

**Institute for Computational and Experimental Research in Mathematics**

# **Annual Report**

## **August 1, 2011 – July 31, 2012**

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## Letter from the Director



I am happy to report that ICERM's first year was productive and successful.

As of August 2011, ICERM has a full time staff of seven, and we are now seeking additional part or full time IT assistance in programming and web site maintenance. The management staff includes two half time Deputy Directors and several Associate Directors charged with special projects.

On August 1, we held our first of two Topical Workshops prior to the start of the fall program in September. These relatively small (40) workshops afforded us a necessary opportunity to fine-tune our processes (and provided Brown the impetus to replace the roof over ICERM's lecture hall). The P vs NP workshop brought together algebraic geometers and computer scientists: scribes produced a comprehensive report, posted on ArXiv and included in an appendix.

ICERM co-sponsored the AWM: 40 Years and Counting Conference in September 2011. ICERM staff handled all of the pre-conference planning and on-site logistics for an event that involved nearly 350 people and five additional co-sponsors and exhibitors. ICERM program and IT staff spent the weekend on duty at Brown campus helping with registration and the A/V needs of two auditoriums and twelve lecture sessions running simultaneously.

The fall program in Kinetic Theory and Computation (KTC) brought together theorists and computational experts on issues ranging from classical analysis of Vlasov and Boltzmann models to the feasibility problems of computational quantum modeling. One of the goals for an ICERM semester program is the creation of a cohort of early career researchers (graduate students and postdocs) who will become and remain professionally connected to senior researchers in the field, and to one another. Every student or postdoc is matched to a mentor in advance and there are special seminars and professional training round table discussions offered regularly during the program. In the spring program, ICERM took charge of the NSF Ethical Training requirement by incorporating a (mandatory) session into the regular professional round table seminar series.

ICERM fully supported (by stipend) five semester postdocs for the fall program as well as one year-long salaried postdoc. The application process for both semester programs was carried out simultaneously. Several of the top ranked postdocs for KTC were unable to be released from other obligations or defer acceptance to other programs and postdoctoral appointments in order to come to ICERM. It appears that this will be a factor in any semester program where the majority of postdoc applicants are searching for postdoctoral grant-supported fellowships, as opposed to university-supported positions. (This feature was less of a factor in our spring semester program in Complex and Arithmetic Dynamics (CAD).) In addition, we were surprised to learn that two of the five semester postdocs had no jobs in place after December 2011. Fortunately, both of them found continuing support for the spring semester, and one secured a subsequent position. We are following up with them, and with all postdocs, on a regular basis.

Some follow-up comments from young researchers in KTC indicate that the program had a high impact on the direction of their research and created new collaborations. One research award has already been made to three researchers based on work that grew out of their participation in KTC in the fall.

A semester program typically has three international conferences/workshops, each of which is preceded by series of tutorials. The conferences were well attended in the fall, and even larger during the spring. We added poster sessions as a regular feature of our workshops beginning in the spring semester. Although we intended these sessions primarily for graduate student presenters, we found that many other participants who were not invited speakers were happy to share their research results in poster form. We also invited AMS and Springer to exhibit books (and then donate them to ICERM) at our workshops, and these have become an important mid week addition to the conferences.

During the fall program the Directors discovered that direct monitoring of organizing increased activity during the non-workshop weeks. We followed up by working with the organizers of the subsequent semester programs in order to step up the level of activity during the non-workshop weeks.

In January, we launched the VI-MSS pilot program for SAVI with a workshop in cryptography hosted by ISI, Kolkata. Thirteen experts from academia and industry traveled to ISI, most supported by ICERM some self-supported, for a three-day intensive workshop focusing on mathematical and statistical methods in cryptography. Jeff Hoffstein, Brown and ICERM, and Bimal Roy, ISI, were the primary organizers. Two additional workshops in India are planned: one in neural engineering and one in probability (a companion workshop for our fall program). Four Indian visiting scholars are coming to ICERM this fall, supported by India. One will participate in the fall semester program, and the other visitors are starting research collaborations with local faculty. The ICERM VI-MSS grant was awarded in August 2011, but since the Indian funding was not in place until April of 2012 there has been some delay in the application process for visitors to ICERM programs.

The spring CAD program brought together two groups of researchers from arithmetic and from complex dynamics. Four semester postdocs were provided with ICERM stipends and one was a salaried institute postdoc. In all, CAD had a cohort of almost thirty graduate students and postdocs. Several researchers used the HPC resources at ICERM to gather data in support of a conjecture in Arithmetic Dynamics. A computational working group met regularly to develop algorithms and implement them in open source SAGE. In particular, Ben Hutz implemented in SAGE the fundamental cohomological computation behind Thurston rigidity and this inspired a new collaboration between Xavier Buff, Sarah Koch and Adam Epstein. Sarah Koch, Ben Hutz, and Tom Tucker are now preparing an application for a conference/workshop on the computational aspects of algebraic-geometric approaches to Thurston rigidity and McMullen multiplier maps. The impact of the CAD program was high for the graduate students in particular, and at least two reported a dramatic change in research focus and significant improvement in overall productivity.

ICERM hosted several important special lectures. In the fall, Dave Levermore gave a mini-course in “Financial Modeling of Portfolios Containing Risky Assets”. In the spring, John Milnor gave a version of his Abel Prize Lecture, “Spheres”, John Ball spoke on “Smooth topology-preserving approximations of rough domains”, and Xavier Buff, Clay Senior Scholar nominated by ICERM, spoke on “The Prevalence of Chaos”.

We implemented our evaluation process and created pre-event and post-event surveys.

ICERM is in the process of launching its Summer@ICERM undergraduate research program. Fourteen undergraduates will spend eight weeks at ICERM exploring a collection of research problems in geometry and dynamics, under the supervision of Sergei Tabachnikov and Pat Hooper and two graduate student assistants. Ten of the undergraduates are supported by ICERM, and four are self-funded through grants from Brown or Brown faculty. The summer research programs are intended to reflect research themes explored in one of the semester programs of that year. Sarah Koch, a participant in CAD, will be giving a one-week mini-course for the undergraduate group in July.

We co-planned the Institute reception at JMM 2012, with Fadil Santosa, and participated in the Modern Math workshop in October 2011. Jose Blanchet, a co-organizer of the fall Computational Probability program, was the ICERM speaker at this SACNAS event.

Ruth Crane, ICERM Assistant Director, led the development and creation of an Academic Sponsorship plan and a Corporate Sponsorship plan. These plans were only recently launched, but ICERM already has several sponsors in both categories.

The IT team developed and implemented a unique networking portal that facilitates communication and collaboration of visitors within the institute. We anticipate that it will help us track the future research activity of participants who use it. Already, our FaceBook page has seen a great deal of activity, serving as a social link to maintain connections formed at ICERM.

We have engaged in several activities and hosted events that increase the visibility of ICERM and raise awareness of the importance of NSF mathematics institutes in general. In January, we hosted the Providence Foundation, a group including Providence and RI government officials. In January, Jan Hesthaven was an invited speaker at WEF, Davos. In March, we hosted the RI “Governor’s Knowledge Economy” team meeting, led by RI Governor Chafee. We were invited by AMS to present an exhibit about ICERM at CNSF on May 16. Earlier that day, I spoke with both Senators Reed and Whitehouse about the regional and national impact of ICERM and how the NSF Mathematics Institutes play a critical role in innovation and in broadening participation in STEM disciplines nationally.

We are looking ahead to launching the IdeaLab for postdoctoral researchers in summer 2013, and to expanding our efforts to find additional sources of funding for participants and for new activities and events.

Sincerely,

A handwritten signature in dark ink, appearing to read 'JP L' or 'J P L', with a stylized, cursive script.

Jill Pipher  
Director

### Mission

“The mission of the Institute for Computational and Experimental Research in Mathematics (ICERM) is to support and broaden the relationship between mathematics and computation: specifically, to expand the use of computational and experimental methods in mathematics, to support theoretical advances related to computation, and address problems posed by the existence and use of the computer through mathematical tools, research and innovation.”

### Core Programs and Events

ICERM’s scheduled programs and events through June 2012 are as follows:

ICERM Program/Event	Title	Date	Number Attended
Special Event	ICERM provided staff support for AWM’s Anniversary Conference at Brown University: <i>"40 Years and Counting: AWM's Celebration of Women in Mathematics"</i>	September 17-18, 2011	307 (registered)
Topical Workshop	Mathematical Aspects of P versus NP and its Variants	August 1-5, 2011	37
Topical Workshop	Cluster Algebras and Statistical Physics	August 15-19, 2011	38
Semester Program (KTC)	Kinetic Theory: Analysis and Computation (KTC)	Fall 2011: September 7 – Dec. 9	38 (long-term visitors)
Semester Workshop (KTC)	Vlasov Models in Kinetic Theory	September 19-23, 2011	62
Semester Workshop (KTC)	Novel Applications of Kinetic Theory and Computations	October 17-21, 2011	68
Special Event	Modern Math Workshop (at SACNAS): <i>"Monte Carlo Methods for Risk Analysis"</i> , Professor Jose Blanchet	October 26-27, 2011 in San Jose, CA	150 (estimate)
Semester Workshop (KTC)	Boltzmann Models in Kinetic Theory	November 7-11, 2011	65
Special Event	David Levermore’s series of public talks: Modeling Portfolios that Contain Risky Assets I: Risk and Return; Modeling Portfolios that Contain Risky Assets II: Efficient Frontiers for Various Models; Modeling Portfolios that Contain Risky Assets III: Stochastic Models and Optimization	November 2011	35 (average)
Special Event	ICERM provided staff and facilities support for the annual meeting of the “Providence Foundation”	January 11, 2012	125

Topical Workshop	Synchronization-reducing and Communication-reducing Algorithms and Programming models for Large-scale Simulations	January 9-13, 2012	44
VI-MSS Topical Workshop	Mathematical and Statistical Aspects of Cryptography (in Kolkata, India)	January 12-14, 2012	30
Semester Program (CAD)	Complex and Arithmetic Dynamics (CAD)	Spring 2012: January 30 – May 4	56 (long-term visitors)
Semester Workshop (CAD)	Complex and p-adic Dynamics	February 13-17, 2012	89
Special Event	The Brown University Symposium for Undergraduates in the Mathematical Sciences (SUMS): “ <i>Math and Strategy, Competition, and Cooperation</i> ” (co-sponsored by ICERM)	March 10, 2012	120 (pre-registered)
Special Event	ICERM provided facilities for RI Governor Lincoln Chaffee’s “Knowledge Economy” meeting	March 10, 2012	25
Semester Workshop (CAD)	Global Arithmetic Dynamics	March 19-23, 2012	89
Special Event	Special Lecture: “ <i>Spheres</i> ”, Professor John Milnor	April 5, 2012	85
Special Event	Special Lecture: “ <i>Non-derivative optimization: the sound, the fury, and the bottom line</i> ”, Professor Margaret Wright (Lefschetz Center for Dynamical Systems Special Seminar, joint with ICERM)	April 9, 2012	65
Special Event	Special Lecture: “ <i>Smooth topology-preserving approximations of rough domains</i> ”, Professor John Ball (joint with Department of Applied Math)	April 12, 2012	50
Semester Workshop (CAD)	Moduli Spaces Associated to Dynamical Systems	April 16-20, 2012	79
Special Event	Movie screening of “Wolfgang Goebelin: A Mathematician Rediscovered”	April 23, 2012	50

Special Event	ICERM/Clay Mathematics Institute Special Lecture: " <i>The Prevalence of Chaos</i> ", Professor Xavier Buff	May 3, 2012	45
Special Event	ICERM provided staff support and facilities for a STEM to STEAM mini-institute: "Seeing and Making Mathematical Paper Structures" workshop	May 4, 2012	14
Special Event	Hosted annual Mathematics Institute Directors (MIDs) meeting	May 11-12, 2012	19
Special Event	ICERM provided staff and facilities support for Brown University's "Day of Data"	May 18, 2012	90 (estimate)
Special Event	ICERM provided staff and facilities for "Providence Geeks" meeting: talks given by Brown Mathematics Professors Jeffrey Hoffstein and George Karniadakis	May 23, 2012	70 (estimate)
Topical Workshop (outside funding)	ICERM providing staff support for Heterostructured Nanocrystalline Materials	May 30 - June 1, 2012	43
Special Event (AIM funded)	ICERM providing AIM with staff and facilities support for their Research Experiences for Undergraduate Faculty (REUF)	June 4 - June 8, 2012	25
Topical Workshop (outside funding)	ICERM providing staff support for the NSF/CBMS Conference: Finite Element Exterior Calculus (FEEC)	June 11-15, 2012	65
Summer Undergraduate Research Program	Summer@ICERM: Geometry and Dynamics	June 18-August 10, 2012	14 (NSF funded 10)

### **Virtual Institute of Mathematical and Statistical Sciences (VI-MSS)**

ICERM's supplemental proposal for the two-year pilot program "Virtual Institute of Mathematical and Statistical Sciences (VI-MSS)" was awarded in August 2011, creating a partnership that formally connects two US mathematical sciences institutes (ICERM and SAMSI) with several mathematics and statistics institutes in India.

