Materials for a Sustainable Energy Future.
December 8 - 13, 2013

The culminating workshop was organized by the long program organizing committee.

The final workshop in the long program, held at Lake Arrowhead Conference Center, provided an opportunity for the program's core participants to report on their work during the past three

months and to discuss future projects. Many of the collaborations and interactions that were formed during the program had a chance to deepen.

REUNION CONFERENCE: Computational Methods in High Energy Density Plasmas Reunion Conference I: December 8 - 13, 2013

The reunion conference was organized by the original long program organizing committee.

This was the first reunion conference for participants of the spring 2012 long program "Computational Methods in High Energy Density Plasmas." It was a timely get-together to continue some of the collaborations that were started during the long program. Presentations were given by all participants, with plenty of time between talks for discussions and collaborations.

REUNION CONFERENCE: Navigating Chemical Compound Space for Materials and Bio Design Reunion Conference II. December 8 - 13, 2013

The reunion conference was organized by the original long program organizing committee.

This was the second reunion conference for participants of the spring 2010 long program "Navigating Chemical Compound Space for Materials and Bio Design." It was a timely get-together to continue some of the collaborations that were started during the long program and at the first reunion. Presentations were given by all participants, with plenty of time between talks for discussions and collaborations.

WORKSHOP: Mathematics of Social Learning. January 6 - 10, 2014
Organizing Committee:
Santo Fortunato (Aalto University)
James Fowler (University of California, San Diego (UCSD))
Kristina Lerman (University of Southern California (USC))
Michael Macy (Cornell University)
Cosma Shalizi (Carnegie-Mellon University)

Scientific Overview:

The goal of this workshop is to bring together mathematicians, physicists, and social, information, and computer scientists to explore the dynamics of social learning and cultural evolution. Of particular interest will be ways of using data from social media and online experiments to address questions of interest, which include but are not limited to:

- How do individual attributes and cognitive constraints affect the dynamics and evolution of social behavior?
- How does network structure both within and between groups (including online networks and communities) affect social learning and cultural evolution?
- What are the similarities and differences between cultural and genetic evolution?
- How do social norms emerge and evolve?

- What are the main mechanisms driving social learning and the evolution of culture?

PUBLIC LECTURE: "Bursts, Cascades, and Hot Spots: A Glimpse of Some On-Line Social Phenomena at Global Scales" by Jon Kleinberg. January 8, 2014

Abstract:
As an increasing amount of social interaction moves on-line, it becomes possible to study phenomena that were once essentially invisible: how our social networks are organized, how groups of people come together and attract new members, and how information spreads through society. With computational and mathematical ideas, we can begin to map the rich social landscape that emerges, filled with "hot spots" of collective attention, and behaviors that cascade through our networks of social connections.

Speaker Bio:

Jon Kleinberg is the Tisch University Professor of Computer Science and Information Science at Cornell, where his research focuses on the social and information networks that underpin the Web and other on-line media. He is the recipient of awards including a MacArthur Fellowship, the Nevanlinna Prize, the Lanchester Prize, the ACM SIGKDD Innovation Award, and the ACM-Infosys Foundation Award in the Computing Sciences, and he is a member of the National Academy of Engineering and the National Academy of Sciences.

WORKSHOP: Mathematical Challenges in Ophthalmology. January 16 - 18, 2014

Organizing Committee:
Jean-Pierre Hubschman (UCLA)
Joseph Teran (UCLA)
Emanuele Trucco (University of Dundee)
Irena Tsui (UCLA)

Scientific Overview:

Ophthalmology has become increasingly subspecialized and technologically advanced, making it impossible to be an expert in every area and highlighting the need for multi-disciplinary collaborations with engineers and mathematicians. The goal of this workshop is to encourage communication between engineers, mathematicians, scientists, and clinicians to improve patient care and scientific advancement.

The integration of new imaging technology allows visualization down to the cellular level, but objectivity of evaluation and automated analysis still need more refinement. The incorporation of intra-operative imaging technology would be the beginning of a new surgical era in ophthalmology. Robotics in ophthalmic surgery is also on the horizon. It would reduce human error, improve precision, and increase surgical capabilities

WORKSHOP: Rough Paths: Theory and Applications. February 27 - 31, 2014

Organizing Committee:
Marek Biskup (University of California, Los Angeles (UCLA), Mathematics)
Dan Crisan (Imperial College)
Peter Friz (Technische Universität Berlin and WIAS Berlin)
Massimiliano Gubinelli (Université de Paris IX (Paris-Dauphine))
Martin Hairer (University of Warwick)

Scientific Overview:

Since its introduction in the 1990s, the theory of rough paths has established itself as a powerful tool to analyze a variety of stochastic systems that are too "rough" for their solutions to exist in the class of functions that can be handled by classical analytical methods. The power of the theory resides in its ability to cleanly separate the probabilistic components from their purely analytic aspects. Among the early achievements of the theory have been various regularity estimates of the solutions to SDEs with respect to boundary conditions. Further results included analysis of solutions to SDEs driven by fractional Brownian motion for values of the Hurst parameter less than 1/2, good error estimates on the remainder in the stochastic Taylor expansion, a simpler proof and extension of the Freidlin-Wentzell large deviations, etc. More recently, the theory has seen an explosion of new results that caused its scope to expand considerably. For example, it has successfully been used to build efficient cubature methods on Wiener space with applications to numerical methods for solving the filtering problem and approximations of solutions of backward SDEs. Another recent development has been the combination of rough paths theory with Malliavin calculus to provide hypoellipticity results in non-Markovian situations. A completely different set of developments has been the successful application of some tailor-made variations of the theory to the solution of classes of stochastic PDEs.

This workshop will bring together experts in the theory of rough paths with researchers working in related areas of mathematics (probability, PDEs/SDEs, analysis, etc) and sciences in general. It will include a poster session; a request for posters will be sent to registered participants in advance of the workshop.

WORKSHOP: Translating Cancer Data and Models to Clinical Practice.
February 10 - 14, 2014

Organizing Committee:

Tülay Adali (University of Maryland Baltimore County)
Mark Cohen (University of California, Los Angeles (UCLA))
Klaus-Robert Müller (Technische Universität Berlin)

Scientific Overview:

Modern technological advances in cell and tissue imaging, genomic analysis, as well as the accumulating body of knowledge derived from systematic dissection of cellular signaling pathways has led to an evolving view of cancer. Cancer is clinically thought of as a whole host of different cellular diseases with different causes and manifestations. Initiators can include viral infections, somatic mutations, and/or germline mutations. Besides genetics, a wide range of physiological processes also influence the progression of cancers, and include development, tissue metabolism, stem cell dynamics, immune responses, and hormonal regulation. Despite this complexity, many aspects of cancer cell biology can often be described by basic paradigms in biology, especially development. This emerging view, coupled with an ever-improving mechanistic understanding of parts of cancer initiation and progression, may enable the physical and mathematical sciences to make new contributions to the field.

This workshop will emphasize an integrated approach to understanding cancer initiation, progression, metastasis, and treatment. Proposed participants will include a number of clinicians and experimentalists whose approach and research may complement and motivate new mathematical and physical modeling, as well as empirical or clinical investigations. Our ultimate goals will be to critically examine and discuss approaches for improving clinical "standards of care" and to foster new investigative directions in applied cancer research that involve the right level of detail in emerging mathematical and physical approaches.

WORKSHOP: Stochastic Gradient Methods. February 24 - 28, 2014.

Organizing Committee:
Leon Bottou (Microsoft Research, CS)
Yann LeCun (New York University, Canadian Institute for Advanced Research)
Ben Recht (University of California, Berkeley (UC Berkeley))
Stephen Wright (University of Wisconsin-Madison, Computer Science)

Scientific Overview:

Stochastic gradients (SG) methods have a long history in optimization, dating to the work of Robbins and Monro in 1951. The appeal of these methods is due largely to their ability to cope efficiently and robustly with inexact information about the underlying optimization problem. Recently, there has been an outburst of research activity on SG methods, driven in part by their remarkable suitability to machine learning models involving huge data sets. A prominent feature of these methods is their ability to make progress by examining only a small fraction of the data set rather than scanning the entire data set – an operation that is prohibitively expensive in many modern applications.

This workshop will address various topics in the theory, implementation, and practice of SG methods, possibly including the following: applications to nonconvex problems and regularized objectives; parallel implementations; hybridization of SG methods with other optimization techniques; and use of SG methods in deep learning, latent variable models, and other settings

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LONG PROGRAM: Algebraic Techniques for Combinatorial and Computational Geometry. March 10 – June 13, 2014

Organizing Committee:
Jordan Ellenberg (University of Wisconsin-Madison)
Nets Katz, Chair (California Institute of Technology)
Micha Sharir (Tel Aviv University)
Jozsef Solymosi (University of British Columbia, Mathematics)

Scientific Overview:

The field of combinatorial geometry has some of its roots in profound questions asked by Paul Erdos, back in the 1940s. Erdos continued to investigate many aspects of the field, shaping it in the process, and helped make it a deep, rich, and intensively studied branch of mathematics. In the 1980s, computer scientists became involved due to applications to computational geometry, and in the 1990s, harmonic analysts became interested due to its relationship with the Kakeya problem.

In the past four years, the landscape of combinatorial geometry has considerably changed due to the work of Guth and Katz (inspired by earlier work of Dvir on the finite field Kakeya problem), who solved the joints problem in 3D and the Erdos distinct distances problem. More recently, Green and Tao stunningly solved the long-standing conjecture of Dirac and Motzkin on the number of ordinary lines. What these results have in common is algebraic geometry.

The application of algebraic geometry to problems in incidence geometry has been a rather surprising development. This interdisciplinary work is still at its infancy, and a major goal of this program is to provide a venue for deepening and widening the interaction between combinatorial geometry, algebraic geometry, Fourier analysis, and hopefully other mathematical disciplines too.

The following quotes from participants of the program demonstrate the impact it had on their research and careers:

“This program gave me the time to focus on research and the flexibility to think about new problems that I might not otherwise consider. In particular the discussions and problems that were presented about geometric aspects have helped motivate me to pursue this area in the future.” - Steve Butler, Department of Mathematics, Iowa State University

“It's been incredibly helpful. The ideas that originated from discussions at IPAM kept me busy with my work for at least 6 months, and I believe that this led to interesting results. There are many more ideas from my time at IPAM which have not yet born fruit, but I am confident that there will be more interesting research in the future for which IPAM should take some of the credit. It was a great pleasure to be surrounding by such stimulating mathematical company, and

I only wish I could do it again right now."- Oliver Roche-Newton, Mathematics, University of Reading

WORKSHOP: Combinatorial and Computational Geometry: Tutorials. March 11 - 24, 2013

Organizing Committee:

Luigi Ambrosio (Scuola Normale Superiore)
Pekka Koskela (University of Jyväskylä)
Nages Shanmugalingam (University of Cincinnati)
Karl Sturm (Universität Bonn)

Scientific Overview:

The long program opens with four days of tutorials that will provide an introduction to major themes of the entire program and the four workshops. The goal is to build a foundation for the participants of this program who have diverse scientific backgrounds.
Registration for tutorials is free, to encourage broad participation.

WORKSHOP: Combinatorial Geometry Problems at the Algebraic Interface (Algebraic Techniques for Combinatorial and Computational Geometry Workshop I). March 24 - 28, 2014

Organizing Committee:

Haim Kaplan (Tel Aviv University)
Jiri Matousek (Charles University, Prague)
Micha Sharir (Tel Aviv University)
Terence Tao (University of California, Los Angeles (UCLA), Mathematics)

Scientific Overview:

A major goal of the program is to study the development and applications of tools from algebraic geometry for the solution of problems in combinatorial (and computational) geometry, with incidence geometry as one focus. The goal of this workshop is to provide an arena for presenting and discussing research problems in incidence geometry and other related topics in combinatorial and computational geometry that seem amenable to the developed tools, including possible partial or full solutions to these problems.
Among the main themes that the workshop will cover are:

- Incidence geometry: Incidences between points and lines in higher dimensions, incidences with other types of curves (such as circles), incidences with higher-dimensional surfaces.

- Incidence-related problems: Repeated distances, distinct distances, congruent and similar simplices, unit-area triangles and unit-volume simplices, and other types of repeated patterns.
- Combinatorial geometry at large: Geometric partitions range searching, spanning trees with small crossing numbers, and relations between the new algebraic machinery and older sampling-based techniques.

Another goal of the workshop is to enhance and foster a two-way interaction between algebraic geometers and combinatorial and computational geometers, so as (a) to allow the latter community to learn more from algebraic geometers about the known tools and techniques that are relevant to combinatorial geometry, and (b) to attract algebraic geometers to the new application area, and get them involved in the study of the numerous challenging problems in algebraic geometry that the new area raises. We expect to achieve this goal by offering several survey talks on algebraic geometry, specially tailored problem sessions, and ample time for free discussions.