#### **VI-MSS Goals:**

1. Collaborative workshops held in US and/or Indian Institutes
2. Research visits by Indian faculty, postdocs and students to ICERM semester programs and workshops
3. Satellite workshops associated long programs at ICERM held in India
4. Creation of joint online catalog of special lectures, courses, and workshops
5. Graduate/postdoc training event held in India
6. Research visits to India: 1-3 weeks

In May 2012, Professor Govind Menon was hired as Associate Director of Special Projects/VI-MSS. During its first year, VI-MSS has sponsored a joint workshop in Kolkata, India, and is laying the groundwork for research visits and graduate educational activities as funding from the Indo-US Science and Technology Forum, and the Indian Department of Science and Technology gets approved. Two additional workshops are planned in Bangalore in December 2012 and January 2013.

This collaboration will create a thriving "virtual" institute in the mathematical and statistical sciences based on collaboration primarily between the following institutions.

In US:

- Institute for Computational and Experimental Research in Mathematics (ICERM), Providence, RI
- Statistical and Applied Mathematical Sciences Institute (SAMSI), Research Triangle Park, NC

In India:

- Chennai Mathematical Institute (CMI), Chennai
- Indian Institute of Science (IISc), Bangalore
- Institute of Mathematical Sciences (IMSc), Chennai
- Indian Statistical Institute (ISI), Kolkata, Delhi, Bangalore

VI-MSS is also collaborating with International Centre for Theoretical Sciences (ICTS) and Tata Institute of Fundamental Research (TIFR).

A listing of past and upcoming VI-MSS programs appear later in this report.

### Participant Summaries by Program Type

For fiscal year 2011-2012 (August 1, 2011 to May 1, 2012) 399 unique participants were enrolled in two semester long programs and/or nine workshops. Of the 399, 307 received some sort of funding to attend an ICERM program. ICERM actively seeks women and members of underrepresented ethnic groups to participate in its programs as speakers and participants. While most participants choose to report their gender and ethnicity, some choose not to do so. *Please note that the institute's registration and application forms have not collected minority information based on U.S. citizenship.* ICERM will include a citizenship category (self-identified) in its registration and application forms from now on. All data below includes organizers, and is as of May 1, 2012.

### ICERM Funded Participants

			Gender and Ethnicity							Geographical Point of Origin									
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	US - West	Africa	Asia	Canada	Europe	Latin & South America	Oceania
Fall Semester '11	Semester Program	33	8	32	0	0	12	1	21	3	10	9	2	0	1	0	8	0	0
	Workshop 1	56	9	54	0	0	14	1	32	6	14	14	3	0	2	0	15	2	0
	Workshop 2	57	10	55	1	0	16	1	34	5	12	13	6	0	3	2	16	0	0
	Workshop 3	53	15	51	2	0	20	0	39	6	13	10	2	0	4	1	17	0	0
	<b>Total</b>	<b>199</b>	<b>42</b>	<b>192</b>	<b>3</b>	<b>0</b>	<b>62</b>	<b>3</b>	<b>126</b>	<b>20</b>	<b>49</b>	<b>46</b>	<b>13</b>	<b>0</b>	<b>10</b>	<b>3</b>	<b>56</b>	<b>2</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>22%</b>		<b>2%</b>	<b>0%</b>	<b>49%</b>	<b>2%</b>		<b>10%</b>	<b>25%</b>	<b>23%</b>	<b>7%</b>	<b>0%</b>	<b>5%</b>	<b>2%</b>	<b>28%</b>	<b>1%</b>	<b>0%</b>
Spring Semester '12	Semester Program	50	11	46	0	0	9	4	34	9	18	1	5	0	2	0	13	2	0
	Workshop 1	74	15	66	1	0	10	5	47	11	22	3	8	0	6	2	19	3	0
	Workshop 2	71	17	66	0	0	12	4	51	11	26	2	10	0	2	0	15	3	2
	Workshop 3	67	14	59	0	0	10	4	41	14	27	1	5	0	3	0	14	3	0
	<b>Total</b>	<b>262</b>	<b>57</b>	<b>237</b>	<b>1</b>	<b>0</b>	<b>41</b>	<b>17</b>	<b>173</b>	<b>45</b>	<b>93</b>	<b>7</b>	<b>28</b>	<b>0</b>	<b>13</b>	<b>2</b>	<b>61</b>	<b>11</b>	<b>2</b>
	<b>% of # Reporting</b>		<b>24%</b>		<b>1%</b>	<b>0%</b>	<b>24%</b>	<b>10%</b>		<b>17%</b>	<b>35%</b>	<b>3%</b>	<b>11%</b>	<b>0%</b>	<b>5%</b>	<b>1%</b>	<b>23%</b>	<b>4%</b>	<b>1%</b>
Topical '11-'12	Workshop A	27	3	26	0	0	5	1	20	8	9	6	0	0	1	1	2	0	0
	Workshop B	31	6	31	0	0	7	0	18	7	9	1	8	0	1	0	5	0	0
	Workshop C	28	3	23	0	0	2	1	5	5	4	8	8	0	1	0	2	0	0
	<b>Total</b>	<b>86</b>	<b>12</b>	<b>80</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>2</b>	<b>43</b>	<b>20</b>	<b>22</b>	<b>15</b>	<b>16</b>	<b>0</b>	<b>3</b>	<b>1</b>	<b>9</b>	<b>0</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>15%</b>		<b>0%</b>	<b>0%</b>	<b>33%</b>	<b>5%</b>		<b>23%</b>	<b>26%</b>	<b>17%</b>	<b>19%</b>	<b>0%</b>	<b>3%</b>	<b>1%</b>	<b>10%</b>	<b>0%</b>	<b>0%</b>

**All Participants (ICERM funded and Non-ICERM funded)**

			<i>Gender and Ethnicity</i>							<i>Geographical Point of Origin</i>	
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
Fall Semester '11	Semester Program	38	9	36	0	0	14	1	24	26	12
	Workshop 1	62	10	60	0	0	15	1	35	42	20
	Workshop 2	68	14	65	1	0	21	1	41	40	28
	Workshop 3	65	18	61	0	0	23	2	46	36	29
	<b>Total</b>	<b>233</b>	<b>51</b>	<b>222</b>	<b>1</b>	<b>0</b>	<b>73</b>	<b>5</b>	<b>146</b>	<b>144</b>	<b>89</b>
	<b>% of # Reporting</b>		<b>23%</b>		<b>1%</b>	<b>0%</b>	<b>50%</b>	<b>3%</b>		<b>62%</b>	<b>38%</b>
Spring Semester '12	Semester Program	56	12	51	0	0	10	5	39	36	20
	Workshop 1	89	16	78	1	0	14	5	46	51	38
	Workshop 2	89	19	80	0	0	18	4	63	58	31
	Workshop 3	79	15	68	0	0	11	4	37	54	25
	<b>Total</b>	<b>313</b>	<b>62</b>	<b>277</b>	<b>1</b>	<b>0</b>	<b>53</b>	<b>18</b>	<b>185</b>	<b>199</b>	<b>114</b>
	<b>% of # Reporting</b>		<b>22%</b>		<b>1%</b>	<b>0%</b>	<b>29%</b>	<b>10%</b>		<b>64%</b>	<b>36%</b>
Topical '11-'12	Workshop A	37	3	36	0	0	8	1	30	33	4
	Workshop B	38	8	38	0	0	10	0	25	31	7
	Workshop C	44	5	37	0	0	2	1	9	36	8
	<b>Total</b>	<b>119</b>	<b>16</b>	<b>111</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>2</b>	<b>64</b>	<b>100</b>	<b>19</b>
	<b>% of # Reporting</b>		<b>14%</b>		<b>0%</b>	<b>0%</b>	<b>31%</b>	<b>3%</b>		<b>84%</b>	<b>16%</b>

**ICERM Funded Speakers** - In fiscal year 2011-2012, 129 unique speakers were enrolled in two semester long programs and/or nine workshops. Of the 129, 122 received some sort of funding to attend an ICERM program. *N/A = None Attended*

			<b>Gender and Ethnicity</b>							<b>Geographical Point of Origin</b>									
	Program Type	Total Speakers	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	US - West	Africa	Asia	Canada	Europe	Latin & South America	Oceania
<b>Fall Semester '11</b>	Semester Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Workshop 1	21	4	20	0	0	2	0	11	3	1	4	0	0	1	0	11	1	0
	Workshop 2	22	3	21	1	0	5	0	11	0	1	5	3	0	2	2	9	0	0
	Workshop 3	22	7	21	0	0	5	1	17	2	2	3	1	0	3	1	10	0	0
	<b>Total</b>	<b>65</b>	<b>14</b>	<b>62</b>	<b>1</b>	<b>0</b>	<b>12</b>	<b>1</b>	<b>39</b>	<b>5</b>	<b>4</b>	<b>12</b>	<b>4</b>	<b>0</b>	<b>6</b>	<b>3</b>	<b>30</b>	<b>1</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>23%</b>		<b>3%</b>	<b>0%</b>	<b>31%</b>	<b>3%</b>		<b>8%</b>	<b>6%</b>	<b>18%</b>	<b>6%</b>	<b>0%</b>	<b>9%</b>	<b>5%</b>	<b>46%</b>	<b>2%</b>	<b>0%</b>
<b>Spring Semester '12</b>	Semester Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Workshop 1	21	1	15	0	0	2	0	8	2	6	0	3	0	2	1	6	1	0
	Workshop 2	18	4	17	0	0	4	1	10	2	7	1	3	0	0	0	4	1	0
	Workshop 3	18	5	14	0	0	0	1	5	1	8	0	2	0	0	0	6	1	0
	<b>Total</b>	<b>57</b>	<b>10</b>	<b>46</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>2</b>	<b>23</b>	<b>5</b>	<b>21</b>	<b>1</b>	<b>8</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>16</b>	<b>3</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>22%</b>		<b>0%</b>	<b>0%</b>	<b>26%</b>	<b>9%</b>		<b>9%</b>	<b>37%</b>	<b>2%</b>	<b>14%</b>	<b>0%</b>	<b>4%</b>	<b>2%</b>	<b>28%</b>	<b>5%</b>	<b>0%</b>
<b>Topical '11-'12</b>	Workshop A	19	2	18	0	0	4	0	14	5	7	4	0	0	1	0	2	0	0
	Workshop B	21	4	21	0	0	2	0	12	7	6	0	4	0	1	0	3	0	0
	Workshop C	15	2	11	0	0	0	1	1	3	3	4	5	0	0	0	0	0	0
	<b>Total</b>	<b>55</b>	<b>8</b>	<b>50</b>	<b>0</b>	<b>0</b>	<b>6</b>	<b>1</b>	<b>27</b>	<b>15</b>	<b>16</b>	<b>8</b>	<b>9</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>16%</b>		<b>0%</b>	<b>0%</b>	<b>22%</b>	<b>4%</b>		<b>27%</b>	<b>29%</b>	<b>15%</b>	<b>16%</b>	<b>0%</b>	<b>4%</b>	<b>0%</b>	<b>9%</b>	<b>0%</b>	<b>0%</b>

**All Speakers (ICERM funded and Non-ICERM funded)**

			<i>Gender and Ethnicity</i>							<i>Geographical Point of Origin</i>	
	Program Type	Total Speakers	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
<b>Fall Semester '11</b>	Semester Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Workshop 1	21	4	20	0	0	2	0	11	8	13
	Workshop 2	22	3	21	0	0	5	0	11	9	13
	Workshop 3	23	7	22	1	0	5	1	18	9	14
	<b>Total</b>	<b>66</b>	<b>14</b>	<b>63</b>	<b>1</b>	<b>0</b>	<b>12</b>	<b>1</b>	<b>40</b>	<b>26</b>	<b>40</b>
	<b>% of # Reporting</b>		<b>22%</b>		<b>3%</b>	<b>0%</b>	<b>30%</b>	<b>3%</b>		<b>39%</b>	<b>61%</b>
<b>Spring Semester '12</b>	Semester Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Workshop 1	21	1	15	0	0	2	0	8	11	10
	Workshop 2	18	4	17	1	0	4	1	10	13	5
	Workshop 3	18	5	13	1	0	0	1	5	11	7
	<b>Total</b>	<b>57</b>	<b>10</b>	<b>45</b>	<b>2</b>	<b>0</b>	<b>6</b>	<b>2</b>	<b>23</b>	<b>35</b>	<b>22</b>
	<b>% of # Reporting</b>		<b>22%</b>		<b>9%</b>	<b>0%</b>	<b>26%</b>	<b>9%</b>		<b>61%</b>	<b>39%</b>
<b>Topical '11-'12</b>	Workshop A	19	2	18	0	0	4	0	14	16	3
	Workshop B	21	4	21	0	0	2	0	12	17	4
	Workshop C	19	2	15	1	0	0	1	2	16	3
	<b>Total</b>	<b>59</b>	<b>8</b>	<b>54</b>	<b>1</b>	<b>0</b>	<b>6</b>	<b>1</b>	<b>28</b>	<b>49</b>	<b>10</b>
	<b>% of # Reporting</b>		<b>15%</b>		<b>4%</b>	<b>0%</b>	<b>21%</b>	<b>4%</b>		<b>83%</b>	<b>17%</b>

**ICERM Funded Postdocs** - In fiscal year 2011-2012, 58 unique postdocs were enrolled in two semester long programs and/or nine workshops. Of the 58, 47 received some sort of funding to attend an ICERM program (9 were hired as semester-long postdoctoral fellows and provided a stipend, 2 were hired as year-long institute fellows and provided a salary).