WORKSHOP: Tools from Algebraic Geometry (Algebraic Techniques for Combinatorial and Computational Geometry Workshop II). April 7 - 11, 2014

Organizing Committee:

Saugata Basu (Purdue University)
Igor Dolgachev (University of Michigan)
Jordan Ellenberg (University of Wisconsin-Madison)
Joseph Landsberg (Texas A&M University - College Station)
Marie-Francoise Roy (Université de Rennes I)
Micha Sharir (Tel Aviv University)

Scientific Overview:

Algebraic techniques are playing an increasingly important role in certain areas of discrete geometry and combinatorics. This workshop will focus on those aspects of algebraic geometry that have an impact on incidence geometry and related areas. The workshop will primarily focus on those topics from classical algebraic geometry that seem poised to play important roles in this area including: the theory of ruled surfaces; Hilbert functions and polynomials; generalized Bezout theorems; the relationship between algebraic geometry over the field of real and complex numbers as well as fields of positive characteristic, combinatorial and algorithmic aspects of space decomposition induced by real algebraic varieties; and a variety of quantitative and combinatorial results in algebraic geometry.

A central challenge that the workshop will address is how to adequately identify the class of problems in discrete geometry susceptible to the algebraic method. The workshop will include expository talks by experts that make classical results of algebraic geometry accessible to researchers in discrete geometry by explaining them in modern terms. Another important goal of

this workshop is to expose experts in algebraic geometry to new applications, and present them with some open problems.

WORKSHOP: Mathematics of Politics. April 22 - 23, 2014

Organizing Committee:

Jacob Foster (University of California, Los Angeles (UCLA), Sociology)
Vwani Roychowdhury (University of California, Los Angeles (UCLA), Professor, Electrical Engineering)
Don Saari (University of California, Irvine (UCI), Director, Institute for Mathematical Behavioral Sciences)

Scientific Overview:

Recent political campaigns have dramatically demonstrated the power of data analysis and social network analysis for politics. Mathematical tools – such as machine learning, network analysis, topic modeling and Bayesian methods – are expected to have significant impact on a variety of political questions such as predicting voting results, decision making and redistricting. This workshop will bring together researchers and practitioners from mathematics, statistics, computer science, electrical engineering, political science and other fields to collectively address the emerging area of mathematics for politics.

PUBLIC LECTURE: "How Election Campaigns are Run and the Future of Math in Politics" by Congressman Jerry McNerney. April 22, 2014.

As part of the workshop Mathematics of Politics, Congressman Jerry McNerney gave a public lecture. He did not provide an abstract.

Speaker Bio:

Congressman Jerry McNerney holds a Ph.D. in mathematics from the University of New Mexico. He served several years as a contractor to Sandia National Laboratories on national security programs. In 1990, McNerney moved with his family to California, accepting a senior engineering position with U.S. Windpower, Kenetech. He later served as an energy consultant for PG&E, FloWind, the Electric Power Research Institute, and other utility companies. Prior to his election to Congress in 2006, he formed a start-up company to manufacture wind turbines. Congressman McNerney represents California's 9th District, and serves on the Committee on Energy and Commerce, which is vested with broad jurisdiction on a number of issues including telecommunications, consumer protection, food and drug safety, public health research, environmental quality, energy policy, and interstate and foreign commerce.

PUBLIC LECTURE: "Some People Have All the Luck," April 28, 2014. Presented by Skip Garibaldi, Lawrence Mower, and Philip B. Stark

Abstract:

Winning a prize of at least $600 in the lottery is a remarkable thing — for a scratcher ticket the odds are worse than 1-in-1200 and 1-in-9000 is a more typical figure. Some people have won many of these large prizes, and clearly they are very lucky or they buy a ton of lottery tickets. When we investigated records of all claimed lottery prizes, we discovered that some people had won hundreds of these prizes! Such people seem to be not just lucky, but suspiciously lucky. We will explain what we think they might have been up to, what mathematics says about it, and what further investigations revealed.

Speaker Bios:

Skip Garibaldi is associate director of UCLA's Institute for Pure and Applied Mathematics and a professor in Emory University's Department of Mathematics & Computer Science. His previous work on the lottery received the Lester R. Ford Award and is the subject of a chapter in the popular book "Brain Trust". Millions of people have seen him talk about math on 20/20, CNN, and Fox & Friends, and he is featured in a museum exhibit about mathematics currently on display at Exploration Place in Wichita.

Lawrence Mower is an investigative reporter with The Palm Beach Post. He joined The Post in 2013, after working for the Las Vegas Review-Journal, where his yearlong investigation into Las Vegas police shootings sparked a Department of Justice investigation and led to reforms in policy and oversight. The five-part series was awarded by the National Headliner Awards, Investigative Reporters and Editors, and the ACLU of Nevada, and in 2012 he was named Nevada's Outstanding Journalist by the Nevada Press Association. He is a 2006 graduate of the University of Nevada, Las Vegas.

Philip B. Stark is professor and chair of the Department of Statistics at UC Berkeley. His current research includes uncertainty quantification, cosmology, earthquake forecasting, election integrity, risk assessment, online education, and sustainable urban foraging. He has consulted for many firms and government agencies, including the U.S. Department of Justice, the U.S. Department of Agriculture, the U.S. Department of Commerce, the U.S. Department of Housing and Urban Development, the U.S. Department of Veterans Affairs, and the Federal Trade Commission.

WORKSHOP: The Kakeya Problem, Restriction Problem, and Sum-product Theory (Algebraic Techniques for Combinatorial and Computational Geometry Workshop III). May 5- 9, 2014

Organizing Committee:

Larry Guth (Massachusetts Institute of Technology)
Alex Iosevich (University of Rochester)
Nets Katz, Chair (California Institute of Technology)
Izabella Laba (University of British Columbia)

Scientific Overview:

The workshop will cover advances in harmonic analysis that have been linked to geometric combinatorial problems. Specific examples include the Kakeya problem, the restriction problem, continuous and finite field distance set problems, and continuous and finite field variants of the sum-product theory in additive combinatorics. This workshop will bring together experts in Fourier analysis, geometric measure theory, and combinatorics of finite fields.

The classical Kakeya problem asks how small a set (called a Kakeya set) can be in n-dimensional Euclidean space if it contains a unit line segment in every direction. It is conjectured that for any reasonable definition of fractal dimension, such a set should have dimension n. This is known to be the case in two dimensions, but in three and higher dimensions only weaker partial results are known. The Kakeya problem has been shown (through the work of Fefferman, Bourgain, and others) to be closely related to central problems in Fourier analysis such as Fourier multipliers and restriction estimates, but on the other hand, it involves combinatorics of union of lines that can be viewed as formally analogous to point-line incidence theory. Researchers (notably Wolff) went on to establish and exploit further connections of this type, in the process introducing harmonic analysts to combinatorial geometric problems.

More recently, algebraic methods first introduced in the context of the Kakeya problem (Dvir's polynomial method in finite fields, and Guth's endpoint result for the multilinear Kakeya problem based on the polynomial ham sandwich theorem) have also led to dramatic results in incidence geometry. Some geometric aspects of this work inspired the work of Guth and Katz on the joints problem and subsequently on the distance set problem. More recent work of Bourgain. It is possible that some of these ideas could be used in studying the conventional Kakeya problem.

The workshop will also examine questions related to distance sets and sum-product phenomena in continuous and finite field settings. While there has been substantial progress on the corresponding discrete problems, the continuous variants remain less understood. We hope that the new algebraic methods can shed more light on these questions; for instance, a major open problem is whether the sum-product phenomenon can ultimately be understood in an algebraic way. The workshop will be an excellent opportunity for experts who study these problems in different settings to interact and learn from one another.

WORKSHOP: Finding Algebraic Structures in Extremal Combinatorial Configurations (Algebraic Techniques for Combinatorial and Computational Geometry Workshop IV).
May 19- 23, 2014

Organizing Committee:
Emmanuel Breuillard (Université d'Orsay, Mathematics)
Ben Green (University of Oxford, Mathematics)
Jozsef Solymosi (University of British Columbia, Mathematics)
Terence Tao (University of California, Los Angeles (UCLA), Mathematics)
Julia Wolf, Chair (University of Bristol, Mathematics)

Scientific Overview:

Understanding the fine structure of extremal configurations is a key step in the solution of many problems in extremal combinatorics. For example, in many cases a group action underlies the structure found in an extremal scenario, making the problem amenable to algebraic methods. This principle is illustrated by recent work of Elekes, Hrushovski, Szabó and Green and Tao amongst others, who applied techniques from algebra, algebraic geometry, model theory and additive combinatorics to obtain important new results in discrete geometry.
We expect this fusion of algebraic geometry and combinatorics to become a very active area of research in the coming months and years. It is our aim to showcase the most exciting results, techniques and recent trends in this workshop. This workshop will include a poster session; a request for posters will be sent to registered participants in advance of the workshop.

PUBLIC LECTURE: "Randomness and Pseudorandomness" by Avi Wigderson. May 19, 2014.

This lecture was the first lecture in the 2014 Green Family Lectures Series.

Abstract:

Is the universe inherently deterministic or probabilistic? Perhaps more importantly – can we tell the difference between the two?

Humanity has pondered the meaning and utility of randomness for millennia. There is a remarkable variety of ways in which we utilize perfect coin tosses to our advantage: in statistics, cryptography, game theory, algorithms, gambling… Indeed, randomness seems indispensable! Which of these applications survive if the universe had no randomness in it at all? Which of them survive if only poor quality randomness is available, e.g. that arises from "unpredictable" phenomena like the weather or the stock market?

A computational theory of randomness, developed in the past three decades, reveals (perhaps counter-intuitively) that very little is lost in such deterministic or weakly random worlds. In the talk I'll explain the main ideas and results of this theory.

Speaker Bio:

Avi Wigderson is Professor of Mathematics at the Institute for Advanced Study (Princeton), where he leads the Institute's Computer Science and Discrete Math Program. He received his Ph.D. in computer science in 1983 from Princeton University. During 1986-2001 he held a permanent position at the Hebrew University Computer Science Institute and served as chair from 1992-95. Wigderson has held visiting positions at UC Berkeley, IBM Research, the Mathematical Sciences Research Institute, and the Institute for Advanced Study. He was an invited speaker at the International Congress of Mathematicians on two occasions, and was awarded the Nevanlinna Prize for outstanding contributions in mathematical aspects of information sciences in 1994. He gave the AMS Gibbs Lectures and received the AMS Conant Prize for mathematical exposition in 2008, and received the Gödel Prize, which recognizes outstanding papers in theoretical computer science, in 2009. Wigderson was elected to the American Academy of Arts and Sciences in 2011, and to the National Academy of Sciences in 2013.

Avi Wigderson works in the Theory of Computation, a field which studies the mathematical foundations of computer science. He is interested in the broad aspects of this exciting and rapidly developing field, including algorithms, Boolean and arithmetic circuit complexity, communication and proof complexity, cryptography, randomness, as well as the interactions of the field with other sciences including mathematics, physics, biology and economics.

PUBLIC LECTURE: "Permanent & Determinant: Non-identical Twins" by Avi Wigderson. May 20, 2014

This lecture was the second lecture in the 2014 Green Family Lectures Series, also featuring Avi Wigderson.

Abstract:

The determinant is undoubtedly the most important polynomial function in mathematics. Its lesser known sibling, the permanent, plays very important roles in enumerative combinatorics, statistical and quantum physics, and the theory of computation. In this lecture I plan to survey some of the remarkable properties of the permanent, its applications and impact on fundamental computational problems, its similarities to and apparent differences from the determinant, and how these relate to the P vs. NP problem. This lecture is intended for a general Math and CS audience.

WORKSHOP: Culminating Workshop, Algebraic Techniques for Combinatorial and Computational Geometry. June 6 – 13, 2014

The culminating workshop was organized by the long program organizing committee.

The final workshop in the long program, held at Lake Arrowhead Conference Center, provided an opportunity for the program's core participants to report on their work during the past three months and to discuss future projects. Many of the collaborations and interactions that were formed during the program had a chance to deepen.

REUNION CONFERENCE: Materials Defects Reunion Conference I. June 8 - 13, 2014

The reunion conference was organized by the original long program organizing committee.

This was the first reunion conference for participants of the fall 2012 long program "Materials Defects." It was a timely get-together to continue some of the collaborations that were started during the long program. Presentations were given by all participants, with plenty of time between talks for discussions and collaborations.

REUNION CONFERENCE: High Throughput Genomics Reunion Conference II. June 8 - 13, 2014

The reunion conference was organized by the original long program organizing committee.

This was the second reunion conference for participants of the fall 2011 long program "High Throughput Genomics." It was a timely get-together to continue some of the collaborations that were started during the long program and at the first reunion. Presentations were given by all participants, with plenty of time between talks for discussions and collaborations.