			<i>Gender and Ethnicity</i>							<i>Geographical Point of Origin</i>									
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	US - West	Africa	Asia	Canada	Europe	Latin & South America	Oceania
Fall Semester '11	Semester Program	7	1	7	0	0	2	0	2	1	3	2	0	0	0	0	1	0	0
	Workshop 1	11	2	11	0	0	2	0	6	2	4	3	1	0	0	0	1	0	0
	Workshop 2	10	1	10	0	0	3	0	6	2	4	2	1	0	0	0	1	0	0
	Workshop 3	10	3	10	0	0	5	0	6	1	5	3	0	0	0	0	1	0	0
	<b>Total</b>	<b>38</b>	<b>7</b>	<b>38</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>0</b>	<b>20</b>	<b>6</b>	<b>16</b>	<b>10</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>18%</b>		<b>0%</b>	<b>0%</b>	<b>60%</b>	<b>0%</b>		<b>16%</b>	<b>42%</b>	<b>26%</b>	<b>5%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>11%</b>	<b>0%</b>	<b>0%</b>
Spring Semester '12	Semester Program	13	4	12	0	0	5	0	9	1	6	0	1	0	1	0	3	1	0
	Workshop 1	13	5	12	0	0	3	0	9	1	6	0	1	0	1	0	3	1	0
	Workshop 2	17	6	16	0	0	4	0	12	1	6	0	2	0	1	0	4	2	1
	Workshop 3	13	5	12	0	0	4	0	9	1	7	0	1	0	1	0	2	1	0
	<b>Total</b>	<b>56</b>	<b>20</b>	<b>52</b>	<b>0</b>	<b>0</b>	<b>16</b>	<b>0</b>	<b>39</b>	<b>4</b>	<b>25</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>12</b>	<b>5</b>	<b>1</b>
	<b>% of # Reporting</b>		<b>38%</b>		<b>0%</b>	<b>0%</b>	<b>41%</b>	<b>0%</b>		<b>7%</b>	<b>45%</b>	<b>0%</b>	<b>9%</b>	<b>0%</b>	<b>7%</b>	<b>0%</b>	<b>21%</b>	<b>9%</b>	<b>2%</b>
Topical '11-'12	Workshop A	5	0	5	0	0	1	0	4	3	0	0	0	0	0	1	1	0	0
	Workshop B	2	1	2	0	0	1	0	2	0	1	0	1	0	0	0	0	0	0
	Workshop C	4	0	4	0	0	0	0	2	2	1	0	0	0	1	0	0	0	0
	<b>Total</b>	<b>11</b>	<b>1</b>	<b>11</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>8</b>	<b>5</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>9%</b>		<b>0%</b>	<b>0%</b>	<b>25%</b>	<b>0%</b>		<b>45%</b>	<b>18%</b>	<b>0%</b>	<b>9%</b>	<b>0%</b>	<b>9%</b>	<b>9%</b>	<b>9%</b>	<b>0%</b>	<b>0%</b>

**All Postdocs (ICERM funded and Non-ICERM funded)**

			<i>Gender and Ethnicity</i>							<i>Geographical Point of Origin</i>	
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
Fall Semester '11	Semester Program	7	1	7	0	0	2	0	2	6	1
	Workshop 1	13	2	13	0	0	3	0	7	12	1
	Workshop 2	11	2	11	0	0	3	0	6	10	1
	Workshop 3	11	3	11	0	0	5	0	6	10	1
	<b>Total</b>	<b>42</b>	<b>8</b>	<b>42</b>	<b>0</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>21</b>	<b>38</b>	<b>4</b>
	<b>% of # Reporting</b>		<b>19%</b>		<b>0%</b>	<b>0%</b>	<b>62%</b>	<b>0%</b>		<b>90%</b>	<b>10%</b>
Spring Semester '12	Semester Program	15	5	14	0	0	5	1	11	9	6
	Workshop 1	13	5	12	0	0	3	0	9	8	5
	Workshop 2	19	7	18	0	0	5	0	14	9	10
	Workshop 3	13	8	12	0	0	6	0	16	9	4
	<b>Total</b>	<b>60</b>	<b>25</b>	<b>56</b>	<b>0</b>	<b>0</b>	<b>19</b>	<b>1</b>	<b>50</b>	<b>35</b>	<b>25</b>
	<b>% of # Reporting</b>		<b>45%</b>		<b>0%</b>	<b>0%</b>	<b>38%</b>	<b>2%</b>		<b>58%</b>	<b>42%</b>
Topical '11-'12	Workshop A	7	0	7	0	0	2	0	6	5	2
	Workshop B	4	1	4	0	0	1	0	4	4	0
	Workshop C	4	0	4	0	0	0	0	2	3	1
	<b>Total</b>	<b>15</b>	<b>1</b>	<b>15</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>0</b>	<b>12</b>	<b>12</b>	<b>3</b>
	<b>% of # Reporting</b>		<b>7%</b>		<b>0%</b>	<b>0%</b>	<b>25%</b>	<b>0%</b>		<b>80%</b>	<b>20%</b>

**ICERM Funded Graduate Students** - In fiscal year 2011-2012, 87 unique graduate students were enrolled in two semester long programs and/or nine workshops. Of the 87, 57 received some sort of funding to attend an ICERM program.

			<i>Gender and Ethnicity</i>							<i>Geographical Point of Origin</i>									
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	US - West	Africa	Asia	Canada	Europe	Latin & South America	Oceania
<b>Fall Semester '11</b>	Semester Program	10	1	9	0	0	3	1	8	1	2	2	1	0	0	0	3	0	0
	Workshop 1	9	0	8	0	0	4	1	7	1	3	3	1	0	0	0	0	1	0
	Workshop 2	10	1	9	0	0	3	1	8	1	2	3	1	0	0	0	3	0	0
	Workshop 3	14	3	13	0	0	7	1	12	3	2	3	1	0	0	0	5	0	0
	<b>Total</b>	<b>43</b>	<b>5</b>	<b>39</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>4</b>	<b>35</b>	<b>6</b>	<b>9</b>	<b>11</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>11</b>	<b>1</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>13%</b>		<b>0%</b>	<b>0%</b>	<b>49%</b>	<b>11%</b>		<b>14%</b>	<b>21%</b>	<b>26%</b>	<b>9%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>26%</b>	<b>2%</b>	<b>0%</b>
<b>Spring Semester '12</b>	Semester Program	13	2	13	0	0	4	1	13	6	1	0	2	0	1	0	3	0	0
	Workshop 1	16	3	16	0	0	4	1	16	6	2	1	2	0	1	0	4	0	0
	Workshop 2	19	4	19	0	0	5	1	19	7	7	0	2	0	1	0	2	0	0
	Workshop 3	21	4	20	0	0	4	1	18	9	4	0	2	0	1	0	5	0	0
	<b>Total</b>	<b>69</b>	<b>13</b>	<b>68</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>4</b>	<b>66</b>	<b>28</b>	<b>14</b>	<b>1</b>	<b>8</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>14</b>	<b>0</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>19%</b>		<b>0%</b>	<b>0%</b>	<b>26%</b>	<b>6%</b>		<b>41%</b>	<b>20%</b>	<b>1%</b>	<b>12%</b>	<b>0%</b>	<b>6%</b>	<b>0%</b>	<b>20%</b>	<b>0%</b>	<b>0%</b>
<b>Topical '11-'12</b>	Workshop A	2	0	1	0	0	1	0	2	0	1	1	0	0	0	0	0	0	0
	Workshop B	8	2	8	0	0	3	0	5	1	2	0	4	0	0	0	1	0	0
	Workshop C	2	0	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
	<b>Total</b>	<b>12</b>	<b>2</b>	<b>11</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>7</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>
	<b>% of # Reporting</b>		<b>18%</b>		<b>0%</b>	<b>0%</b>	<b>57%</b>	<b>0%</b>		<b>8%</b>	<b>25%</b>	<b>17%</b>	<b>42%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>8%</b>	<b>0%</b>	<b>0%</b>

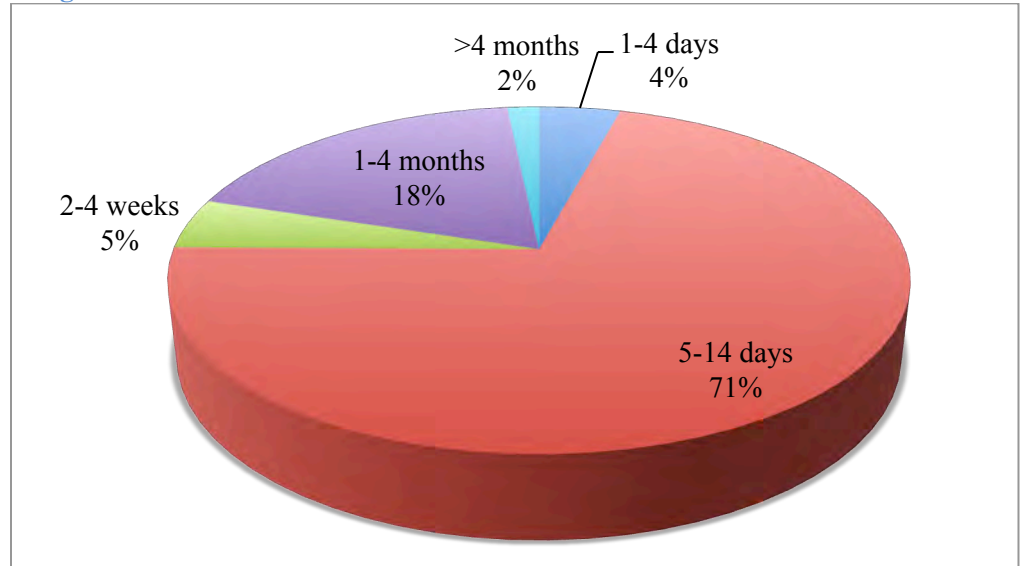
**All Graduate Students (ICERM funded and Non-ICERM funded)**

			<i>Gender and Ethnicity</i>							<i>Geographical Point of Origin</i>	
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
Fall Semester '11	Semester Program	14	2	12	0	0	4	1	10	9	5
	Workshop 1	12	1	11	0	0	4	1	9	10	2
	Workshop 2	16	4	14	0	0	6	1	12	9	7
	Workshop 3	19	5	17	0	0	8	1	15	12	7
	<b>Total</b>	<b>61</b>	<b>12</b>	<b>54</b>	<b>0</b>	<b>0</b>	<b>22</b>	<b>4</b>	<b>46</b>	<b>40</b>	<b>21</b>
	<b>% of # Reporting</b>		<b>22%</b>		<b>0%</b>	<b>0%</b>	<b>48%</b>	<b>9%</b>		<b>66%</b>	<b>34%</b>
Spring Semester '12	Semester Program	14	2	14	0	0	4	1	14	10	4
	Workshop 1	20	4	20	0	0	4	1	19	14	6
	Workshop 2	26	5	25	0	0	6	1	24	22	4
	Workshop 3	28	5	25	0	0	4	1	23	19	9
	<b>Total</b>	<b>88</b>	<b>16</b>	<b>84</b>	<b>0</b>	<b>0</b>	<b>18</b>	<b>4</b>	<b>80</b>	<b>65</b>	<b>23</b>
	<b>% of # Reporting</b>		<b>19%</b>		<b>0%</b>	<b>0%</b>	<b>23%</b>	<b>5%</b>		<b>74%</b>	<b>26%</b>
Topical '11-'12	Workshop A	5	0	4	0	0	2	0	5	5	0
	Workshop B	11	3	11	0	0	5	0	8	10	1
	Workshop C	5	1	5	0	0	0	0	1	5	0
	<b>Total</b>	<b>21</b>	<b>4</b>	<b>20</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>0</b>	<b>14</b>	<b>20</b>	<b>1</b>
	<b>% of # Reporting</b>		<b>20%</b>		<b>0%</b>	<b>0%</b>	<b>50%</b>	<b>0%</b>		<b>95%</b>	<b>5%</b>

### Additional Participant Data

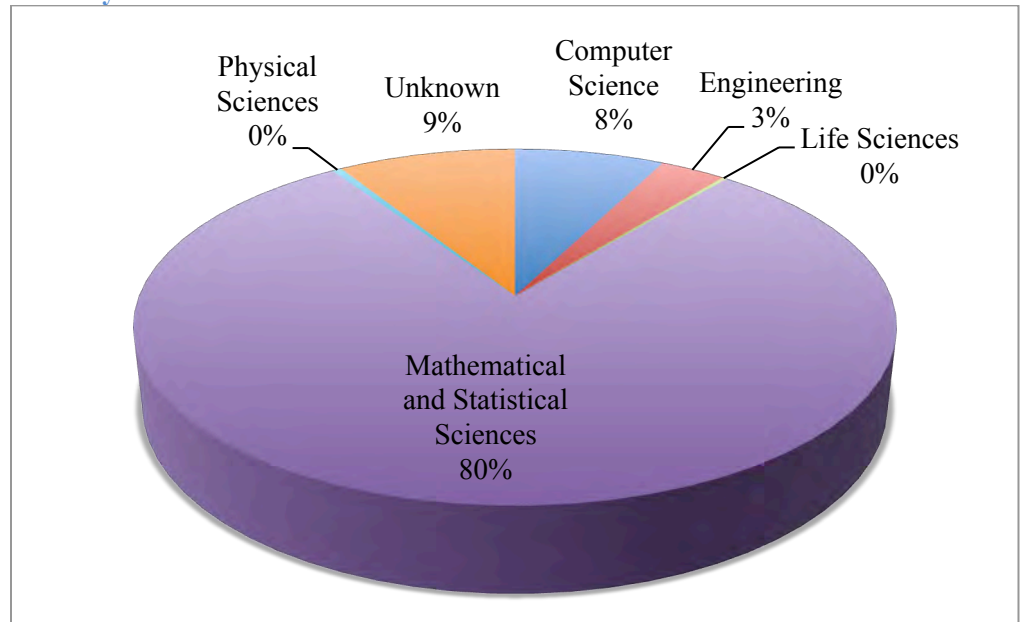
The charts below display breakdowns of ICERM's confirmed participants (including organizers by category as of May 1, 2012 for all funded programs. Note that VI-MSS program data is not included.

#### Length of Visits



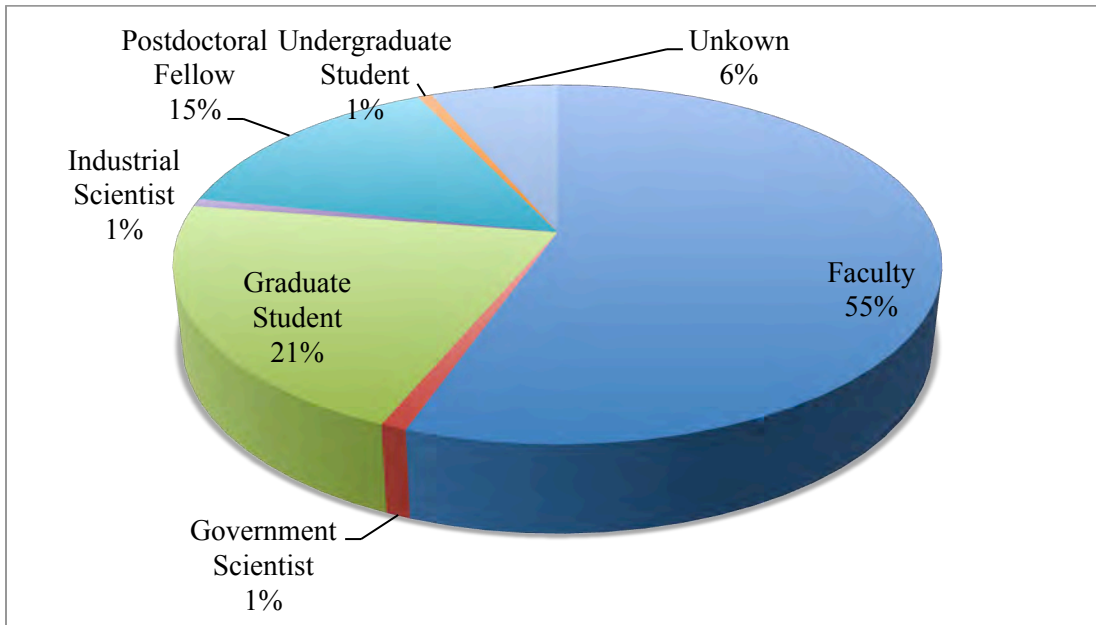
**Figure 1:** The institute counts anyone who participates all 5 days of a conference as a one-week participant, even though they only are registered at a hotel for 5 or 6 nights. Participants who are at the institute for less than one week are those who spend part of a conference or come for a special event.

#### Primary Field of Interest:



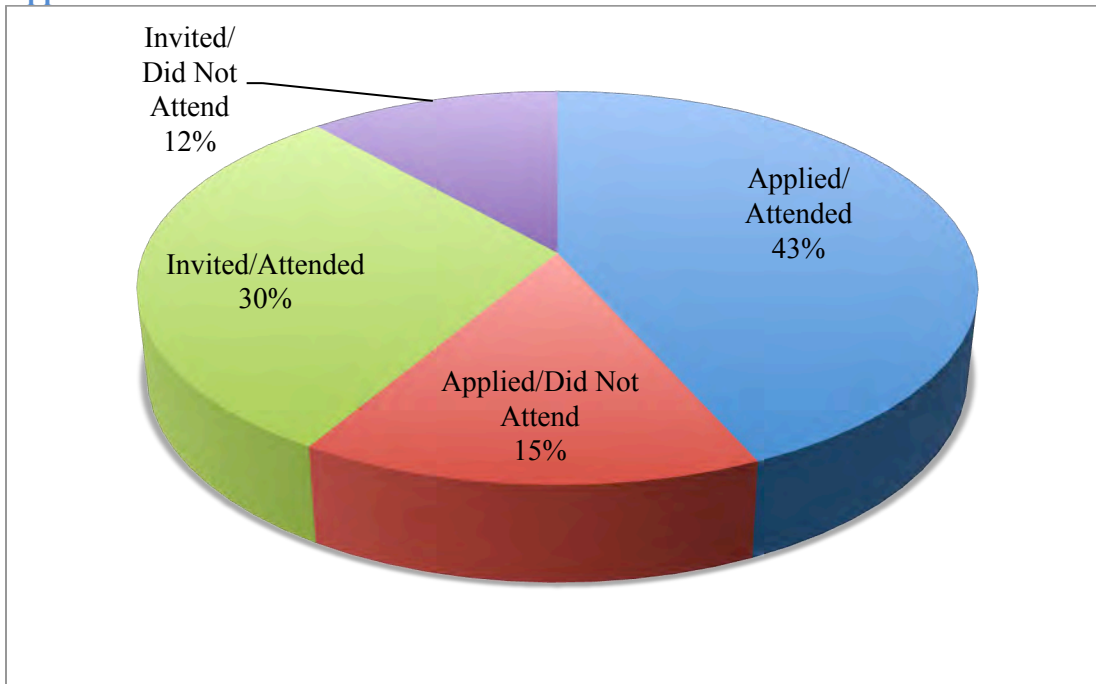
**Figure 2**

#### Academic Breakdown:



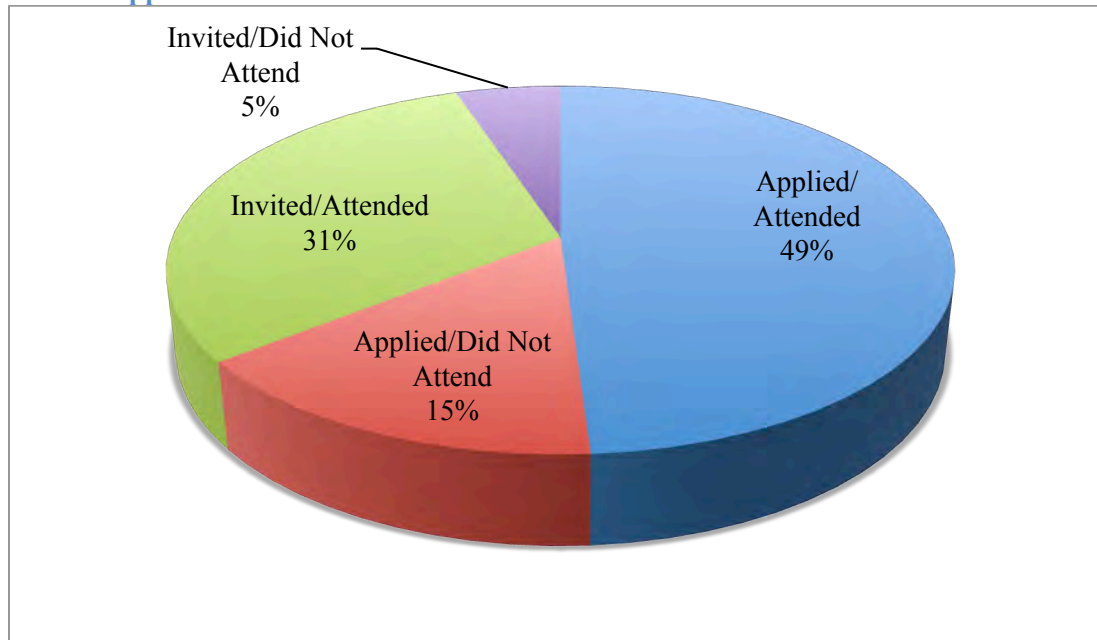
**Figure 3**

#### Applied Attendees VS Invited Attendees:



**Figure 4:** Applied/Did Not Attend includes applicants who were not qualified as well as applicants who were accepted without full funding but could not attend, or who declined without a reason given.

### Female Applied Attendees VS Female Invited Attendees:



**Figure 5:** Applied/Did Not Attend includes applicants who were not qualified as well as applicants who were accepted without full funding but could not attend, or who declined without a reason given.

### Semester Programs

Since its inaugural semester program in September 2011, a large portion of the Institute's activity has taken place in the context of semester long thematic programs together with their associated workshops.

#### Semester Program Process

ICERM's Scientific Advisory Board meets annually in November. The 2011 meeting resulted in the selection of semester programs and topical workshops through Spring 2014. Gabor Szekely, NSF, attended the SAB meeting.

The semester program selection process follows these steps:

#### 1. Solicitation of Proposals:

Proposals for semester-long programs consist of 4-7 pages containing:

- a description of the program area/theme (written with a general mathematical audience in mind),
- a description of the central scientific challenges to be addressed by the program
- a list of organizers (normally around 4-7),
- a list of 8-10 high priority senior scientists who are likely to visit ICERM as long-term participants (for a month or more),
- an additional ranked list of up to 20 (or more) potential long-term participants the organizing committee feels will help form a critical mass for the scientific program,
- a main contact (chair) of organizing committee,
- a description of the three proposed workshops (including potential organizers if possible),
- a discussion of the experimental and computational aspects of the program,

- concrete plans for involving and mentoring graduate students, postdocs, and early-career mathematicians in the program,
- an assigned organizer responsible for coordination of mentoring,
- plans for ensuring the participation of underrepresented groups (organizers are expected to work with ICERM Directors on diversity issues).
- 

## 2. Proposal Selection:

The Science Advisory Board (SAB) approves the semester programs. The deadline for proposals is early October, prior to the annual November SAB meeting. Proposals will usually be sent out for review. Once a proposal is accepted, an ICERM Director and members of a SAB subcommittee are assigned to assist the organizers. The “high priority” list of senior scientists are contacted and invited to participate immediately upon approval of the program and this list by the SAB. Program dates are scheduled with details posted on the ICERM website and various on-line math organization calendars (SIAM, AMS, European Mathematical Society, National Math Institutes, and Conference Service Mandl). In addition, ICERM reserves some funds to encourage people to apply to participate.

From this point on, organizers are involved in making decisions on the following: ICERM postdoc selection; applications for long-term visitors, graduate students, and workshop participants; mentoring of students and postdocs (an institute Director assists organizers with mentor coordination). The chair of the organizing committee (or other designated organizer) assists ICERM staff by providing appropriate program images for web and print ads, and may be asked to review marketing materials.