SUMMER PROGRAM: Research in Industrial Projects for Students (RIPS)-Hong Kong 2014. June 8 - August 8, 2014.

In collaboration with Hong Kong University of Science and Technology (HKUST), IPAM recruits eight U.S. students to work on cross-cultural teams with eight HKUST students on four projects, each sponsored by a company based in the region. The student team, with support from their academic mentor and industry mentor, will research the problem and present their results, both orally and in writing, at the end of the program.

The program is nine weeks. IPAM provides the U.S. participants with a travel allowance and a stipend of $3,000. Housing and most meals are also included. Hong Kong students: please consult the HKUST announcement for the benefits they offer local students.

U.S. citizens and permanent residents are eligible for RIPS-Hong Kong. English is the only language required for participation. The local students, academic mentors and industry mentors will speak English.

Students will stay in residence halls and eat most meals in the campus dining halls. The HKUST math department provides technical support and offices, and offers some cultural activities and Cantonese lessons.

IPAM's partner, HKUST, recruits four project sponsors from local industry. The 2014 sponsors and projects included:

RIPS-Hong Kong 2014: Sponsors and Projects	
Sponsor	Title of Project
BGI	Detection of somatic mutations in sequenced pair samples
Hong Kong Observatory	Probabilistic radar-based nowcasting of springtime and summer monsoonal rainstorms in Hong Kong
Lenovo	Intelligent Eye for the Visually Impaired
Microsoft Research Asia	The Schelling model: Simulation and Analysis

SUMMER PROGRAM: Research in Industrial Projects for Students (RIPS) 2014.
June 22 - August 22, 2014.

The Research in Industrial Projects for Students (RIPS) Program provides an opportunity for talented undergraduate students to work in teams on a real-world research projects proposed by sponsors from industry or the public sector. The student team, with support from their academic mentor and industry mentor, will research the problem and present their results, both orally and in writing, at the end of the program.

The 2014 sponsors and projects included:

Sponsor	Project
Aerospace Corporation	Calculating Channel Capacity for Satellite Communication Systems
Disney Animation Studios	Preconditioning of the Poisson equation using the domain decomposition method
Google LA	Using Machine Translation to Improve Text Classification
Gum Gum	Inventory forecasting for ad campaigns
HRL	Self-organized criticality for optimal random search
LAPD	Long-term Crime Forecasting & Setting Crime Reduction Targets
Lawrence Livermore National Lab	Polynomial expansion method for the numerical solution of the Lenard-Balescu equation
Shoah Foundation Institute	Enriching Visual History Archive with External Knowledge from Wikipedia
Symantec	Project Soothsayer: A Simulation Model for Backup-System Capacity Planning

The program is nine weeks. IPAM provides each undergraduate student with a travel allowance and a stipend of $3,000. Housing and most meals are also included.
RIPS-LA students will live in residence halls on the UCLA campus and will work at IPAM. We expect to have nine projects. The project sponsors are announced in March.

International students, including students attending a university outside the U.S., are eligible to apply for RIPS-LA, as are graduating seniors.

We have provided below a selection of statements from RIPS2014 students that demonstrate the impact of the program.

"RIPS is a fantastically unique opportunity in an environment that emphasizes learning to work on research problem in industry, to work with people from around the globe. I was already interested in work in industry (not academia) but RIPS made me realize how much I like research and made me more enthused about going to grad school before some type of work in industry." Kate Donahue, Harvard University (HRL team)

"The educational value of the projects speaks for itself. What stands out to me is the unique opportunity to work with 35 peers who share the same passion for academic and intellectual pursuits, and all of whom bring with them a different perspective on life and problem-solving. This program provides eye-opening experiences that students are hard-pressed to find elsewhere." - Nathan Ng, University of Maryland (Lawrence Livermore team)

"RIPS is a great opportunity to begin using the knowledge we learn in class and actually applying it to a real world problem. The interaction with industry sponsors has given me great insight into what working in industry or researching might be like." - Sarah Verros, Colorado School of Mines (LAPD team)

SUBWORKSHOP: RIPS 2014 Projects Day. August 19, 2014

The nine RIPS-LA teams presented their industry-sponsored research on the projects listed above. Representatives of the industry sponsors attend, and the event was open to the public. Math students and faculty from East Los Angeles College, family members of the students, IPAM supporters, and members of UCLA's math and science community attended.

SUMMER PROGRAM: Graduate-Level Research in Industrial Projects for Students (GRIPS)-Berlin. June 29 – August 22, 2014
Scientific Overview:

Graduate-Level Research in Industrial Projects for Students (GRIPS) will offer graduate students in mathematics and related disciplines the opportunity to work on industry-sponsored research problems. Three students from the U.S. and three from Germany will work on cross-cultural teams on three research problems designed by the industrial sponsor. The projects will be of

serious interest to the sponsor and will offer a stimulating challenge to students; most will involve both analytic and computational work. At the end of the program, the teams will present the results of their work and prepare a final report. English is the only language required for participation.

Round-trip travel to Berlin and accommodations in Berlin are included. Students will also receive a meal allowance and a stipend of $3,000 for their full participation. (These terms apply to U.S. participants recruited by IPAM.)

The Institute for Pure and Applied Mathematics (IPAM) will partner with the Research Campus MODAL in Berlin, Germany. MODAL has existing industrial partners affiliated with their laboratories that provide their research groups with interesting and challenging research problems.
All work was based on real-world data provided by the industry partner. The sponsors and projects for 2014 included:

1. SAP-INNOVATIONSZENTRUM (BIOTECH):

Company: Headquartered in Walldorf, Germany, with locations in more than 130 countries, SAP is the market leader in enterprise application software, developing innovations that help businesses run better. SAP empowers people and organizations to work together more efficiently and use business insight more effectively to stay ahead of the competition. SAP applications and services enable more than 248,500 customers to operate profitably, adapt continuously, and grow sustainably.

Project: Building on SAP's newest HANA database technology students will develop new machine-learning techniques to analyze medical massive data sets. First, students will learn the necessary biological foundation needed to successfully complete the project. They will then use data from a large clinical trial to model medical phenomena using latest network-of-networks theory.

2. DEUTSCHE BAHN (GERMAN RAILWAYS):

Company: Deutsche Bahn (DB) is the main German railway company. It transports on average 5.4 million customers every day over a rail network that consists of 33,500 km of track, and 5,645 train station. DB operates in over 130 countries world-wide. It provides its customers with mobility and logistical services, and operates and controls the related rail, road, ocean and air traffic networks.

Project: This project will help develop new and optimized schedules. In general, there is a trade-off for complex systems between robustness and efficiency. The students will do simulations and develop analytic models to explore this trade-off.

3. OPEN GRID EUROPE (GAS INFRASTRUCTURE):

Company: Open Grid Europe GmbH is Germany's biggest gas transport operator (TSO), responsible for the efficient planning and operation of a highly advanced and intermeshed pipeline system of more than 10,000 km in length. The company provides its customers with natural gas transportation and all associated services, and gives assistance and advice on both grid access and pipeline network.

Project: Gas is driven through a network of pipelines by compressor stations consisting of complex sub-networks with several compressor machines. The aim of this project would be to improve the handling of compressor stations by the optimization code.

SUMMER PROGRAM: Hands-on Summer School: Electronic Structure Theory for Materials and (Bio)molecules. July 21 – August 1, 2014

Organizing Committee:

Volker Blum (Duke University)
Christian Carbogno (Fritz-Haber-Institut der Max-Planck-Gesellschaft)
Matthias Scheffler (Fritz-Haber-Institut der Max-Planck-Gesellschaft)
Scientific Overview:

Electronic structure theory (for total energies, forces, neutral and charged excitations, dynamics and transport, etc.) has reached a level where quantitative analyses and predictions of hitherto unknown properties and functions of materials are possible – including bulk materials, isolated molecules, surfaces, nanostructures, clusters, liquids, (bio)molecules in their environment, and more. Finding better or even novel functional materials is critical for nearly every aspect of our society. Key issues are, for example, the "energy challenge" and "managing the environment". This ten-day Hands-on Summer School introduces the basics of electronic-structure theory and teaches how actual calculations are performed. Morning lectures on the most important topics will be given by internationally renowned experts. In the afternoon (and evening) the participants will put this knowledge into practice. We will also discuss recent developments towards the "Materials Genome", and how to treat large amounts of data.

OUTREACH ACTIVITIES, 2013-2014

IPAM participated in the **Modern Math Workshop,** a one-day program for undergraduate and graduate students held the day before the official start of the national meeting of SACNAS, on Oct. 2-3, 2013. IPAM was not the lead organizer this year, so the participants of the program, mostly Hispanic students, are not included in our report. IPAM provided one speaker (Charlie Doering, University of Michigan) and encouraged former participants of our programs, especially RIPS, to participate.

Also in 2013-2014, IPAM continued partnerships with two- and four-year schools in the Los Angeles area in order to increase the representation of minorities and women in its programs. IPAM invited students at East Los Angeles College, Santa Monica College, Loyola-Marymount

University, and Cal State Northridge to attend our public lectures. IPAM continues to demonstrate its support for the UCLA chapter of SACNAS. The outreach coordinator attends quarterly meetings and encourages them to participate in IPAM programs. In 2013-2014, the chapter used IPAM facilities for a K-12 educational event and their year-end banquet.

IPAM held two women's luncheons in 2013-2014: one during the fall program on Materials for Sustainable Energy (12 women attended), and another during the spring program on Combinatorial and Computational Geometry (9 women attended).

Other outreach activities, 2013-2014:

- An IPAM representative attended the Nebraska Conference for Undergraduate Women in Math (NCUWM) in 2014 to talk to undergraduate women about opportunities in math
- IPAM staff attended the Modern Math Workshop and national meeting of SACNAS to talk to conference attendees about IPAM programs.
- RIPS students presented their research at SACNAS and NCUWM
- IPAM advertised RIPS (summer research program) through minority institutions and organizations
- IPAM advertised its "call for proposals" on the AWM and SACNAS websites.
- With the other NSF math institutes, IPAM supported the AWM Mentor Network Program.
- IPAM used funds from the Berland Foundation endowment to pay for children of program participants at the culminating workshop of Materials for Sustainable Energy, and offered a child care grant to a participant of a Combinatorial and Computational Geometry workshop who could not have otherwise participated.

K. PROGRAM CONSULTANT LIST

IPAM consulted a variety of scholars and practitioners in the scientific planning of each program. The list below includes program organizers for 2013-2014 as well as 2014-2015, as the planning for these programs had begun by August 30, 2014. We have also included members of IPAM's Board of Trustees and Science Advisory Board who were active in 2013-2014. The list excludes our own scientific staff (directors).

Name	Institution
Alejandro Adem	Mitacs
Amit Agrawal	Amazon Lab126
Saurabh Amin	Massachusetts Institute of Technology
Federico Ardila	San Francisco State University
Alán Aspuru-Guzik	Harvard University
Jonathan Aurnou	University of California, Los Angeles
Marco Avellaneda	New York University

David Balaban	Amgen
Rodrigo Bañuelos	Purdue University
Richard Baraniuk	Rice University
Saugata Basu	Purdue University
Martin Bazant	Massachusetts Institute of Technology
Tanya Beder	SBCC Group Inc.
Gyan Bhanot	Rutgers University
Marek Biskup	University of California, Los Angeles
Volker Blum	Duke University
Alexei Borodin	Massachusetts Institute of Technology
Leon Bottou	Microsoft Research
Jean-Philippe Bouchaud	Capital Fund Management
Annalisa Bracco	Georgia Institute of Technology
Emmanuel Breuillard	Université d'Orsay
Oliver Bühler	New York University
Kieron Burke	University of California, Irvine
Russel Caflisch	University of California, Los Angeles
Robert Calderbank	Duke University
Eric Cances	École Nationale des Ponts-et-Chaussées
Emmanuel Candes	Stanford University
Christian Carbogno	Fritz-Haber-Institut der Max-Planck-Gesellschaft
Lawrence Carin	Duke University
René Carmona	Princeton University
Jose Castillo	San Diego State University
Colm-cille Caulfield	University of Cambridge
Tony Chan	Hong Kong University of Science and Technology
Tom Chou	University of California, Los Angeles
Henry Cohn	Microsoft Research
Peter Constantin	Princeton University
Rama Cont	Imperial College
Ricardo Cortez	Tulane University
Oliver Cossairt	Northwestern University
Bill Coughran	Sequoia Capital
Dan Crisan	Imperial College
Gabor Csanyi	University of Cambridge