## 3. Selection of Long-term Visitors/Research Fellows

The organizers propose a ranked list of 15 to 20 research fellows. ICERM Directors approve and/or suggest additions or re-rankings in consultation with assigned SAB members. The standard model for long-term participation for senior faculty is through paid leaves such as sabbatical.

## 4. Offers to Research Fellows

Once the list of research fellows has been finalized and funding determined, an invitation is sent to each. The invitation describes the program and outlines the support to be provided. Using its Discovery database, ICERM tracks demographic information about, and all interactions with, research fellows.

## 5. Semester Workshops

The semester program proposal should include a list of organizers for each of its three workshops. The organizers propose a ranked list of 15 to 20 possible speakers. The ICERM Directors approve and/or suggest additions or re-rankings in consultation with assigned SAB members. Formal invitations are sent by ICERM staff (describing the program and outlining the support to be provided) to those who indicate an interest.

The chair of each workshop’s organizing committee (or other designated organizer) assists ICERM staff by providing appropriate program images for the workshop’s web and print ads, and may be asked to review marketing materials.

## 6. Application Process

Once the organizers and Directors agree there is enough critical mass in terms of confirmed long-term visitors and/or workshop speakers, the on-line application for that particular program is opened on the ICERM website. All applications are stored in our Application database. The ICERM postdoctoral fellow applicants who were not chosen are either automatically entered into the online applicant pool, or they are alerted that these positions have closed and that they should apply online for partial support to attend if they are still interested.

## 7. Applicant Selection

The Application database allows program organizers, ICERM Directors and staff to view each candidate's application. Every two weeks or so, the organizers are asked to recommend a ranking of applicants for their program (graduate students, participants). ICERM Directors review the ranked list, re-rank as appropriate and make the final selections, taking into consideration the remaining budget for the program, diversity, participant support requested, and whether or not the applicant (if a young researcher) has an advisor already participating in the program. ICERM staff then updates the applicant about their status, and any support they are eligible for, as appropriate. This process continues until funds for the program run out.

## Financial Decisions for Semester Programs

Financial decisions are made by ICERM Directors based on discussions with organizers. On average, the institute provides stipends for 4 semester postdoctoral fellows and support for travel and shared housing for 6-10 graduate students per program. There is support for housing and travel for around 10-15 long-term visitors (including organizers), who stay for 4 months, and around 20-25 short-term visitors, who stay for 1-4 weeks. In addition, there is support for workshop attendees. The institute also has very limited funds for stipends and buyout of teaching for key participants. Some funds are reserved for support for uninvited applicants. In general, ICERM will aim to help participants negotiate sabbatical leaves and teaching release from their departments to participate in institute programs.

## Opening, "Middle" and Closing Events

Semester program opening and closing events are tailored to each program. Here are some examples of planned events during semester programs.

### Opening event:

- 2-3 day event at the beginning of the semester program
- Morning: three lectures
- Afternoon: 15-minute presentations by the postdocs, plus 5-minute presentations by the grad students, designed to get everyone acquainted

### Prior to each of semester workshops:

- Tutorials the week before each workshop, timing varies workshop to workshop, but equivalent to two full days of tutorial lectures
- Tutorials are given by long term visitors to the program

### During Semester Workshops:

- Workshops last 1 week and consist of 50-minute talks with 10 minutes of Q&A.
- Typically one afternoon is left "open" for collaborations and small groups
- Workshops include a "wrap-up" session to discuss ideas and new directions among all of the workshop participants together

### Non-workshop weeks:

- Lectures occur through either mini courses, research seminars, special talks, and/or computational working group meetings
- Young Researcher Seminar, where graduate students and postdocs meet sans faculty and discuss scientific questions
- Postdocs and grad students are mentored throughout the program, both informally and with formal professional development seminars and meetings

### Final Event:

- Consists of 3 days of short talks from all long term visitors who are still in residence
- Special Colloquium closes out the event on the last day of the program
- Time set aside for takeaways

See Appendix A for a sample event schedules (tutorial week and closing event)

## 2011-2012 Semester Programs



*Front and back of flier advertising 2011-2012 semester programs*

### Fall Semester 2011: Kinetic Theory: Analysis and Computation

September 7, 2011 - December 9, 2011

#### Organizing Committee:

Francis Filbet, Université de Lyons  
Irene Gamba, University of Texas  
Yan Guo, Brown University  
Chi-Wang Shu, Brown University  
Walter Strauss, Brown University

**Program Description:**

Kinetic theory plays a central role in many areas of mathematical physics, from nanoscales to continuum mechanics. It is an indispensable tool in the mathematical description of applications in physical and social sciences, from its origin in dilute gases, to wide applications such as semiconductors, polymers, cells, plasma, galaxies, traffic networking, and swarming. The number of particles is typically more than  $10^{20}$ .

On the one hand, kinetic models provide more detailed and accurate description of regimes where hydrodynamic equations are either invalid or simply not available. On the other hand, because modern computers are still inadequate in simulating the molecular or even quantum dynamics in emerging industrial needs in micro- and nanotechnology, kinetic equations provide models that can capture important features of microscopic or quantum phenomena with a manageable computational cost. Kinetic theory is at the core of multiscale modeling, which connects fundamental invisible microscopic models with macroscopic models. Many challenges remain in both the analysis and efficient computational techniques for such problems. This semester-long program in kinetic theory and computation will provide the participants with an introduction to a broad range of analytical and computational aspects of kinetic theory. The program will be centered around three broad topics, for each of which an international workshop will be held.

**Workshop 1: Vlasov Models in Kinetic Theory**

September 19-23, 2011

*Number of participants: 62*

**Organizing Committee:**

Pierre Degond, CNRS Toulouse  
Francis Filbet, Université de Lyon  
Robert Glassey, Indiana University  
Jingmei Qiu, University of Houston  
Gerhard Rein, Universität Bayreuth

**Speakers:**

Hakan Andreasson, AAAS  
Anton Arnold, Technische Universität Wien  
Francois Bolley, Université de Paris-Dauphine  
Simone Calogero, University of Granada  
Jose Antonio Carrillo, Autonomous University of Barcelona  
Yingda Cheng, Michigan State University  
Alina Chertock, North Carolina State University  
Andrew Christlieb, Michigan State University  
Irene Gamba, University of Texas at Austin  
Robert Glassey, Indiana University  
Francois Golse, École Polytechnique  
Hyung Ju Hwang, Pohang University of Science and Technology (POSTECH)  
Pierre-Emmanuel Jabin, Université de Nice Sophia Antipolis  
Mohammed Lemou, Centre National de la Recherche Scientifique (CNRS)  
Phil Morrison, University of Texas at Austin  
Jingmei Qiu, University of Houston  
Gerhard Rein, Universität Bayreuth  
Alan Rendall, Max Planck Institute für Gravitationsphysik, Albert-Einstein-Institut  
Giovanni Russo, Università di Catania

Jack Schaeffer, Carnegie Mellon University  
Eric Sonnendrucker, Université de Strasbourg I (Louis Pasteur)

**Workshop Description:**

Vlasov-type models deal with continua of particles where long range forces (such as electrostatic, electromagnetic, or gravitational forces) dominate the collisions among the particles, so that collisions can be ignored. They occur in physical plasmas, including astrophysical plasmas and fusion reactors. There are many examples of astrophysical plasmas of this type, such as the solar wind. When a fusion reactor is very hot, the relevant times scales are so short that collisions can be ignored. Vlasov theory also models systems where the dominant force is gravity, such as clusters of stars or galaxies. This workshop is part of a semester long program on Kinetic Theory which is at the core of multiscale modeling and connects fundamental microscopic models with macroscopic models.

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

**Some workshop organizer comments:**

*“There was collaboration on common problems with experts from afar. There was learning about new applications in Kinetic theory. There was learning about new methods in Kinetic theory, as applied to long-standing problems. There was meeting and talking with the next generation of young people in the area.”*

*“A highlight was being able to interact with my long-time co-authors and hit the white board at the same time (as opposed to distance collaboration)”*

**Some workshop participant comments:**

*“I liked that the workshop collected several researchers interested in the same subject, and that there was a lot of opportunities and facilities for very interesting scientific discussions.”*

*“Facilities were great, the attendees were some of the best in the field, there was funding, there was an interesting selection of topics from both pure and applied math.”*

*“I liked (1) the way the workshop was organized, numbers of talks versus free time for discussions; (2) quality of talks; (3) locations, ICERM structure is wonderful and the space is organized encourages discussions and collaborations; (4) stuff very helpful and friendly.”*

*“There is not such an opportunity for younger folks (who are generally not speaking) to talk to more established folks whom they don't already know.”*

This last comment inspired a change in the workshop format. Starting in Spring 2012, we added a poster session mid week to the workshops so that graduate students could present a poster. Indeed, the poster sessions were open to all, and subsequent poster sessions had posters from students and faculty alike.

## Workshop 2: Novel Applications of Kinetic Theory and Computation

October 17-21, 2011

*Number of participants: 64*

### Organizing Committee:

Irene Gamba, University of Texas

Axel Klar, Technische Universität Kaiserslautern

Benoit Perthame, Université Pierre et Marie Curie

Christian Ringhofer, Arizona State University

Chi-Wang Shu, Brown University

### Speakers:

Martial Agueh, University of Victoria

Kazuo Aoki, Kyoto University

Dieter Armbruster, Arizona State University

Francois Baccelli, Institut National de Recherche en Informatique Automatique (INRIA)

Vincent Calvez, École Normale Supérieure de Lyon

Marie Doumic-Jauffret, Institut National de Recherche en Informatique Automatique (INRIA)

Miguel Escobedo, Universidad del País Vasco

Irene Gamba, University of Texas at Austin

Simone Göttlich, Universität Mannheim

Seung Y. Ha, Seoul National University

Cory Hauck, Oak Ridge National Laboratory

Reinhard Illner, University of Victoria

Axel Klar, Universität Kaiserslautern

Armando Majorana, Università di Catania

Vlad Panferov, California State University

Lorenzo Pareschi, Università di Ferrara

Benoit Perthame, Université de Paris VI (Pierre et Marie Curie)

Kui Ren, University of Texas at Austin

Christian Ringhofer, Arizona State University

Chi-Wang Shu, Brown University

Ravi Srinivasan, University of Texas at Austin

### Workshop Description:

There are several new fundamental and broad applications involving kinetic theory and computations. They range from mathematical physics models that may include nano scale device modeling involving kinetic and quantum charged transport, radiative transfer, conservative and dissipative phenomena in rarefied and grain and polymer flows. Novel applications appear in biological and social dynamical models of aggregation, chain supply and traffic dynamics, as well as statistical methods for multi-agent systems in control that have recently been extended to kinetic type models for particle swarms, networks or the dynamics of information.

New approaches to reduced dimensionality via hydrodynamic limits or moment methods are of special interest as well as novel computational techniques in kinetic dynamics and transport. Our program will focus on recent developments in these areas in an attempt to set basic benchmarks in terms of analytical and numerical methods.

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

**Some workshop organizer comments:**

*“High quality research behind the talks. Good mixture in the community represented, in particular in terms of new applications. Enthusiastic atmosphere, many questions, high research activity...”*

*“It would be nice to add a poster session so that all participants have a chance to present their works.”*

This last comment inspired a change in the workshop format. Starting in Spring 2012, we added a poster session mid week to the workshops so that graduate students could present a poster. Indeed, the poster sessions were open to all, and subsequent poster sessions had posters from students and faculty alike.

**Some workshop participant comments:**

*“The talks were interesting and relevant, the timing allowed discussion among attendees, and the space made working enticing! Great board space.”*

*“I appreciated the opportunity to compare different approaches in the same field (e.g. flocking, traffic modeling, etc.)”*

*“Excellent facilities, staff, organization, choice of participants and schedule of talks, which left enough time for interaction.”*

**Workshop 3: Boltzmann Models in Kinetic Theory**

November 7-11, 2011

Number of participants: 65

**Organizing Committee:**

Kazuo Aoki, Kyoto University  
Yan Guo, Brown University  
Shi Jin, University of Wisconsin  
Lorenzo Pareschi, University of Ferrara  
Laure Saint-Raymond, Université Paris VI

**Speakers:**

Diogo Arsenio, École Normale Supérieure  
Claude Bardos, Université de Paris VII (Denis Diderot)  
Laurent Desvillettes, École Normale Supérieure de Cachan  
Raffaele Esposito, Università di L'Aquila  
Irene Gamba, University of Texas at Austin  
Nicolas Hadjiconstantinou, Massachusetts Institute of Technology  
Cory Hauck, Oak Ridge National Laboratory  
Frederic Herau, Université de Nantes  
Juhi Jang, University of California, Riverside  
Chanwoo Kim, University of Cambridge  
David Levermore, University of Maryland  
Tong Li, University of Iowa  
Rossana Marra, Seconda Università di Roma "Tor Vergata"

Nader Masmoudi, New York University  
Stephane Mischler, Université de Paris-Dauphine  
Anne Nouri, Aix-Marseille University  
Laure Saint-Raymond, École Normale Supérieure  
Marshall Slemrod, University of Wisconsin  
Robert Strain, University of Pennsylvania  
Henning Struchtrup, University of Victoria  
Shigeru Takata, Kyoto University  
Tong Yang, City University of Hong Kong  
Shih-Hsien Yu, National University of Singapore

### **Workshop Description:**

The celebrated Boltzmann equation is the foundation of the kinetic theory for dilute collections of particles, which undergo elastic binary collisions. The Boltzmann theory is at the center of a series of multi-scaled physical models that connect microscopic multiparticle models to macroscopic fluid models such as the Navier-Stokes equations.