Charlie Doering	University of Michigan
Igor Dolgachev	University of Michigan
Claudia Draxl	Humboldt-Universität
Cynthia Dwork	Microsoft Research
Karina Edmonds	California Institute of Technology
Jordan Ellenberg	University of Wisconsin-Madison
Gregory Eyink	Johns Hopkins University
Santo Fortunato	Aalto University
Jacob Foster	University of California, Los Angeles
Jean-Pierre Fouque	University of California, Santa Barbara
James Fowler	University of California, San Diego
Baylor Fox-Kemper	Brown University
Daniel Freed	University of Texas at Austin
Peter Friz	Technische Universität Berlin and WIAS Berlin
Angela Gallegos	Loyola Marymount University
Giulia Galli	University of California, Davis
Pascale Garaud	University of California, Santa Cruz
Ben Green	University of Oxford
Mark Green	UCLA
Hardy Gross	Max Planck Institute of Microstructure Physics
Massimiliano Gubinelli	Université de Paris IX (Paris-Dauphine)
Xin Guo	University of California, Berkeley
Larry Guth	Massachusetts Institute of Technology
Martin Hairer	University of Warwick
Alfred Hales	CCR West
Matthew Hastings	Microsoft Research
Graeme Henkelman	University of Texas at Austin
Michael Hermele	University of Colorado
Tom Hou	California Institute of Technology
Jean-Pierre Hubschman	University of California, Los Angeles
Alex Iosevich	University of Rochester
Monica Jackson	American University
Trachette Jackson	University of Michigan
Richard James	University of Minnesota, Twin Cities
Michael Jolly	Indiana University

Peter Jones	Yale University
Keith Julien	University of Colorado
Haim Kaplan	Tel Aviv University
Anton Kapustin	California Institute of Technology
Nets Katz	California Institute of Technology
Sallie Keller	Virginia Tech University
Rich Kerswell	University of Bristol
John Kim	University of California, Los Angeles
Alexander Kiselev	Rice University
Rupert Klein	Freie Universität Berlin
Joseph Klewicki	University of New Hampshire
Bryna Kra	Northwestern University
Izabella Laba	University of British Columbia
Joseph Landsberg	Texas A&M University
Yann LeCun	New York University
Alan Lee	AMD Research
Jim Leebens-Mack	University of Georgia
Kristina Lerman	University of Southern California
David Levermore	University of Maryland
Doron Levy	University of Maryland
Andrew Lo	Massachusetts Institute of Technology
John Lowengrub	University of California, Irvine
Jennifer Lukes	University of Pennsylvania
Michael Macy	Cornell University
Jiri Matousek	Charles University
Anna Mazzucato	Penn State University
Beverley McKeon	California Institute of Technology
Herbert Medina	Loyola Marymount University
Klaus-Robert Müller	Technische Universität Berlin
Assaf Naor	Princeton University
Jeff Neaton	Lawrence Berkeley Laboratory
Jens Norskov	Stanford University
Stanley Osher	University of California, Los Angeles
Victor Ostrik	University of Oregon
Asuman Ozdaglar	Massachusetts Institute of Technology

George Papanicolaou	Stanford University
Kristin Persson	Lawrence Berkeley Laboratory
Gopal Prasad	University of Michigan
Keith Promislow	Michigan State University
Andrei S. Rapinchuk	University of Virginia
Ben Recht	University of California, Berkeley
Alan Reid	University of Texas at Austin
Sebastien Roch	University of Wisconsin-Madison
Igor Rodnianski	Massachusetts Institute of Technology
Nancy Rodríguez	UNC - Chapel Hill
Marie-Francoise Roy	Université de Rennes I
Vwani Roychowdhury	University of California, Los Angeles
Misha Rudnev	University of Bristol
Don Saari	University of California, Irvine
Jeffrey Saltzman	AstraZeneca
Matthias Scheffler	Fritz-Haber-Institut der Max-Planck-Gesellschaft
Alexander Schied	Universität Mannheim
Galina Schwartz	University of California, Berkeley
Cosma Shalizi	Carnegie-Mellon University
Micha Sharir	Tel Aviv University
Ati Sharma	University of Southampton
Ronnie Sircar	Princeton University
Jozsef Solymosi	University of British Columbia
Ronald Stern	UC Irvine
Pieter Swart	Los Alamos National Laboratory
Terence Tao	University of California, Los Angeles
Yohann Tendero	École Nationale Supérieure de Télécommunications
Joseph Teran	University of California, Los Angeles
Jean-Luc Thiffeault	University of Wisconsin-Madison
Elizabeth Thompson	University of Washington
Alexandre Tkatchenko	Fritz-Haber-Institut der Max-Planck-Gesellschaft
Claire Tomlin	University of California, Berkeley
Tatiana Toro	University of Washington
Emanuele Trucco	University of Dundee
Irena Tsui	University of California, Los Angeles

Alejandro Uribe	University of Michigan
Ashvin Vishwanath	University of California, Berkeley
Tandy Warnow	University of Illinois at Urbana-Champaign
Amie Wilkinson	Univ. of Chicago
Julia Wolf	University of Bristol
Stephen Wright	University of Wisconsin-Madison
Wei Xiong	Princeton University
Bin Yu	University of California, Berkeley
Thaleia Zariphopoulou	University of Texas at Austin
Hongkai Zhao	University of California, Irvine

L. PUBLICATIONS LIST

The following publications are the participants' responses to "Please list up to three publications of the past year (including preprints and technical papers) that were a result of or influenced by your participation at the IPAM program" which was part of a survey conducted in May 2015. For this 2013-2014 annual report, we surveyed participants of the 2013 summer programs and the two long programs in 2013-2014, Materials for a Sustainable Energy Future and Combinatorial and Computational Geometry. Note that some papers with multiple authors are listed twice (reported by two different participants). As these publications are self-reported, the formatting of the citations is inconsistent.

See appendix 1 for the publications list.

M. INDUSTRIAL AND GOVERNMENTAL INVOLVEMENT

We have significant involvement of industry and government labs in our summer program, Research in Industrial Projects for Students (RIPS). See the program description for RIPS-LA (Section J) for a complete list of sponsors in RIPS-LA 2014.

We also offered RIPS-Hong Kong for the fourth time in the summer of 2014. Our partner, Hong Kong University of Science and Technology, recruited the sponsors. See the program description (Section J) for more information. IPAM had an IRES grant from the NSF OISE to support this program.

IPAM received in-kind support from Intel and MathWorks in 2013-14. Intel donated compiler licenses, valued at approximately $5,000, for IPAM's 2014 Graduate Summer School. MathWorks contributed eight different toolbox licenses to MatLab to our "RIPS" program, with a total value of approximately $1,200 for the student teams to use on their research projects.

Out of 1,656 participants in 2013-2014, 34 held positions in government or military, and 52 worked in industry. In addition to RIPS, industry researchers from Intel, Microsoft, Facebook, Reddit, Google, Flickr, Bosch, Novartis Institutes for Biomedical Research, and other companies attended IPAM workshops, with the largest number attending the workshop on Stochastic Gradient Methods. Eight researchers from TrueVision Systems and other biotech companies attended Mathematics for Ophthalmology. Government and military research laboratories represented at IPAM programs include all the major national labs as well as National Renewable Energy Laboratory and Oak Ridge. A U.S. Congressman and a member of the Congressional Staff attended Mathematics of Politics. Of course, many representatives of industry and government participated in RIPS and attend RIPS Projects Day.

In 2013-2014, our Board of Trustees included Al Hales (CCR West), Jeff Saltzman (AstraZeneca), Pieter Swart (Los Alamos National Lab), David Balaban (Amgen), Alan Lee (AMD), Tanya Beder (SBCC Group Inc.) and Bill Coughran (Sequoia Capital). Karina Edmonds, Executive Director for Corporate Partnerships at Caltech, also served on the Board that year. See section O for the complete list.

Our 2013-2014 Science Advisory Board included Cynthia Dwork and Henry Cohn from Microsoft Research, and Yann LeCun, who was hired by Facebook in 2013 to lead their artificial intelligence efforts. See section O for the complete list.

Here are a few comments from representatives of industry and government labs who participated in IPAM programs in 2013-2014.

N. EXTERNAL SUPPORT

In addition to the funding listed in Table N below, IPAM receives substantial in-kind financial support from UCLA. The Director's entire salary and administrative stipend are paid directly by UCLA. The Director of Special Projects is released from two courses at the cost of replacing him by a junior person. IPAM is not charged for the use of its building or for custodial care. The value of these items is considerable. Additionally, senior long-term participants from other universities are usually funded on a teaching replacement-buyout basis, by which they are released from teaching for the cost of hiring a junior person as a replacement.

Table N: Other Funding Support, 2013-2014	
Federal Funding	**Amount**
NSF-IRES: RIPS-Hong Kong	$50,000
Sub-total	$50,000
Support from Foundations	
Alfred P. Sloan Foundation	$20,000
Berland Foundation	$7,000
Sub-total	$17,000
University Funding Support	
Dean Physical Sciences	$134,554
Vice Chancellor for Research	$127,152
Sub-total	$261,706
Industrial Affiliates and Other Support	
Aerospace	$15,000
HRL, Inc.	$15,000
Intel	$16,000
Google	$15,000
Disney	$15,000
GumGum	$15,000
Microsoft	$10,000
Symantec	$15,000
Sub-total	$116,000
Others	
Registration Fees-Programs	$44,980
Green Family Lectureship Foundation Investment Income	$5,688
Frontier's Society and Other Contributions	$24,305
Sub-total	$74,973
TOTAL	**$519,679**

O. COMMITTEE MEMBERSHIP

IPAM's committees include the Board of Trustees and Science Advisory Board. The members during the 2013-2014 fiscal year are listed below. The IPAM directors are *ex officio* members.

Science Advisory Board, 2013-2014 Membership

Full Name	Discipline or Expertise	Institution
Borodin, Alexei	Mathematics	MIT
Calderbank, Robert	Mathematics	Duke University
Candes, Emmanuel	Statistics	Stanford University
Cohn, Henry	Math/Cryptography	Microsoft Research
Couzin, Iain	Ecology & Evolutionary Biology	Princeton
Dwork, Cynthia	Computer Science	Microsoft Research
Jones, Peter Wilcox	Mathematics	Yale University
LeCun, Yann	Computer Science	NYU and Facebook
Levermore, David (Chair)	Applied Math	University of Maryland
Naor, Assaf	Mathematics	Princeton
Tao, Terence	Mathematics	UCLA
Tomlin, Claire	Electrical Engineering	UC Berkeley
Wilkinson, Amie	Mathematics	Univ. of Chicago
Wright, Stephen	Computer Science	University of Wisconsin - Madison
Yu, Bin	Statistics	UC Berkeley

Board of Trustees, 2013-2014 Membership

Name	Title	Organization
Balaban, David	VP for R&D Informatics	Amgen
Beder, Tanya	Chairman & CEO	SBCC Group Inc.
Chan, Tony	President	HKUST
Coughran , Bill	Partner	Sequoia Capital
Edmonds, Karina	Executive Director for Corporate Partnerships	Caltech
Green, Mark	Professor Emeritus	UCLA
Hales, Alfred (Chair)	Director	CCR West
Keller, Sallie	Professor and Director	Virginia Tech University
Kra, Bryna	Professor	Northwestern University
Lee, Alan	Corporate VP, Engineering Research	AMD Research
Saltzman, Jeffrey	Director of Predictive Sciences	AstraZeneca
Stern, Ronald	Professor Emeritus	UC Irvine
Swart, Pieter	Researcher	Los Alamos National Lab
Toro, Tatiana	Professor	University of Washington

P. CONTINUING IMPACT OF PAST IPAM PROGRAMS

This spring, we surveyed the participants of our 2013 summer programs for students: our graduate summer school on computer vision (GSS), and Research in Industrial Projects for Students (RIPS), a program for undergraduate students. We asked them about the impact of the program on their research and careers. Here are some of their responses:

Graduate Summer School: Computer Vision

It was a great experience for my research career since I was in the beginning of my doctoral studies. I believe it helped me broadening my research vision as well as improving my technical knowledge. In fact, I recommend this program to my colleagues and friends, and I would like to attend once more in case the summer school topic and my schedule meets. Thank you very much again for organizing such a great summer school.
-Murat Arar, Electrical Engineering, École Polytechnique Fédérale de Lausanne (EPFL)

I feel, that it was perfect for me to participate at the Graduate Summer School in the first year of my PhD. The summer school gave me a great insight into the diverse topics in computer vision. Moreover, I got to know several researches with substantial contribution in this field. This motivated/motivates me a lot for my own research.
-Julia Bergbauer, Computer Science, Technische Universtitat München

I have learnt how to build detectors for robust and efficient object detection. Now, I am using IPAM summer school resources to engage myself in large scale machine learning.
-Sujoy Kumar Biswas, Electrical Engineering, University of California, Santa Cruz

IPAM has given me a broad view of the direction in which computer vision research is going and has positively affected my research direction to select certain problems which I think will be useful for general community.
-Siddharth Choudhary, College of Computing, Georgia Institute of Technology

The IPAM computer vision summer school exposed me to a very wide array of cutting edge mathematical techniques, presented by experts in their areas. In particular presentations by Drs. Daniel Cremers and Raquel Urtasun inspired new project ideas for me in the areas of image registration and Gaussian processes.
-Greg Fleishman, Bioengineering, University of California, Los Angeles

I have gained much more understanding of the field. I also learned the passion and attitude towards research from a number of teachers from the program.
-Lin Gan, Computer Science, Illinois Institute of Technology

GSS was great, compared to other summer schools, it focused on well-established foundations (and not recent tips & tricks). It has helped me to understand these foundations better and motivate myself to start studying and focusing my research a bit on more a theoretical side.

-Ondrej Miksik, Brookes Vision Group, Oxford Brookes University

In the last years I have been actively collaborating with one fellow participant, Ekaterina Potapova. This collaboration led to a publication. We are in the process of submitting another article we have been working on in this year. I consider my participation at GSS2013 [to be] very important for my career and research. First, the lectures given by the Professors and the discussions with them and the fellow students, have helped me better understand research problems I was working on at the time. Additionally, my participation at the program helped me to identify further interesting research questions, answers to which I have pursued since then. My interest in the problems I am currently working on originated from the discussions I had and the lectures I heard at GSS2013.
-Valsamis Ntouskos, Department of Computer, Control and Management Engineering "Anto, Università di Roma “La Sapienza”

I am now a postdoctoral researcher in the CS/Stats department at UCLA. I secured this position because of my interaction with my current supervisor, Prof. Alan Yuille, who I met at the IPAM summer school.
-Vittal Premachandran, School of Computer Engineering, Nanyang Technological University

IPAM provides a highly innovative environment for research discussion and nurturing research collaboration. All of my publications in computer graphics came from discussions I had with my collaborators at IPAM. The summer school … provided me with wonderful opportunities to interact with the top researchers in the computer vision community.
-Lap Fai Yu, Computer Science, University of California, Los Angeles

I truly benefit from this event. Through attending GSS 2013, I get a chance to know many research areas which I was not familiar with in the past. Thanks for inviting a lot of pioneers from computer vision area that I can understanding so many cutting edge researches and techniques in just a few weeks. I have a long time collaboration with someone I met at GSS 2013.
-Zhang, Xi, Computer Science, Illinois Institute of Technology

Research in Industrial Projects for Students (RIPS)

While my current research doesn't continue my work from RIPS, my time at IPAM has had a significant positive impact on my career. Spending a summer with so many talented, hardworking, and accomplished peers has motivated me to work hard to keep up with them. Mike Raugh's coaching helped me improve my presentation skills. Before RIPS, I expected to have a career in very pure math, but my experiences working for the LAPD have motivated me to seek out projects that are on the border between pure and applied math.
-Daniel Bernstein, Mathematics, Davidson College

It solidified my desire to go into research--I will be pursuing a PhD in pure mathematics at UC

Berkeley next fall.
-Rahul Dalal, Mathematics, Harvard University

The program was invaluable in helping me understand where my research interests lie. It is influenced me to pursue applied math and data science in my graduate career, and gave me vital experience in reaching this stage.
-Arjun Dhillon, Mathematics, Princeton University

Participation of the RIPS program motivated me to pursue a graduate degree in mathematics.
-Xuchen Han, Math/Economics, Northwestern University

I have realized that I enjoy the application aspect of research, and plan on pursuing a PhD in Physics at UCSB this upcoming fall. I vastly enjoyed working at an excellent institute (IPAM), and plan to visit similar institutes in the future. I stay in touch with the other participants. When going to math conferences, I look forward to seeing familiar faces.
-Eric Jones, Applied Mathematics and Engineering Physics, Colorado School of Mines

Being a mentor, I had a first-hand experience managing group of people towards reaching and completing a goal. It was an experience like having/starting your own group, and I believe it will be valuable in the future in my career.
-Jakub Kaminski, California Institute of Technology

I had an internship at The Aerospace Corporation (our corporate sponsor at RIPS), working with the same department and researchers that I met during my time at RIPS. I still maintain contact with those researchers/managers. I have become a lot more interested in numerics and large scale computations (High-Performance Computing).
-Scott Manifold, Mathematics, University of California, Riverside

***

Additionally, we survey the participants of some of our programs 6-8 years later. Here are a few comments that demonstrate the continuing impact of the programs on the participants, many years later.

IPAM was very influential in my career. I met many of my favorite collaborators there and was introduced to some of the most exciting and cutting edge research in cryptography at the time. It was really one of the best experiences I had in graduate school.
-Seny Kamara, Securing Cyberspace long program, 2006

The "Securing Cyberspace" program was immensely helpful for me and my career. There was a broad mix of excellent researchers at various points in their academic careers, as well as members of industry, allowing me to learn from and work with a full spectrum of people. There is no doubt that the program had an everlasting positive impact on my career.
-Steve Lu, Securing Cyberspace long program, 2006

The IPAM program has had a huge impact in my career. Everything that I learned during the program has helped to grow as a researcher. The experience has helped to broaden my fields of interest and focus on interdisciplinary problems where mathematics plays an important role.
-Susana Serna, Random Shapes long program, 2007

The IPAM Random Shapes program had significant on my career by introducing me to data analysis methods that later became central to my research.
-Dimitrios Giannakis, Random Shapes long program, 2007

RIPS had a profound impact on my later career choices, not only for showing me what was potentially available, but also that my skill set was actually of value in a research environment. The experience of working with a team of significantly differing individuals from numerous backgrounds and with very different capabilities and skills was an enormous challenge but also great preparation for academic life. Additionally, I have maintained a strong relationship with my academic mentor from RIPS; he has been someone who has guided me, advised me and supported me at every turn since my time at RIPS, I will be forever grateful to him and to RIPS for introducing us in the first place.
-Jennifer Treanor, RIPS 2006, Los Alamos team

APPENDIX 1: Math Institute Directors' Meeting Report (Section E)

Minutes of the Math Institute Directors meeting
May 2 - 3, 2014
Location: MSRI

Friday, May 2, 2014

Present: Tony Nance, MBI, Greg Rempala, MBI, Russel Caflisch, IPAM, Jill Pipher, ICERM, David Eisenbud, MSRI, Hélène Barcelo, MSRI, Estelle Basor, AIM, Brian Conrey, AIM, Fadil Santosa, IMA, Richard L. Smith, SAMSI.

Absent: Robert Dijkgaaf (IAS), Martin Golubitsky (MBI), Snehalata Huzurbazar (SAMSI).

MSRI Staff Present: Arthur Bossé

Meeting Guest: (video conference) Andreas Daniel Matt of the Mathematisches Forschungsinstitut Oberwolfach (MFO)

The meeting was called to order at 1:00 PM by David Eisenbud.

All participants introduced themselves.

Review of Minutes: The minutes of the MIDS meeting of May 3-4, 2013 were reviewed.

It was noted that Tony Nance was left off of the attendance and Hélène Barcelo's name was misspelled. With these corrections, the minutes were approved.

Updates and Follow-up: The group revisited action items and pending issues during the review of the minutes. Of significant discussion:

The library project for book sharing included an action item to create a Google Doc for the sharing of titles to send to Africa. Fadil Santosa will send an email to all institutions containing information about who to contact to give books to Africa. Because the shipping of books is so costly, Fadil will also poll the Institutes to see if there are any ideas on resources to ship.

Russel Caflisch followed up about the plans to write a Math Institutes column for SIAM and agreed to take this item up by writing an article, during the year 2014-15. Fadil agreed to write the next.

Jill Pipher followed up on her discussion about the composition of external NSF site visit teams. She has learned that the reviewers who evaluate the institute proposals and send a written report, as well as the eventual site visit team, are neither given the reports from the 3rd year review nor from the previous recompetition. It was agreed that we should ask for information about this on Saturday.

Greg Rempala stated that the continuation of "Mathematics of Planet Earth (MPE) 2013" is in progress. Hélène agreed to send the 2013 MPE report to all Directors.

Presentation: Andreas Daniel Matt joined the meeting via video conference to encourage the Institutes to participate in outreach projects in collaboration with IMAGINARY/MFO via the use of other media or MFO's open platform. He described a typical exhibition which would include 2-4 interactive displays and 10-15 3-D sculptures. The recommended space for such an exhibit would be 100 to 150 square meters. IMAGINARY tries to prepare each exhibition with good content, new materials and involving different fields. The MIDs interviewed him about replicating the exhibits and about target audiences.

The NSF project to evaluate the Math Institutes Portfolio: The methodology of the project was discussed with some anecdotal stories about how the process has unfolded and how information has been requested. One Institute was asked for meeting minutes so that the rationale for choosing a program would be better understood. All were in agreement that the emphasis should focus more on outcomes and less on why a program was selected. There is a rumor that the House Science Committee may plan to look at the Math Institutes portfolio which could send the evaluation process into overdrive.

David suggested presenting to the NSF a set of reasonable metrics upon which the Institutes should be evaluated. There was agreement that the Institutes need to better communicate how as a group they benefit the mathematics community.

A brainstorming session produced areas of evaluation (metrics) that the Institutes would like to see, including evaluations that are based on participants, the collaborations produced and success stories; the impact of the program on the careers of all participants and in particular, those of the postdocs, graduate students and early career researchers. The issue of diversity was considered important because it is something that the Institutes have worked hard at and it distinguishes an NSF Institute from other institutions.

Further discussion produced suggestions for the proposed NSF survey that would take into consideration the fact that some who would respond have not received NSF grants and may blame the Institutes for this; and that some who have not been to an Institute may still have an opinion about an Institute's value to the community. The question should be posited up front if the respondent has been to an Institute. It will be difficult to produce quantitative evaluations from success stories.

It was agreed that a suggestion should be made to the NSF on Saturday to create an Institute subcommittee to work with the NSF and STPI (if appropriate) to formulate a set of measures of our success. Jill Pipher agreed to be the chair.

Joint Video Database Update: Jill stated that a developer worked on the project to catalogue the assets to the point where it needed an interface and the work stopped. In moving the project forward, it was decided that a project manager needs to be hired to take ownership of the project and possibly do some of the technical work. Very little money has been spent on this part of the project so funds exist to take this step. A request for services has been created and the person

will be hired soon to see the project through to the end (for an additional six months) to stay on top of it as it is rolled out. This phase of the project is on track to be completed by the end of the grant in 2015.

The proposal to create the database did not include a plan for long-term maintenance and everyone agreed that, due to the constant changes in technology, it is likely that a maintenance budget will be required.

The next challenge will be to create the metadata. It was the consensus of the group that it would be desirable for the programmer to develop a batch metadata editor.

Topics to bring up at the meeting with the DMS team on Saturday: A list of topics that should be presented to the NSF on Saturday included:

- Make the suggestion to work together on the evaluation plan.
- Ask how the Institutes can help make the case for Math funding.
- Ask how the highlights are being used, how often they make it to the main NSF page and if there could be a link from the DMS page to the Institute Highlights page.

Creating a section of the meeting organized by the Deputy Directors: David and Hélène suggested that the Deputy Directors could organize a one hour segment at each future MIDS meeting, focused on operational issues. All agreed that this would be acceptable. For example, David and Hélène gave an example of a topical discussion about the increasing requests for buyouts and whether or not anyone is trying to cap them.

The meeting was adjourned at 4:30 PM

Saturday, May 3, 2014

Present: Tony Nance, MBI, Greg Rempala, MBI, Russel Caflisch, IPAM, Jill Pipher, ICERM, David Eisenbud, MSRI, Hélène Barcelo, MSRI, Estelle Basor, AIM, Brian Conrey, AIM, Fadil Santosa, IMA, Richard L. Smith, SAMSI, Michael Vogelius, NFS, Henry Warchall, NFS, Joanna Kania-Bartoszynska, NSF, Mary Ann Horn, NSF, Christopher Stark, NSF

Absent: Robert Dijkgaaf (IAS), Martin Golubitsky (MBI), Snehalata Huzurbazar (SAMSI).

MSRI Staff Present: Arthur Bossé, Heike Friedman

The meeting was called to order at 9:00 AM by David Eisenbud.

All participants introduced themselves.

Updates from DMS: The update on the DMS budget was presented by Michael Vogelius who reported that the budget is currently down to 92% of what it was in 2010 which is a larger decrease than the MPS overall budget, which is down to 95% during the same time period. He stated that an area of the DMS budget where an Institute might be able to get additional funding would be from the OMA (interdisciplinary programs). He described the process by which budget requests are made to Congress and mentioned the FIRST Law which presently is in committee and has provisions about the NSF that could have dramatic implications.