The Boltzmann theory provides a practical tool and machinery for deriving macroscopic models in broad physical applications. Due to its importance, there has been an explosion of mathematical studies, both theoretical and numerical, for the Boltzmann equation. A major open problem that remains is to determine whether or not smooth initial data would lead to a unique global-in-time solution of the Boltzmann equation. Nevertheless, there have been exciting new developments in recent years. As part of a semester long program on Kinetic Theory, this workshop will focus on bringing computational and theoretical people together to investigate problems of fundamental importance.

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

### **Some workshop organizer comments:**

*“We invited speakers working on a wide range of aspects of the kinetic theory. There were many excellent talks. There were very healthy scientific interactions between theoretical and computational groups of experts. Our tutorials were well attended by the postdocs and graduate students.”*

*“A highlight was the interaction between senior and young researchers.”*

### **Some workshop participant comments:**

*“One of the most successful workshops I ever attended.”*

*“I liked the selection of speakers. I liked that there were a lot of opportunities to interact with other participants, and two coffee breaks helped with that. Also, I like very much the idea of creating video archive of the talks. Maybe it would be nice to have slides used during the talks available too. Overall, the workshop was excellent.”*

*“I liked: the scientific level, environment, efficiency of organization.”*

*“We invited speakers working on a wide range of aspects of the kinetic theory. There were many excellent talks. There were very healthy scientific interactions between theoretical and computational groups of experts. Our tutorials were well attended by the postdocs and graduate students.” (Workshop Organizer)*



*Posters advertising fall 2011 semester program workshops*

## Fall 2011 Participants by Length of Stay

### 2011 Fall Semester Program Participants\* by Length of Stay

First Name	Last Name	Organization	Primary Interest	Visit Length
Martial	Agueh	University of Victoria	Mathematical and Statistical Sciences	6
Giacomo	Albi	Università di Ferrara	Mathematical and Statistical Sciences	35
Jose Antonio	Alcantara Felix	University of Granada	Mathematical and Statistical Sciences	22
Hakan	Andreasson	AAAS	Mathematical and Statistical Sciences	6
Kazuo	Aoki	Kyoto University	Engineering	62
Dieter	Armbruster	Arizona State University	Mathematical and Statistical Sciences	6
Anton	Arnold	Technische Universität Wien	Mathematical and Statistical Sciences	6
Diogo	Arsenio	École Normale Supérieure	Mathematical and Statistical Sciences	6
Francois	Baccelli	Institut National de Recherche en Informatique Automatique (INRIA)	Mathematical and Statistical Sciences	6
Weizhu	Bao	National University of Singapore	Mathematical and Statistical Sciences	8

Alethea	Barbaro	University of California, Los Angeles	Mathematical and Statistical Sciences	10
Claude	Bardos	Université de Paris VII (Denis Diderot)	Mathematical and Statistical Sciences	51
Francois	Bolley	Université de Paris-Dauphine	Mathematical and Statistical Sciences	6
Stephane	Brull	Université de Bordeaux I	Mathematical and Statistical Sciences	7
Xavier	Buff	Université de Toulouse III (Paul Sabatier)	Mathematical and Statistical Sciences	5
Luis	Caffarelli	University of Texas at Austin	Unknown	6
Simone	Calogero	University of Granada	Mathematical and Statistical Sciences	15
Vincent	Calvez	École Normale Supérieure de Lyon	Unknown	6
Jose Antonio	Carrillo	Autonomous University of Barcelona	Mathematical and Statistical Sciences	7
Matthew	Causley	Michigan State University	Mathematical and Statistical Sciences	6
Frederique	Charles	University Pierre et Marie Curie (PARIS 6)	Mathematical and Statistical Sciences	5
Yingda	Cheng	Michigan State University	Mathematical and Statistical Sciences	19
Alina	Chertock	North Carolina State University	Mathematical and Statistical Sciences	6
Heesun	Choi	Seoul National University	Mathematical and Statistical Sciences	5
Andrew	Christlieb	Michigan State University	Mathematical and Statistical Sciences	12
Zhenlu	Cui	Fayetteville State University	Mathematical and Statistical Sciences	6
Laurent	Desvillettes	École Normale Supérieure de Cachan	Mathematical and Statistical Sciences	6
Marie	Doumic-Jauffret	Institut National de Recherche en Informatique Automatique (INRIA)	Mathematical and Statistical Sciences	6
Yong	Duk	Seoul National University	Mathematical and Statistical Sciences	5
Miguel	Escobedo	Universidad del País Vasco	Mathematical and Statistical Sciences	6
Raffaele	Esposito	Università di L'Aquila	Mathematical and Statistical Sciences	13
Francis	Filbet	Université de Lyon II	Mathematical and Statistical Sciences	55
Irene	Gamba	University of Texas at Austin	Mathematical and Statistical Sciences	60

Robert	Glasse	Indiana University	Mathematical and Statistical Sciences	7
Francois	Golse	École Polytechnique	Mathematical and Statistical Sciences	6
Simone	Göttlich	Universität Mannheim	Mathematical and Statistical Sciences	6
Maria Pia	Gualdani	University of Texas at Austin	Mathematical and Statistical Sciences	8
Yaman	Guclu	Michigan State University	Engineering	5
Wei	Guo	Colorado School of Mines	Mathematical and Statistical Sciences	94
Yan	Guo	Brown University	Mathematical and Statistical Sciences	101
Seung	Ha	Seoul National University	Mathematical and Statistical Sciences	6
Nicolas	Hadjiconstantinou	Massachusetts Institute of Technology	Engineering	10
Mahir	Hadzic	Massachusetts Institute of Technology	Mathematical and Statistical Sciences	6
George Isaac	Hagstrom	New York University	Physical Sciences	12
Cory	Hauck	Oak Ridge National Laboratory	Mathematical and Statistical Sciences	10
Andong	He	Brown University	Mathematical and Statistical Sciences	274
Frederic	Herau	Université de Nantes	Mathematical and Statistical Sciences	6
Jingwei	Hu	University of Texas at Austin	Mathematical and Statistical Sciences	7
Hyung Ju	Hwang	Pohang University of Science and Technology (POSTECH)	Mathematical and Statistical Sciences	6
Reinhard	Illner	University of Victoria	Mathematical and Statistical Sciences	5
Pierre-Emmanuel	Jabin	Université de Nice Sophia Antipolis	Mathematical and Statistical Sciences	6
Juhi	Jang	University of California, Riverside	Mathematical and Statistical Sciences	114
Evan Alexander	Johnson	University of Wisconsin	Mathematical and Statistical Sciences	5
Ahmed	Kaffel	Virginia Polytechnic Institute and State University	Mathematical and Statistical Sciences	102
Chanwoo	Kim	University of Cambridge	Mathematical and Statistical Sciences	14
Axel	Klar	Universität Kaiserslautern	Mathematical and Statistical Sciences	6
Ji Oon	Lee	Korea Advanced	Mathematical and	8

		Institute of Science and Technology	Statistical Sciences	
Mohammed	Lemou	Centre National de la Recherche Scientifique (CNRS)	Mathematical and Statistical Sciences	6
David	Levermore	University of Maryland	Mathematical and Statistical Sciences	60
Tong	Li	University of Iowa	Mathematical and Statistical Sciences	6
Qin	Li	University of Wisconsin	Mathematical and Statistical Sciences	7
Fengyan	Li	Rensselaer Polytechnic Institute	Mathematical and Statistical Sciences	87
Zhiwu	Lin	Georgia Tech College of Computing	Mathematical and Statistical Sciences	14
Armando	Majorana	Università di Catania	Mathematical and Statistical Sciences	8
Rossana	Marra	Seconda Università di Roma "Tor Vergata"	Mathematical and Statistical Sciences	13
Nader	Masmoudi	New York University	Mathematical and Statistical Sciences	18
Stephane	Mischler	Université de Paris-Dauphine	Mathematical and Statistical Sciences	6
Jose Alberto	Morales	University of Texas at Austin	Unknown	69
Phil	Morrison	University of Texas at Austin	Mathematical and Statistical Sciences	6
Sebastien	Motsch	University of Maryland	Mathematical and Statistical Sciences	4
Clement	Mouhot	University of Cambridge	Mathematical and Statistical Sciences	19
Anne	Nouri	Aix-Marseille University	Mathematical and Statistical Sciences	61
Vlad	Panferov	California State University	Mathematical and Statistical Sciences	7
Stephen	Pankavich	U.S. Naval Academy	Mathematical and Statistical Sciences	7
Lorenzo	Pareschi	Università di Ferrara	Mathematical and Statistical Sciences	17
Gustavo	Perla Menzala	Laboratorio Nacional de Computacao Cientifica	Mathematical and Statistical Sciences	21
Benoit	Perthame	Université de Paris VI (Pierre et Marie Curie)	Mathematical and Statistical Sciences	6
Xueke	Pu	Chongqing University	Unknown	75
Jingmei	Qiu	University of Houston	Mathematical and Statistical Sciences	80
Amelie	Ramnaud	Institut Camille Jordan, Université Lyon 1	Mathematical and Statistical Sciences	40

Gerhard	Rein	Universität Bayreuth	Mathematical and Statistical Sciences	8
Kui	Ren	University of Texas at Austin	Computer Science	4
Alan	Rendall	Max Planck Institute für Gravitationsphysik, Albert-Einstein-Institut	Mathematical and Statistical Sciences	6
Thomas	Rey	Université Claude-Bernard (Lyon I)	Mathematical and Statistical Sciences	26
Matthew	Reyna	Rensselaer Polytechnic Institute	Mathematical and Statistical Sciences	98
Christian	Ringhofer	Arizona State University	Mathematical and Statistical Sciences	6
Luis Miguel	Rodrigues	Université Claude-Bernard (Lyon I)	Mathematical and Statistical Sciences	9
Jesus	Rosado Linares	University of California, Los Angeles	Mathematical and Statistical Sciences	6
Giovanni	Russo	Università di Catania	Mathematical and Statistical Sciences	6
Laure	Saint-Raymond	École Normale Supérieure	Mathematical and Statistical Sciences	5
Jack	Schaeffer	Carnegie Mellon University	Mathematical and Statistical Sciences	6
Chi-Wang	Shu	Brown University	Mathematical and Statistical Sciences	94
Marshall	Slemrod	University of Wisconsin	Mathematical and Statistical Sciences	6
Vedran	Sohinger	Pennsylvania State University	Mathematical and Statistical Sciences	6
Eric	Sonnendruker	Université de Strasbourg I (Louis Pasteur)	Mathematical and Statistical Sciences	13
Ravi	Srinivasan	University of Texas at Austin	Mathematical and Statistical Sciences	6
Robert	Strain	University of Pennsylvania	Mathematical and Statistical Sciences	61
Walter	Strauss	Brown University	Mathematical and Statistical Sciences	101
Henning	Struchtrup	University of Victoria	Engineering	6
Eitan	Tadmor	University of Maryland	Mathematical and Statistical Sciences	6
Shigeru	Takata	Kyoto University	Engineering	6
Maja	Taskovic	University of Texas at Austin	Mathematical and Statistical Sciences	5
Daniela	Tonon	International School for Advanced Studies (SISSA/ISAS)	Mathematical and Statistical Sciences	98
Minh-Binh	Tran	Université de Paris XIII (Paris-Nord)	Mathematical and Statistical Sciences	32

Ariane	Trescases	École Normale Supérieure de Cachan	Mathematical and Statistical Sciences	88
Tetsuro	Tsuji	Kyoto University	Engineering	28
Kent	Van Vels	University of Texas at Austin	Mathematical and Statistical Sciences	55
Li	Wang	University of Wisconsin	Mathematical and Statistical Sciences	5
Dongming	Wei	University of Wisconsin	Mathematical and Statistical Sciences	99
Miles Harley	Wheeler	Brown University	Mathematical and Statistical Sciences	101
Lei	Wu	Brown University	Unknown	75
Yulong	Xing	Oak Ridge National Laboratory	Unknown	9
Xiang	Xu	Carnegie Mellon University	Mathematical and Statistical Sciences	6
Bokai	Yan	University of Wisconsin	Mathematical and Statistical Sciences	56
Tong	Yang	City University of Hong Kong	Mathematical and Statistical Sciences	5
Xu	Yang	New York University	Mathematical and Statistical Sciences	6
Chang	Yang	Université de Lille I (Sciences et Techniques de Lille Flandres Artois)	Unknown	15
He	Yang	Rensselaer Polytechnic Institute	Mathematical and Statistical Sciences	96
Takeru	Yano	Osaka University	Engineering	7
Brent O'Neil	Young	Rutgers University	Mathematical and Statistical Sciences	6
Cheng	Yu	University of Pittsburgh	Mathematical and Statistical Sciences	6
Shih-Hsien	Yu	National University of Singapore	Mathematical and Statistical Sciences	6
Seok-Bae	Yun	Brown University	Mathematical and Statistical Sciences	5
Yanzhi	Zhang	Missouri University of Science and Technology	Mathematical and Statistical Sciences	6
Chenglong	Zhang	University of Texas at Austin	Mathematical and Statistical Sciences	91
Keya	Zhu	University of Pennsylvania	Mathematical and Statistical Sciences	7

\* Includes ICERM Institute and Semester Postdoctoral Fellows

Here follows a sample of the most substantive comments from our long-term visitors. We were not satisfied with the percentage return on our exit survey in our first program, nor with the level of detail in the responses from the semester organizers. To remedy this, some changes were made in the spring survey processes: the Director makes a personal appeal to the entire group prior to survey distribution, and also sends a post-program email to all participants and organizers requesting survey completion from those who haven't already submitted one.