Vogelius made a slide presentation that showed, for example a DMS Funding Rate graph indicating a current rate of 2200-2300 research proposals and 3000 conference proposals. The total NSF budget is $1.3 Billion. Of the Major Award Categories (2013), the largest part of the budget (76%) goes to the Disciplinary Programs (unsolicited and solicited); the Institutes garner 12-13% of the budget. He expressed concern about the Workforce Program which at 9% of the total budget has taken a disproportionate cut. They are working on modifying this and hope to get the Institutes more involved.

A slide presentation by Henry Warchall showed that the Institutes host large numbers of participants who do not receive significant NSF support in other ways: in fact, who had not even applied for NSF funding during the 10 years targeted by the study. Warchall said that the data was too incomplete for publication, but indicated an area of success of the Institutes portfolio.

Evaluating the DMS Institutes Portfolio: Michael Vogelius stated that the STPI has submitted its report on the pilot study that was to suggest how to do a study of Institute outcomes. The report essentially said that this was infeasible. MSRI stated that it had almost no interaction with STPI and felt that much more could have been done. Vogelius mentioned that a different way would have to be found to understand the effect of the DMS' Institutes portfolio.

A discussion on potential society membership surveys concerning Institute activities was led by Henry Warchall who stated the NSF is interested in gathering data to assess the effectiveness of programs and wants the Institutes' input on how to do this. A current idea is to find out how the community feels about the Institutes by surveying the membership of a society (e.g. the AMS) and ask for input through an electronic survey.

Jill Pipher suggested creating the survey collaboratively with the NSF but it was clarified that Federal rules prohibit the NSF from conducting surveys. It was the consensus of the Institutes that there will be a need to conduct the surveys in a neutral environment, protect the integrity of the data and avoid a situation where this becomes a vote for or against an Institute. All agreed that there is an art to creating surveys and David Eisenbud suggested using an outside organization to create the survey and random sample. In answer to the question about the outcome of the survey, Henry stated that no one has a good overview of how effective the spending on the Institutes is and conducting the survey would at least determine how the math community perceives the Institutes. He stated that the NSF wants to hear from those who have

visited an Institute as well as those who have not, while collecting as much data as possible to justify the spending of 12-13% of the budget. He concluded that this will be a long range project.

The Institutes Directors were in agreement on the following points:

- The survey should utilize sound methodology to ensure accurate interpretation
- The survey will be taken seriously and needs to have a high standard of validity
- It would be preferable for a survey to include the DMS portfolio of Disciplinary Programs as well
- There is concern about possible bias in the survey exclusively targeting the DMS institutes program

Update on Timeline for current non-competitive renewal proposals: The recent non-competitive proposals have been received and the review panels are being selected. Site visits will be scheduled for Fall 2014. An adjustment to the schedule of recompetitions was presented whose goal was to (partially) equalize the period between recompetitions, and also to keep the 3-year site visits from coming at the same time as the recompetitions. This would lead to two year extensions for one of the two cohorts, through "bridge awards". The required bridge proposals will be less complicated and will not include site visits. This plan will affect Cohort 2 (AIM, IAS and SAMSI). The NSF needs Cohort 2 to agree to this by September 2014. Comments should be sent to NSF via email.

Discussion of participant data and assessing impact of Institute activities: Christopher Stark discussed the final STPI Report and outlined the conclusions:

- Post Docs are the critical link to getting a good story; they remember their experiences vividly.
- Evidence-based decision making is the trend with the Federal Government and obtaining this type of information is important but anecdotal information tends to provide important information.

Henry Warchall stated that the Participant Data survey was not accurate and will not be published. It was compiled from the Institutes Reports 2004-2013.

Request for Institute assistance in publicizing the Mathematical Sciences Incubator activity: Henry Warchall stated that the NSF would like to get the Math community more involved with the NSF through increased engagement. One way to do this would be to co-fund mathematicians from another funding area of the NSF and get them involved in more of the priority areas. The hope is that this will become a new funding driver; currently it is a pilot project. The Institutes are being asked to think about what they might like to see from this pursuit.

Status of the Math Institutes Highlights page: Henry Warchall stated that the NSF needs highlights for the Institutes Highlights page and prefers to see two highlights per year submitted by each Institute. As a follow-up to the Friday MIDS meeting, the Institutes asked for a link from the DMS page to the Highlights page and asked for guidance on how the highlights are used and how they can be better. Henry agreed to follow-up about the link.

Opportunities for support of preparation of White Papers: Henry Warchall reported that DMS would provide additional funding to write a white paper on the "emerging research areas" that are NSF priorities. For example, for workshops (on emerging research areas) already scheduled, the NSF would be happy to receive requests for additional funding to support the writing of a white paper.

The potential dates for the next MIDS meeting (at IPAM): May 1 & 2, 2015 with alternative dates of April 24 & 25 or May 8 & 9 2015. David Eisenbud will poll the Institutes to select the best date.

Development Activity at MSRI: David Eisenbud provided a history of MSRI's fundraising efforts which began in 1986 with the International Friends of MSRI and the involvement of the Academic Sponsors. This changed in the mid 1990's when the composition of the Board of Trustees changed to include other stakeholders. Heike Friedman, Director of Development at MSRI presented about the various development efforts currently in place at MSRI. She explained that the key to development was building relationships. She stated that as a best practice, an organization's Board should be the centerpiece of a good development effort. The pursuing discussion by the Institutes focused on the challenges that exist with Development when the Institute is part of a University with its own Office of Development whose goals may be different from that of the Institute.

The meeting was adjourned at 1:00 PM

Action Items:

Fadil Santosa:	Send an email to all institutes containing information about who to contact to give books to Africa, and poll the institutes via email to see if there are any ideas on inexpensive resources to ship books.
Russ Caflisch:	Write a Math Institutes column for SIAM.
Hélène Barcelo:	Send the "Mathematics of Planet Earth (MPE) 2013" report to all Directors.

David Eisenbud: Send an email to the Directors polling them about the date for the next meeting; send Warchall's slides; send minutes.

AIM, IAS and SAMSI: Agree to the adjustments to the proposed NSF schedules for non-competitive proposals by September 2014. Comments should be sent to NSF via email.

Henry Warchall: Create a link from the DMS page to the Highlights page.

Appendix 2: Publication List (Section L)

Research in Industrial Projects for Students (RIPS) 2013 (RIPS2013)

Bernstein, Daniel, Mathematics, Davidson College

Unimodular binary hierarchical models (with Seth Sullivant). ArXiv: 1502.06131. Submitted to Journal of Combinatorial Theory, Series B

Bounds on the expected size of the maximum agreement subtree (with Lam Ho, Colby Long, Mike Steel, Katherine St. John, and Seth Sullivant) Arxiv: 1411.7338. Submitted to SIAM Journal of Discrete Math

Graduate Summer School: Computer Vision (GSS2013)

Arar, Murat, Electrical Engineering, École Polytechnique Fédérale de Lausanne (EPFL)

Robust Gaze Estimation Based on Adaptive Fusion of Multiple Cameras, N.M. Arar, H. Gao, and J.-P. Thiran, 11th IEEE International Conference on Automatic Face and Gesture Recognition (FG'15), Slovenia, May 4-8, 2015.

Towards Convenient Calibration for Cross-Ratio based Gaze Estimation, N.M. Arar, H. Gao, and J.-P. Thiran, IEEE Winter Conference on Applications of Computer Vision (WACV'15), Waikoloa Beach, Hawaii, USA, January 6-9, 2015

Multiple Local Curvature Gabor Binary Patterns for Facial Action Recognition, A. Yuce, N. M. Arar and J.-P. Thiran, 4th International Workshop on Human Behavior Understanding, in conjunction with ACM Multimedia (ACM MM'13), Barcelona, Spain, 2013.

Bergbauer, Julia, Computer Science, Technische Universtitat München

Skeleton-based recognition of shapes in images via longest path matching (G. Bal, J. Diebold, E. W. Chambers, E. Gasparovic, R. Hu, K. Leonard, M. Shaker, C. Wenk), In Research in Shape Modeling, Springer, Accepted, 2014. (To appear)

Interactive Multi-label Segmentation of RGB-D Images (Julia Diebold, Nikolaus Demmel, Caner Hazirbas, Michael Möller, Daniel Cremers), In Scale Space and Variational Methods in Computer Vision (SSVM), 2015. (To appear)

The Role of Diffusion in Figure Hunt Games (Julia Diebold, Sibel Tari, Daniel Cremers), In Journal of Mathematical Imaging and Vision, Springer, volume 52, 2015, p. 108-123

Birdal, Tolga, Computer Aided Medical Procedures (CAMP), Technical University of Muni

U. Şimşekli, T. Birdal, *A Unified Probabilistic Framework for Robust Decoding Of Linear Barcodes*, IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), Brisbane, Australia, 2015

Biswas, Sujoy Kumar, Electrical Engineering, University of California, Santa Cruz (UC Sant

Sujoy Kumar Biswas and Peyman Milanfar: Laplacial Object: One-shot Object Detection by Locality Preserving Projection, 2014 IEEE International Conference on Image Processing (ICIP), 2014

Sujoy Biswas Kumar and Peyman Milanfar, One Shot Detection with Laplacian Object and Fast Matrix Cosine Similarity, *IEEE Trans. on Pattern Analysis and Machine Intelligence.*

Chu, Gregory, Radiological Sciences, University of California, Los Angeles (UCLA)

Chu GH, Lo P, Ramakrishna B, Kim HJ, Morris D, Goldin JG, Brown MS. Bone tumor segmentation on bone scans using context information and random forests. LNCS Vol 8673, pp 601-608. MICCAI, 2014.

Corso, Jason, SUNY Buffalo

S. Kumar, V. Dhiman, and J. J. Corso. Learning compositional sparse models of bimodal percepts. In Proceedings of AAAI Conference on Artificial Intelligence, 2014.

R. Xu, C. Xiong, W. Chen, and J. J. Corso. Jointly modeling deep video and compositional text to bridge vision and language in a unified framework. In Proceedings of AAAI Conference on Artificial Intelligence, 2015.

C. Xu, S.-H. Hsieh, C. Xiong, and J. J. Corso. Can humans fly? Action understanding with multiple classes of actors. In Proceedings of IEEE Conference on Computer Vision and Pattern Recognition, 2015.

De Franchis, Carlo, Mathematics, École Normale Supérieure de Cachan

On Stereo-Rectification of Pushbroom Images, Carlo de Franchis, Enric Meinhardt- Llopis, Julien Michel, Jean-Michel Morel, Gabriele Facciolo. ICIP 2014.

An automatic and modular stereo pipeline for pushbroom images, Carlo de Franchis, Enric Meinhardt-Llopis, Julien Michel, Jean-Michel Morel, Gabriele Facciolo. ISPRS Annals, 2014

Automatic sensor orientation refinement of Pléiades stereo images, Carlo de Franchis, Enric Meinhardt-Llopis, Julien Michel, Jean-Michel Morel, Gabriele Facciolo. IGARSS 2014.

Fleishman, Greg, Bioengineering, University of California, Los Angeles (UCLA)

A transformation similarity constraint for groupwise nonlinear registration in longitudinal neuroimaging studies GM Fleishman, BA Gutman, PT Fletcher, P Thompson SPIE Medical Imaging, 94130X-94130X-12

Simultaneous Longitudinal Registration with Group-wise Similarity Prior Greg M. Fleishman, Boris A. Gutman, P. Thomas Fletcher, and Paul M. Thompson, IPMI 2015

Gan, Lin, Computer Science, Illinois Institute of Technology

Lin Gan, Gady Agam; Regularized image registration with line search optimization, Proc. SPIE 9401, Computational Imaging XIII, 94010E (March 12, 2015); doi:10.1117/12.2083424

Lin Gan, Gady Agam; Piecewise nonlinear image registration using DCT basis functions, Proc. SPIE 9413, Medical Imaging 2015: Image Processing, 94133A (20 March 2015)

Gu, David, SUNY Stony Brook

Zhengyu Su, Yalin Wang, Rui Shi, Wei Zeng, Jian Sun, Feng Luo and Xianfeng Gu, Optimal Mass Transport for Shape Matching and Comparison, IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI), 2015

Xianfeng Gu, Feng Luo, Jian Sun and Shing-Tung Yau, Variational Principles for Minkowski Type Problems, Discrete Optimal Transport, and Discrete Monge- Ampere Equations, Asian Journal of Mathematics (AJM), 2015

Min Zhang, Ren Guo, Wei Zeng, Feng Luo, Shing-Tung Yau and Xianfeng Gu, The Unified Discrete Surface Ricci Flow, Graphics and Models 76(5), 321-339.