**KTC: Organizer Comments:**

*"I think that our program has reached a high level. There were many interactions among numerical and theoretical people. I know that several new research projects, some involving with both numerical and theoretical aspects, were initiated at ICERM. Moreover, the mentoring for postdocs was also successful with new lines of research setting up for the young researchers. ICERM provided excellent support and stimulating atmosphere for our program."*

*"I have supervised one one-semester postdoc, and one visiting graduate student. We are currently working together on a new research project. I have collaborated with three co-workers during the workshop week, and completed a major research project. I have started to work with numerical people on simulation on our analytic results. The interaction with numerical people has an important impact in strengthening our theoretical result. I began collaborating with engineers on asymptotic expansion of fluid limits in the kinetic theory."*

*"The level and quality of scientific activity are both very high. The program has met and exceeded my expectation as an organizer. The lecture room, audio and video in the room, tea breaks, office, and blackboards in the common areas are all very nice."*

*The physical facilities were beyond my expectations! The three workshops were scientifically and mathematically exciting. The informal teas were excellent, bringing people together. The mentoring program for the younger participants worked perfectly. The staff was always wonderfully helpful!"*

**KTC: Long-Term Participant Comment:**

*"It is a fruitful semester that I spent in ICERM. The workshops with tutorial week are very well-organized. I feel the tutorial week to be very helpful for junior person like myself. The workshops and the discussions are very broad and interesting as well."*

*"Inform and make use of activities and possible collaborators that may be outside ICERM but are within Brown University (Applied Math Dept. faculty and classes, conferences in Science & Engineering Departments, etc.). But in general, it was a great program. It helped me a lot in getting a broad scope on Kinetic Theory by means of the workshops and especially the tutorials (the second workshop about semiconductors by Yingda Cheng was great, it's one of the few lectures in which I have seen fully and very well organized the presentation of the math, physics and computational sides of semiconductor modeling), know most of the worldwide community working on it and making connections with graduate students and professors from all over the world. Thanks for the great organization of this program."*

**KTC: Postdoc Comments:**

*"I continued with some past work with [organizer] Irene Gamba. I also met with Andrew Christlieb and Yaman Guclu at some of the workshops, and we started a new project on high-performance computing with GPUs for kinetic equations. I visited them in Michigan State in November to work on this. I also worked on a continuing project on computing a kinetic model for aggregation problems with Sebastien Motsch, and visited him in at University of Maryland to continue our discussions. I also worked with Cory Hauck of Oak Ridge while he was here for some workshops on our continuing*

project examining the asymptotic properties of the Discontinuous Galerkin method for the low Mach number limit of compressible Euler.”

*“It was a fruitful semester spent at ICERM. The workshops with tutorial week were very well organized. I felt the tutorial week to be very helpful for a junior person like myself. The workshops and the discussions were very broad and interesting as well.”*

#### KTC: Graduate Student Comment:

*“It was a great program. It helped me a lot in getting a broad scope on Kinetic Theory by means of the workshops and specially the tutorials (the one of the second workshop about semiconductors by Yingda Cheng was great, it's one of the few lectures in which I have seen fully and very well organized the presentation of the math, physics and computational sides of semiconductor modeling), know most of the worldwide community working on it and making connections with graduate students and professors from all over the world. Thanks for the great organization of this program.”*



Front and back of flier advertising 2012 spring semester program

### Spring Semester 2012: Complex and Arithmetic Dynamics

January 30 - May 4, 2012

#### Organizing Committee:

Rob Benedetto, Amherst College  
 Laura DeMarco, University of IL/ Chicago  
 Mikhail Lyubich, SUNY Stony Brook  
 Juan Rivera-Letelier, Pontificia Universidad Católica de Chile  
 Joseph Silverman, Brown University  
 Lucien Szpiro, CUNY Graduate Center  
 Michael Zieve, University of Michigan

#### Program Description:

The goal of this program is to bring together researchers in complex dynamics, arithmetic dynamics, and related fields, with the purpose of stimulating interactions, promoting collaborations, making progress on fundamental problems, and developing theoretical and computational foundations on which future work will build. Complex dynamics is the study of

iteration of holomorphic self-maps of a complex space. Fundamental examples of such maps arise as algebraic self-maps of algebraic varieties. Starting with the fundamental results of Fatou and Julia, complex dynamics has evolved into a well-established field with many deep theorems and many important unresolved questions. Arithmetic dynamics refers to the study of number theoretic phenomena arising in dynamical systems on algebraic varieties. Many global problems in arithmetic dynamics are analogues of classical problems in the theory of Diophantine equations or arithmetic geometry, including for example uniform bounds for rational periodic points, intersections of orbits with subvarieties, height bounds and/or measure-theoretic distributions of dynamically defined sets of special points, and local-global obstructions.

While global arithmetic dynamics bears a resemblance to arithmetic geometry, the theory of  $p$ -adic (nonarchimedean) dynamics draws much of its inspiration from classical complex dynamics. As in complex dynamics, a fundamental question is to characterize orbits by their topological or metric properties. Recent progress in  $p$ -adic dynamics, especially in dimension one, has benefited from the introduction of Berkovich space into the subject.

Many computational and graphical techniques have been developed for the study of complex dynamics that have been of immense value in the development of the complex theory. Among the goals of the program will be the development of a comprehensive set of tools for studying  $p$ -adic and arithmetic dynamics.

### **Workshop 1: Complex and $p$ -adic Dynamics**

February 13-17, 2012

*Number of participants: 89*

#### **Program Organizers:**

Matthew Baker, Georgia Institute of Technology

Rob Benedetto, Amherst College

Charles Favre, Ecole Polytechnique

Kevin Pilgrim, Indiana University

Juan Rivera-Letelier, Pontificia Universidad Catolica de Chile

#### **Speakers:**

Alexandru Buium, University of New Mexico

Arnaud Cheritat, Université de Toulouse III (Paul Sabatier)

Laura DeMarco, University of Illinois

Adam Epstein, University of Warwick

Xander Faber, University of Hawaii

Thomas Gauthier, Université Paul Sabatier

Dragos Ghioca, University of British Columbia

Walter Gubler, Universität Regensburg

Liang-Chung Hsia, National Taiwan Normal University

Patrick Malte Ingram, Colorado State University

Rafe Jones, College of the Holy Cross

Mattias Jonsson, University of Michigan

Jeremy Kahn, Brown University

Par Kurlberg, Kungliga Tekniska Hogskolan

Alon Levy, ICERM

Karl-Olof Lindahl, Linnaeus University

Mikhail Lyubich, SUNY

Yūsuke Okuyama, Kyoto Institute of Technology  
Lucien Szpiro, City University of New York (CUNY)  
Eugenio Trucco, Universidad Austral de Chile  
Xinyi Yuan, Princeton University

**Program Description:**

This workshop will bring together researchers working in classical complex dynamics and in the newer area of  $p$ -adic (nonarchimedean) dynamics. It will promote interactions between the two groups by highlighting the similarities and differences between complex and  $p$ -adic dynamics. In particular, it will address Berkovich space, whose introduction has greatly enhanced the exchange of ideas between complex and  $p$ -adic dynamics.

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

**Some workshop organizer comments:**

*“The workshop brought together experts in two fields, arithmetic and complex dynamics. The results presented and interactions during the workshop demonstrated that arithmetic techniques would undoubtedly shed new light on problems in complex dynamics, especially those related to understanding degenerations of complex dynamical systems.”*

*“There were a lot of experts from far corners of the globe in one place, and it was a rare chance to talk with several of them at once. Getting a chance to talk to that collection of people (some of whom are long-distance collaborators of mine) all in one place gave a big boost to my research. In addition, I learned a lot from the talks. In some cases, I learned topics I'd been wanting to learn more about, and in other cases I learned about things I didn't even know were out there; both types of learning were great.”*

**Some workshop participant comments:**

*“For me, the topics were extremely relevant. I learned a great deal and I am re-energized to pursue certain projects that weren't my top priorities. I am very happy with the people that came and the discussions I had.”*

*“I liked that the talks were arranged by topic. There were some topics that I was unfamiliar with, but I felt more comfortable with the vocabulary and notation after several consecutive speakers gave talks on similar material. Regarding the building, I was delighted by how many walls doubled as writing surfaces.”*

*“The facility is just amazing, and so conducive to research & collaboration. People were here working & talking late into the evening, and interesting conversations happened after every talk. I was incredibly impressed with (almost) all of the speakers.”*

*“The balance of good talks with solid breaks for collaboration was just right. It was also great to have blackboards and/or whiteboards essentially everywhere.”*

## Workshop 2: Global Arithmetic Dynamics

March 19-23, 2012

Number of participants: 89

### Program Organizers:

Xander Faber, University of Georgia

Michelle Manes, University of Hawaii

Lucien Szpiro, CUNY Graduate Center

Thomas Tucker, University of Rochester

Michael Zieve, University of Michigan

### Speakers:

Ekaterina Amerik, Université de Paris XI (Paris-Sud)

Rob Benedetto, Amherst College

Frederic Bruno Campana, Université de Nancy I (Henri Poincaré)

Jung Kyu Canci, Universität Basel

Zoe Chatzidakis, Centre National de la Recherche Scientifique (CNRS)

Noam Elkies, Harvard University

Benjamin Hutz, City University of New York (CUNY)

Su-ion Ih, University of Colorado

Sarah Koch, Harvard University

Aaron Levin, Michigan State University

Bjorn Poonen, Massachusetts Institute of Technology

Juan Rivera-Letelier, Pontificia Universidad Catolica de Chile

Thomas Scanlon, University of California, Berkeley

William Stein, University of Washington

Bianca Viray, Brown University

Jose Felipe Voloch, University of Texas at Austin

Shou-Wu Zhang, Princeton University

Michael Zieve, University of Michigan

### Program Description:

This workshop will examine global arithmetic dynamics from the perspectives of number theory, algebraic geometry, and model theory. It will introduce aspects of this topic to a larger audience, and clarify connections between different perspectives. In addition, there will be extensive discussion periods in which participants can collaborate on theoretical and computational aspects of the topic.