Ivanov Bonev, Boyan, Statistics, University of California, Los Angeles (UCLA)

A Fast and Simple Algorithm for Producing Candidate Regions European Conference on Computer Vision (ECCV) Zürich, Switzerland, 6th-12th September, 2014

Lee, Hon Leung, Mathematics, University of Washington

Dmitriy Drusvyatskiy, Hon-Leung Lee, Rekha R. Thomas, Counting real critical points of the distance to spectral matrix sets, arXiv:1502.02074

Sameer Agarwal, Hon-leung Lee, Bernd Sturmfels, Rekha R. Thomas, Certifying the Existence of Epipolar Matrices, arXiv:1407.5367

Li, Hongfeng, School of Mathematics and Statistics, Huazhong (Central China) University

Hong Li, Hongfeng Li, Yantao Wei, Yuanyan Tang, Qiong Wang. Sparse-based neural response for image classification, Neurocomputing, vol. 144, pp. 198-207, 2014.

Mao, Junhua, Department of Electronic Engineering & Information Science, University of

Junhua Mao, Wei Xu, Yi Yang, Jiang Wang, Zhiheng Huang, Alan Yuille; Deep Captioning with Multimodal Recurrent Neural Networks (m-RNN), arXiv:1412.6632

Miksik, Ondrej, Brookes Vision Group, Oxford Brookes University

Miksik O., Vineet V., Lidegaard M., Prasaath R., Nießner M., Golodetz S., Hicks S.L., Perez P., Izadi S. and Torr P.H.S.; The Semantic Paintbrush: Interactive 3D Mapping and Recognition in Large Outdoor Spaces, in Proceedings of the 33nd annual ACM conference on Human factors in computing systems (CHI) 2015, Seoul, South Korea

Vineet V., Miksik O., Lidegaard M., Nießner M., Golodetz S., Prisacariu V.A., Kähler O., Murray D.W., Izadi S., Perez P. and Torr P.H.S.; Incremental Dense Semantic Stereo Fusion for Large-Scale Semantic Scene Reconstruction, in Proceedings of the IEEE International Conference on Robotics and Automation (ICRA) 2015, Seattle, USA

Miksik O., Vineet V., Perez P. and Torr P.H.S.; Distributed Non-Convex ADMM-inference in Large-scale Random Fields, in Proceedings of the British Machine Vision Conference (BMVC) 2014, Nottingham, UK

Ntouskos, Valsamis, Department of Computer, Control and Management Engineering "A

F. Natola, V. Ntouskos, F. Pirri. Collaborative Activities Understanding from 3D Data; in Doctoral Consortium on Pattern Recognition Applications and Methods (DCPRAM), 2015 (Best PhD student award)

B. Cafaro, F. Pirri, M. Ruiz, V. Ntouskos, I. Azimi. Point Cloud Structural Parts Extraction based on Segmentation Energy Minimization. In International Conference on Computer Graphics Theory and Applications (GRAPP), 2015

E. Potapova, V. Ntouskos, A. Weiss, M. Zillich, M. Vincze, F. Pirri. A pilot study on eye- tracking in 3D search tasks. In Proceedings of the First International Workshop on Solutions for Automatic Gaze Data Analysis (SAGA), 2013

Premachandran, Vittal, School of Computer Engineering, Nanyang Technological University

Vittal Premachandran, Daniel Tarlow and Dhruv Batra; Empirical Minimum Bayes Risk Prediction: How to extract an extra few % performance from vision models with just three more parameters, IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2014, Columbus, Ohio

Qiu, Weichao, Statistics, University of California, Los Angeles (UCLA)

Weichao Qiu, Xinggang Wang, Xiang Bai, Alan Yuille, and Zhuowen Tu, "Scale-Space SIFT Flow", Winter Conference on Applications of Computer Vision (WACV), 2014

Rogez, Gregory, Computer Science, University of Zaragoza

Grégory Rogez, Maryam Khademi, James Steven Supancic III, J. M. M. Montiel, Deva Ramanan: 3D Hand Pose Detection in Egocentric RGB-D Images. ECCV Workshops (1) 2014: 356-371

Grégory Rogez, James Steven Supancic III, Deva Ramanan: Egocentric Pose Recognition in Four Lines of Code. CoRR abs/1412.0060 (2014)

Todorovic, Sinisa, Oregon State University

S. Todorovic, ``Human activities as stochastic Kronecker graphs,'' in Proc. 12th European Conference on Computer Vision (ECCV), Florence, Italy, 2012

M. Amer, D. Xie, M. Zhao, S. Todorovic, and S.-C. Zhu, ``Cost-sensitive top- down/bottom-up inference for multiscale activity recognition,'' in Proc. 12th European Conference on Computer Vision (ECCV), Florence, Italy, 2012

Wang, Ching-Wei, Biomedical Engineering, National Taiwan University of Science and Technology

Wang C.-W., Huang C.-T., Hsieh, M.-C., Li C.H., Chang S.W., Li W.C., Vandaele R, Maree R., Jodogne S., Geurts P., Chen C., Zheng G., Chu C., Mirzaalian H., Hamarneh G., Vrtovec T., Ibragimov B.; Evaluation and Comparison of Anatomical Landmark Detection Methods for Cephalometric X-Ray Images: A Grand Challenge, IEEE Transactions on Medical Imaging, 2015 (in press)

Wang C.-W., Ka S.-M. and Chen, A. (2014) Robust image registration of biological microscopic images, Scientific Reports 4: 6050 (SCI, JCR 2013 (5/55) in MULTIDISCIPLINARY SCIENCES, IF=5.078)

Wang C.-W.**,** Hunter A., Gravill, N. and Matusiewicz, S. (2014) Unconstrained Video Monitoring of Breathing Behaviour and Application to Diagnosis of Sleep Apnoea, IEEE Transactions on Biomedical Engineering 61(2) 396-404 **(**SCI, JCR 2012 (26/79) in ENGINEERING, BIOMEDICAL, IF=2.348)

Yu, Lap Fai, Computer Science, University of California, Los Angeles (UCLA)

Noah Duncan, Lap-Fai Yu, Sai-Kit Yeung, Demetri Terzopoulos, Zoomorphic Design. ACM Transactions on Graphics (Proceeding of SIGGRAPH 2015)

Lap-Fai Yu, Sai-Kit Yeung, Demetri Terzopoulos, The Clutterpalette: An Interactive Tool for Detailing Indoor Scenes., IEEE Transactions on Visualization and Computer Graphics (TVCG), 2015

Zhang, Jian-Zhou, College of Computer, Sichuan University

Statistical model and applications of compressed sensing. Computer Engineering and Applications. 2014, 50(21): 218-223 (Chinese)

Zhu, Yu, Department of Statistics, University of California, Los Angeles (UCLA)

Single Image Super-resolution using Deformable Patches, CVPR2014

Modeling Deformable Gradient Compositions for Single-Image Super- resolution, CVPR2015

Materials for a Sustainable Energy Future (MSE2013)

Draxl, Claudia, Humboldt-Universität

L. M. Ghiringhelli, J. Vybiral, S. V. Levchenko, C. Draxl, and M. Scheffler, Phys. Rev. Lett. 114, 105503 (2015).

Fehribach, Joseph, bach@math.wpi.edu, Worcester Polytechnic Institute

Fehribach, Matrices and their Kirchhoff graphs, Ars Math. Contemp. 9 (2015), 125–144.

Henkelman, Graeme, Department of Chemistry, University of Texas at Austin

P. Xiao and Q. Wu and G. Henkelman, Basin constrained? -dimer method for saddle point finding, J. Chem. Phys. 141, 164111 (2014).

J. Duncan, Q. Wu, K. Promislow, and G. Henkelman, Biased gradient squared descent saddle point finding method, J. Chem. Phys. 140, 194102 (2014).

P. Xiao, D. Sheppard, J. Rogal, and G. Henkelman, Solid-state dimer method for calculating solid-solid phase transitions, J. Chem. Phys. 140, 174104 (2014).

Ismail-Beigi, Sohrab, Yale University

Matthew S. J. Marshall, Andrei Malashevich, Ankit S. Disa, Myung-Geun Han, Hanghui Chen, Yimei Zhu, Sohrab Ismail-Beigi, Frederick J. Walker, and Charles H. Ahn, Conduction at a Ferroelectric Interface, Physical Review Applied 2, 051001 (2014)

Katre, Ankita, Department of Atomistic Modelling and Simulation, Interdisciplinary Cent

A. Katre, A. Togo, I. Tanaka, G. K. H. Madsen, Journal of Applied Physics, 117, 045102 (2015)

Kolleck, Anton, Applied Functional Analysis, Technische Universität Berlin

On some aspects of approximation of ridge functions (joint with J. Vybíral), to appear in J. Appr. Theory. arXiv: 1406.1747

Mourad, Nahia, Mathematics, Ecole Nationale Des Ponts et Chaussees (LAMI)

E. Cancès and N. Mourad, A mathematical perspective on density functional perturbation theory, Nonlinearity 27 (2014), 1999-2033.

Ozolins, Vidvuds, Materials Science and Eng, University of California, Los Angeles (UCLA)

Farzin Barekat, Ke Yin, Russel Caflisch, Stanley Osher, Rongjie Lai, and Vidvuds Ozolinš, " Compressed Wannier modes found from an L1 regularized energy functional," preprint, arXiv: 1403.6883

Fei Zhou, Weston Nielson, Yi Xia, and Vidvuds Ozolinš, "Lattice Anharmonicity and Thermal Conductivity from Compressive Sensing of First-Principles Calculations," Physical Review Letters 113, 185501 (2014). URL: http://dx.doi.org/10.1103/PhysRevLett.11

V. Ozolins, R. Lai, R. E. Caflisch, and S. Osher, "Compressed plane waves yield a compactly supported multiresolution basis for the Laplace operator," Proceedings of the National Academy of Sciences of the United States of America (PNAS) 111 (5), 1691

Promislow, Keith, Mathematics, Michigan State University

J. Duncan, Q. Wu, K. Promislow, G. Henkelman, Biased gradient-squared descent saddle point finding method, Journal of Chemical Physics, 140 194102 (2014) http://dx.doi.org/10.1063/1.4875477

Promislow, K.; Yang, L, Existence of Compressible Bilayers in the Functionalized Cahn-Hilliard Equation, SIAM Journal on Applied Dynamical Systems, Volume: 13 (2014), Issue 2, p. 629-657

Protas, Bartosz, McMaster University

A. Gully, H. Liu, S. Srinivasan, A. K. Sethurajan, S. Schougaard, and B. Protas, "Effective Transport Properties of Porous Electrochemical Materials - A Homogenization Approach", Journal of The Electrochemical Society 161, (8) E3066-E3077 (2014)

J. Foster, A. Gully, H. Liu, S. Krachkovskiy, Y. Wu, S. B. Schougaard, M. Jiang, G. Goward, G. A. Botton, B. Protas, "A Homogenization Study of the Effects of Cycling on the Electronic Conductivity of Commercial Lithium-ion Battery Cathodes", The Journal of Physical Chemistry – C, 2015, 119 (22), pp 12199–12208

Schneider, Bill, University of Notre Dame

S. Seo, M. Quiroz-Guzman, M. A. DeSilva, T. B. Lee, Y. Huang, B. F. Goodrich, W. F. Schneider, and J. F. Brennecke, “Chemically Tunable Ionic Liquids with Aprotic Heterocyclic Anion (AHA) for CO2 Capture,” J. Phys. Chem. B, 2014, 118, 5740-5751.

T. R. Gohndrone, T. B. Lee, M. A. DaSilva, M. Quiroz-Guzman, W. F. Schneider, and J. F. Brennecke, “Competing Cation- and Anion-CO2 Reactions in Azolide Ionic Liquids,” ChemSusChem, 2014, 7, 1970-1975.

Stern, Robin, Atomistic Modelling and Simulation, Interdisciplinary Centre for Advanced

Bhattacharya S, Gunda NS, Stern R, Jacobs S, Chmielowski R, Dennler G, Madsen GK; Achieving optimum carrier concentrations in p-doped SnS thermoelectrics, Phys Chem Chemical Physics, 2015 Apr 14;17(14):9161-6.

Suthar, Bharatkumar, Energy Environment and Chemical Engineering, Washington Unive

B. Suthar, Paul W.C. Northrop, R. D. Braatz and Venkat R. Subramanian, "Optimal Charging Profiles with Minimal Intercalation-Induced Stresses for Lithium-Ion Batteries Using Reformulated Pseudo 2-Dimensional Models", J. Electrochem. Soc., 161(11), F3144-F

Vybiral, Jan, Department of Mathematics, Technische Universität Berlin

Big data of materials science - Critical role of the descriptor, with L. M. Ghiringhelli, S. V. Levchenko, C. Draxl, and M. Scheffler

Sparse Proteomics Analysis - a compressed sensing-based approach for feature selection and classification of high-dimensional proteomics mass spectrometry data, with Tim OF Conrad; Martin Genzel; Nada Cvetkovic; Niklas Wulkow; Gitta Kutyniok; Christof Schutte

On some aspects of approximation of ridge functions, with A. Kolleck; Journal of Approximation Theory, Volume 194, June 2015, Pages 35–61

Weber, Adam, Lawrence Berkeley Laboratory

Jeffrey T. Gostick and Adam Z. Weber, 'Resistor-Network Modeling of Ionic Conduction in Polymer Electrolytes,' Electrochimica Acta, (2015). Doi: 10.1016/j.electacta.2015.03.126.

Wei, Su-Huai, National Renewable Energy Laboratory

S. Chen, A. Walsh, X. G. Gong, S.-H. Wei; Classification of lattice defects in the kesterite Cu2ZnSnS4 and Cu2ZnSnSe4 earth- abundant solar cell absorbers, Adv. Materials 25, 1522 (2013).

C. Wang, S. Chen, J.-H. Yang, L. Lang, H. J. Xiang, X.-G. Gong, A. Walsh, and S.-H. Wei; Design of I2-II-IV-VI4 semiconductors through element-substitution: The thermodynamic stability limit and chemical trend, Chem. Mater. 26, 3411 (2014).

W.-J. Yin, J.-H. Yang, Halide perovskite materials for solar cells: A theoretical review

J. Kang, Y. Yan, and S.-H. Wei, J. Mater. Chem. A 3, 8926 (2015).

Wu, Qiliang, Mathematics, University of Minnesota, Twin Cities

J. Duncan, Q. Wu, K. Promislow, G. Henkelman, Biased gradient-squared descent saddle point finding method. J. Chem. Phys. 140, 194102(2014)

P. Xiao, Q. Wu, G. Henkelman Basin Constrained k-Dimer Method for Saddle Point Finding. J. Chem. Phys. 141, 164111(2014)

Xiao, Penghao, Chemistry, University of Texas at Austin

P. Xiao, Q. Wu, and G. Henkelman. Basin Constrained k-Dimer Method for Saddle Point Finding, J. Chem. Phys., 141(16):164111, 2014

Y. Zeng, P. Xiao, and G. Henkelman. Unification of algorithms for minimum mode optimization, J. Chem. Phys., 140(4):044115, 2014

Zeng, Yi, Mathematics, Massachusetts Institute of Technology

Zeng, Yi, Penghao Xiao, and Graeme Henkelman. "Unification of algorithms for minimum mode optimization." The Journal of Chemical Physics 140.4 (2014): 044115.

Algebraic Techniques for Combinatorial and Computational Geometry CCG2014)

Ball, Simeon, Matematica Aplicada IV, Polytechnical University of Cataluña (Barcelona)

A finite version of the Kakeya problem (with Aart Blokhuis and Diego Domenzain). arXiv: 1503.06639

Barany, Imre, Renyi Institute of Mathematics

Small subset sums, submitted to Lin Alg Appl. (2015) (with G. Ambrus, V. Grinberg). arXiv: 1502.04027

Bukh, Boris, Carnegie-Mellon University

Random algebraic construction of extremal graphs. arXiv: 1409.3856

Butler, Steve, Department of Mathematics, Iowa State University

S. Butler, Using twins and scaling to construct cospectral graphs for the normalized Laplacian, Electronic Journal of Linear Algebra. arXiv: 1409.8329

S. Butler, J. Ekstrand, S. Osborne, Tiling retangular strips, preprint

B. Bi, S. Butler, S. De Graaf, E. Doebel, Knight's tours on boards with odd dimensions, to appear in Involve.

Carbery, Anthony, University of Edinburgh

Colouring Multijoints, joint with S.I. Valdimarsson, Discr. Comp. Geom. 52 (2014), p. 730-742

Cardinal, Jean, Computer Science, Université Libre de Bruxelles

General Position Subsets and Independent Hyperplanes in d-Space, with Csaba D. Tóth and David R. Wood, Arxiv: 1410.3637

Chen, Xianghong, Mathematics, University of Wisconsin-Madison

Sets of Salem type and sharpness of the L2-Fourier restriction theorem, to appear in Trans. Amer.Math.Soc. ArXiv: 1305.5584

Chitsaz, Hamidreza, Computer Science, Wayne State University

Reza Iraji, Hamidreza Chitsaz. NUROA: A Numerical Roadmap Algorithm, Proceedings of the 53rd IEEE Conference on Decision and Control (CDC), pp 5359 - 5366 (arXiv:1403.5384 [cs.RO]), December 2014

de Zeeuw, Frank, École Polytechnique Fédérale de Lausanne (EPFL)

Jozsef Solymosi and Frank de Zeeuw, Incidence bounds for complex algebraic curves on Cartesian products, 2015. arXiv:1502.05304

Orit Raz, Micha Sharir, and Frank de Zeeuw, Polynomials vanishing on Cartesian products: The Elekes-Szabó Theorem revisited, accepted to SoCG 2015.

Ben Lund, Adam Sheffer, and Frank de Zeeuw, Bisector energy and few distinct distances, 2014, accepted to SoCG 2015.

Dvir, Zeev, Princeton University

On the number of rich lines in truly high dimensional sets, arXiv: 1412.1060

Ellenberg, Jordan, Mathematics, University of Wisconsin-Madison

Furstenberg sets and Furstenberg schemes over finite fields (with Daniel Erman). arXiv: 1502.03736

Gabrielov, Andrei, Purdue University

Basu, S., Gabrielov, A., Vorobjov, N., Triangulations of monotone families I: Two- dimensional families. arXiv:1402.0460, 2014.

Eremenko, A., Gabrielov, A., Tarasov, V., Metrics with conic singularities and spherical polygons, arXiv:1405.1738, 2014.

Gopi, Sivakanth, Princeton University

Dvir, Zeev, and Sivakanth Gopi. "On the number of rich lines in truly high dimensional sets." arXiv preprint arXiv:1412.1060 (2014).

Habliscek, Martin, University of Wisconsin-Madison

On the joints problem with multiplicities. arXiv: 1408.5791

Hanson, Brandon, Mathematics, University of Toronto

Brandon Hanson, Ben Lund, Oliver Roche-Newton, On distinct perpendicular bisectors and pinned distances in finite fields. arXiv: 1412.1611

Character sums over Bohr sets. **arXiv:** 1409.7924

Hu, Jerry, Department of Math and Computer Science, University of Houston-Victoria

Pairwise relative primality of positive integers and independent sets of graphs. arVix: 1406.3113

Jiang, Zilin, Mathematical Sciences, Carnegie-Mellon University

A Slight Improvement to the Colored Bárány's Theorem. Electronic Journal of Combinatorics, Vol. 21 (2014), Paper #P4.39

Klug, Michael, Mathematics, University of Vermont

Numerical calculation of three-point branched covers of the complex projective line, LMS Journal of Computation and Math, vol. 17 (2014), 379-430.

Kolpakov, Aleksandr, Department of Mathematics, Vanderbilt University

A. Kolpakov, L. Slavich, "Symmetries of hyperbolic 4-manifolds", arXiv: 1409.1910

Konyagin, Sergei, Russian Academy of Sciences

K. Ford, B. Green, S. Konyagin, T. Tao, Long gaps between consecutive primes, ArXiv:1408.4505

K. Ford, B. Green, S. Konyagin, J. Maynard, T. Tao, Large gaps between primes, ArXiv:1412.5029

S. Konyagin, I.D. Shkredov, On sum sets of sets having small product set, ArXiv:1503.05771, accepted by Proceedings of the Steklov Institute of Mathematics

Laba, Izabella, University of British Columbia

Quantitative visibility estimates for unrectifiable sets in the plane, with M. Bond and J. Zahl, to appear in Transactions of the AMS , arXiv: 1306.5469

Lund, Benjamin, Computer Science, Rutgers University

On distinct perpendicular bisectors on pinned distances over finite fields, with B. Hanson and O. Roche-Newton. Accepted to Finite Fields and Their Applications.

Bisector Energy and Few Distinct Distances, with A. Sheffer and F. de Zeeuw. SoCG 2015.

Elementary methods for incidence problems in finite fields, with J. Cilleruelo, A. Iosevich, O. Roche-Newton, M. Rudnev. arXiv: 1407.2397

Mattila, Pertti, University of Helsinki

K. J. Falconer and P. Mattila, Strong Marstrand theorems and dimensions of sets formed by subsets of hyperplanes, arXiv:1503.01284

Orponen, Tuomas, University of Edinburgh

A discretised projection theorem in the plane, arXiv:1407.6543

Patel, Rehana, Mathematics, Franklin W. Olin College of Engineering

A classification of orbits admitting a unique invariant measures (with Nathanael Ackerman, Cameron Freer and Aleksandra Kwiatkowska), see http://arxiv.org/abs/1412.2735

Raz, Orit, Computer Science, Tel Aviv University

Polynomials vanishing on Cartesian products: The Elekes-Szabó Theorem revisited. arXiv: 1504.05012

Unit-area triangles: Theme and variation, arXiv: 1501.00379

Sets with few distinct distances do not have heavy lines, with Oliver Roche-Newton and Micha Sharir, arXiv: 1410.1654

Riener, Cordian, Aalto Science Institute, Aalto University

On the isotypic decomposition of cohomology modules of symmetric semi-algebraic sets: polynomial bounds on multiplicities (with S. Basu) arXiv:1503.00138

Roche-Newton, Oliver, Mathematics, University of Reading

Sets with few distinct distances do not have heavy lines (with Orit Raz and Micha Sharir), arXiv: 1410.1654

A bound on the multiplicative energy of a sum set and extremal sum-product problems (with Dmitry Zhelezov), arXiv: 1410.1156

On distinct perpendicular bisectors and pinned distances in finite fields (with Brandon Hanson and Ben Lund)

Rubin, Natan, Mathematics and Computer Science, Jussieu Institute of Mathematics/Par

Beyond the Richter-Thomassen Conjecture, J. Pach, N. Rubin and G. Tardos, arXiv: 1412.1611

Sharir, Micha, Tel Aviv University

O. E. Raz, M. Sharir and F. de Zeeuw, Polynomials vanishing on Cartesian products: The Elekes-Szabó Theorem revisited. arXiv: 1504.05012

O. E. Raz, O. Roche-Newton and M. Sharir, Sets with few distinct distances do not have heavy lines, arXiv: 1410.1654

M. Sharir and N. Solomon, Incidences between points and lines on a two-dimensional variety, arXiv: 1502.01670

Shkredov, Ilya, Steklov Mathematical Institute

Energies and structure of additive sets, Electronic Journal of Combinatorics, 21(3) (2014), #P3.44, 1–53.

On sum sets of sets, having small product sets, (with S.V. Konyagin), Transactions of Steklov Mathematical Institute, Vol. 3, (2015), accepted.

Structural theorems in Additive Combinatorics, Uspekhi Mat. Nauk, v.70 421:1 (2015), 46–99; English transl. Russian Math. Surveys 70:1 (2015) 123–178.

Slavov, Kaloyan, Mathematics, American University in Bulgaria

Variants of the Kakeya problem over an algebraically closed field, Archiv der Mathematik, 103 (2014), no. 3, 267--277, arXiv:1410.4328

An algebraic geometry version of the Kakeya problem, accepted in *Finite Fields and Their Applications,* arXiv: 1410.3701

Stovall, Betsy, University of Wisconsin-Madison

Linear and bilinear restriction to certain rotationally symmetric hypersurfaces, Preprint, Submitted.

Swanepoel, Konrad, Mathematics, London School of Economics and Political Science

Janos Pach, Konrad Swanepoel, Double-normal pairs in space, Mathematika 61 (2015), 259--272.

Janos Pach, Konrad Swanepoel, Double-normal pairs in the plane and on the sphere. Beiträge zur Algebra und Geometrie, in press.

Tran, Manh Tuan, Mathematics, Freie Universität Berlin

A Density Turán Theorem, joint with L. Narins, http://arxiv.org/abs/1503.03441

Wood, David, Monash University

J. Cardinal, C. D. Tóth, D. R. Wood. General position subsets and independent hyperplanes in d-space, 2014. http://arxiv.org/abs/1410.3637

Zahl, Joshua, Mathematics, Massachusetts Institute of Technology

Point-curve incidences in the complex plane, arXiv: 1502.07003

A semi-algebraic version of Zarankiewicz's problem, arXiv: 1407.5705

Zhang, Ruixiang, Mathematics, Princeton University

On configurations where the Loomis-Whitney inequality is nearly sharp and applications to the Furstenberg set problem, Mathematika (2013): 1-17

Polynomials with dense zero sets and discrete models of the Kakeya conjecture and the Furstenberg set problem, arXiv:1403.1352

Zhelezov, Dmitrii, Chalmers University of Technology

A bound on the multiplicative energy of a sum set and extremal sum-product problems (with Oliver Roche-Newton), arXiv: 1410.1156, to appear in Moscow Journal Number Theory.

On sets with small additive doubling in product sets, arXiv: 1502.0370