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

### Some workshop organizer comments:

*“Grad students got reasonably involved with things, which is very important in my opinion.”*

*“I think we should have required every grad student or postdoc who is here at ICERM for the full semester to present a poster at the poster session of at least one of the three workshops. The poster session was a huge success, and it worked extremely well that grad students who only came to ICERM for this one week were forced to present a poster in exchange for getting travel support. In the future, we could say that any grad student or postdoc has to present a poster in exchange for getting office space at ICERM. This would be good for the grad students/postdocs,*

*since it would put them in a situation where they will interact with other mathematicians about their own work."*

**Some workshop participant comments:**

*"I think this is the best conference I've ever attended. I thought the balance between talks and collaborative time was excellent."*

*"Having so many experts in one place was fantastic. I learned a lot of new things in a short time, and I'd like to think I managed to help out a lot of other people learning things that were new to them. I got much needed jump starts on three already ongoing projects, and brand new starts on two new projects."*

*"As a grad student who does not have a lot of research experience, I really appreciated the various opportunities to discuss my research with important people in this area."*

*"I liked the collaborative problem sessions. They were very useful in both learning how to use SAGE and for collaboration."*

*"Perhaps, at least some potential questions for the collaboration can be posted online before the workshop, so that we can prepare before the workshop?"*

*"The workshop saw the formulation of new questions and conjectures, the computation of new types of data and examples, and the proofs of new theorems which will comprise several papers. In addition there were outstanding talks and excellent interaction." (Workshop Organizer)*

**Workshop 3: Moduli Spaces Associated to Dynamical Systems**

April 16-20, 2012

Number of participants: 76

**Program Organizers:**

Laura DeMarco, University of Illinois at Chicago

Adam Epstein, University of Warwick

Sarah Koch, Harvard University

Curt McMullen, Harvard University

Joseph Silverman, Brown University

**Speakers:**

Araceli Bonifant, University of Rhode Island

Xavier Buff, Université de Toulouse III (Paul Sabatier)

Romain Dujardin, École Polytechnique

Adam Epstein, University of Warwick

John Hubbard, Cornell University

Jan Kiwi, Pontificia Universidad Católica de Chile

Janne Kool, Universiteit Utrecht

Tan Lei, Université d'Angers

Alon Levy, ICERM

Michelle Manes, University of Hawaii

John Milnor, SUNY

Nikita Selinger, Jacobs University

Joseph Silverman, Brown University  
Lucien Szpiro, City University of New York (CUNY)  
Thomas Tucker, University of Rochester  
Eva Uhre, Stony Brook University  
Paul Vojta, University of California, Berkeley

**Program Description:**

This workshop will bring together dynamicists, number theorists, and algebraic geometers to study the geometry and arithmetic of dynamical moduli spaces. The set  $\text{Rat}_d^n$  of rational degree  $d$  self-maps of  $\mathbf{P}^n$  has a natural structure as an affine variety. The dynamical moduli space  $M_d^n$  is the quotient of  $\text{Rat}_d^n$  by the conjugation action of the group  $\text{PGL}_{n+1}$ . Problems to be investigated include the geometry of  $M_d^n$ , the distribution of special maps such as post-critically finite maps in  $M_d^n$ , dynamical modular curves associated to one-parameter families of maps with a marked point of period  $N$ , and degeneration of families of maps and the associated points on the boundary of moduli space. A tutorial session will be held the week before this workshop.

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

**Workshop organizer comments:**

*"I proved a new theorem with a colleague, and this is great. I also learned some valuable things in many of the talks."*

*"I was delighted by the success of the poster session. As I mentioned to Jill Pipher (and others), I was skeptical at first. It sounded like just another thing to organize. But in fact, there was good attendance (maybe even better than at the other two workshops), and the students involved were actively communicating with their audience."*

*"The support to the organizers from the ICERM staff was superb."*

*"It seems a bit strange to have funding for participants (particularly poster presenters) to attend the workshop itself but not the tutorial sessions the week before. I don't know how to integrate the learning part in with the conference. But perhaps the tutorial can be built into the workshop week itself. For example, Monday and Tuesday afternoon, after some talks in the morning."*

**Workshop participant comments:**

*"I liked the interaction between arithmetic and complex analytic approaches to moduli spaces; it was clear that the speakers from each area were making an effort to communicate with members of the other group, and that there were ideas that were very familiar to each group that were quite new to the other group."*

*"I liked the pace of the program and ability to interact with people in related but different areas from my own."*

*"I liked the caliber of research talks and \*plenty\* of time in between to digest and collaborate. Staff is extremely helpful. Facility is stunning. Proximity to hotels a major advantage."*

In response to the last comment: ICERM does not dictate a format for the workshops, and some organizers have experimented with building in collaborative time. In light of this comment, the Directors decided to adopt a more hands-on management approach for future workshops with open-ended formats.

*Poster advertising all three of the 2012 spring semester workshops*

### 2012 Spring Semester Program Participants\* by Length of Stay

First Name	Last Name	Organization	Primary Interest	Visit Length
Domenico	Aiello	University of Massachusetts	Mathematical and Statistical Sciences	5
Ekaterina	Amerik	Université de Paris XI (Paris-Sud)	Unknown	13
Jacqueline	Anderson	Brown University	Mathematical and Statistical Sciences	96
Matthieu	Arfeux	Université de Toulouse III (Paul Sabatier)	Mathematical and Statistical Sciences	57
Cecile	Armana	Westfälische Wilhelms-Universität Münster	Mathematical and Statistical Sciences	105

Matthieu	Astorg	Université de Toulouse III (Paul Sabatier)	Mathematical and Statistical Sciences	5
Matthew	Baker	Georgia Institute of Technology	Mathematical and Statistical Sciences	6
Jennifer	Balakrishnan	Harvard University	Mathematical and Statistical Sciences	4
Tatiana	Bandman	Bar-Ilan University	Mathematical and Statistical Sciences	31
Fabrizio	Barroero	Technische Universität Graz	Mathematical and Statistical Sciences	91
Eric	Bedford	Indiana University	Mathematical and Statistical Sciences	7
Rob	Benedetto	Amherst College	Mathematical and Statistical Sciences	98
Anupam	Bhatnagar	City University of New York (CUNY)	Mathematical and Statistical Sciences	122
Paul	Blanchard	Boston University	Mathematical and Statistical Sciences	5
Araceli	Bonifant	University of Rhode Island	Mathematical and Statistical Sciences	73
Joshua	Bowman	Stony Brook University	Mathematical and Statistical Sciences	4
Suzanne	Boyd	University of Wisconsin	Mathematical and Statistical Sciences	3
Brian	Boyd	IT Consultant	Unknown	3
Andrew	Bridy	University of Wisconsin	Mathematical and Statistical Sciences	93
Alexandru	Buium	University of New Mexico	Mathematical and Statistical Sciences	6
Xavier	Buff**	Université de Toulouse III (Paul Sabatier)	Mathematical and Statistical Sciences	150
Frederic	Campana	Université de Nancy I (Henri Poincaré)	Mathematical and Statistical Sciences	21
Jung Kyu	Canci	Universität Basel	Mathematical and Statistical Sciences	34
Zoe	Chatzidakis	Centre National de la Recherche Scientifique (CNRS)	Mathematical and Statistical Sciences	50
Arnaud	Cheritat	Université de Toulouse III (Paul Sabatier)	Unknown	30
Mark	Comerford	University of Rhode Island	Mathematical and Statistical Sciences	10
Alvaro	Coronel	Pontificia Universidad Catolica de Chile	Mathematical and Statistical Sciences	13
Daniel	Cuzzocreo	Boston University	Unknown	5
Carlos	D'Andrea	University of Barcelona	Mathematical and Statistical Sciences	7
Diana	Davis	Brown University	Mathematical and Statistical Sciences	5
Laura	DeMarco	University of Illinois	Mathematical and Statistical Sciences	35
Bob	Devaney	Boston University	Mathematical and Statistical Sciences	1

Kevin	Doerksen	Simon Fraser University	Mathematical and Statistical Sciences	6
John	Doyle	University of Georgia	Mathematical and Statistical Sciences	7
Dzmitry	Dudko	University of Goettingen	Mathematical and Statistical Sciences	45
Romain	Dujardin	École Polytechnique	Unknown	6
Noam	Elkies	Harvard University	Mathematical and Statistical Sciences	5
Adam	Epstein	University of Warwick	Mathematical and Statistical Sciences	84
Timo	Erkama	University of Eastern Finland	Mathematical and Statistical Sciences	7
Xander	Faber***	University of Hawaii	Mathematical and Statistical Sciences	12
Youssef	Fares	Université de Picardie (Jules Verne)	Mathematical and Statistical Sciences	7
Charles	Favre	École Polytechnique	Mathematical and Statistical Sciences	11
Paul	Fili	University of Rochester	Mathematical and Statistical Sciences	7
Tanya	Firsova	Stony Brook University	Mathematical and Statistical Sciences	56
Joanna	Furno	University of North Carolina	Mathematical and Statistical Sciences	7
Derek	Garton	University of Wisconsin	Mathematical and Statistical Sciences	98
Jonah	Gaster	University of Illinois - Chicago	Mathematical and Statistical Sciences	5
Thomas	Gauthier	Univesité Paul Sabatier	Mathematical and Statistical Sciences	5
Dragos	Ghioca	University of British Columbia	Mathematical and Statistical Sciences	6
William	Gignac	University of Michigan	Mathematical and Statistical Sciences	96
Chad	Gratton	University of Rochester	Mathematical and Statistical Sciences	5
Walter	Gubler	Universität Regensburg	Unknown	5
Wade	Hindes	Brown University	Mathematical and Statistical Sciences	5
Mikhail	Hlushchanka	Jacobs University	Mathematical and Statistical Sciences	18
Wei	Ho	Columbia University	Mathematical and Statistical Sciences	6
Liang-Chung	Hsia	National Taiwan Normal University	Mathematical and Statistical Sciences	43
Hsiu Lien	Huang	Academia Sinica	Mathematical and Statistical Sciences	9
John	Hubbard	Cornell University	Mathematical and Statistical Sciences	5
Benjamin	Hutz	City University of New York (CUNY)	Mathematical and Statistical Sciences	39

Zair	Ibragimov	California State University	Mathematical and Statistical Sciences	7
Su-ion	Ih	University of Colorado	Mathematical and Statistical Sciences	16
Patrick	Ingram	Colorado State University	Mathematical and Statistical Sciences	90
Hiroyuki	Inou	Kyoto University	Mathematical and Statistical Sciences	7
Rafe	Jones	College of the Holy Cross	Unknown	6
Mattias	Jonsson	University of Michigan	Mathematical and Statistical Sciences	6
Jeremy	Kahn	Brown University	Mathematical and Statistical Sciences	96
Shu	Kawaguchi	Osaka University	Mathematical and Statistical Sciences	13
Tomoki	Kawahira	Nagoya University	Mathematical and Statistical Sciences	19
Kiran	Kedlaya	University of California, San Diego	Mathematical and Statistical Sciences	5
Linda	Keen	Herbert H. Lehman College, CUNY	Unknown	5
Jan	Kiwi	Pontificia Universidad Catolica de Chile	Mathematical and Statistical Sciences	6
Sarah	Koch	Harvard University	Mathematical and Statistical Sciences	73
Janne	Kool	Universiteit Utrecht	Unknown	5
Robert	Kozma	Stony Brook University	Unknown	1
Holly	Krieger	University of Illinois	Mathematical and Statistical Sciences	7
Par	Kurlberg	Kungliga Tekniska Hogskolan	Mathematical and Statistical Sciences	20
ChongGyu	Lee	University of Illinois	Mathematical and Statistical Sciences	83
Tan	Lei	Université d'Angers	Mathematical and Statistical Sciences	5
Benjamin	LeVeque	Brown University	Unknown	5
Aaron	Levin	Michigan State University	Mathematical and Statistical Sciences	5
Huaibin	Li	Pontificia Universidad Catolica de Chile	Mathematical and Statistical Sciences	80
Jan-Li	Lin	Indiana University	Mathematical and Statistical Sciences	99
Karl-Olof	Lindahl	Linnaeus University	Mathematical and Statistical Sciences	55
Kathryn	Lindsey	Cornell University	Unknown	7
Sijun	Liu	University of Michigan	Mathematical and Statistical Sciences	62
Jinsong	Liu	Chinese Academy of Sciences	Mathematical and Statistical Sciences	7
Russell	Lodge	Indiana University Bloomington	Mathematical and Statistical Sciences	12

Jonathan	Lubin	Morris Avenue Associates	Mathematical and Statistical Sciences	14
Mikhail	Lyubich	SUNY	Mathematical and Statistical Sciences	5
Mahdi	Majidi-Zolbanin	City College, CUNY	Mathematical and Statistical Sciences	7
Khudoyor	Mamayusupov	Jacobs University	Mathematical and Statistical Sciences	19
Michelle	Manes	University of Hawaii	Mathematical and Statistical Sciences	96
Alice	Medvedev	University of California, Berkeley	Mathematical and Statistical Sciences	19
Ricardo	Menares	Pontificia Universidad Catolica de Chile	Mathematical and Statistical Sciences	7
Nikita	Miasnikov	City University of New York (CUNY)	Mathematical and Statistical Sciences	5
John	Milnor	SUNY	Mathematical and Statistical Sciences	70
Igor	Minevich	Brown University	Mathematical and Statistical Sciences	5
Khoa	Nguyen	University of California, Berkeley	Mathematical and Statistical Sciences	91
Andrew	Obus	Max-Planck-Institut für Mathematik	Mathematical and Statistical Sciences	6
Yûsuke	Okuyama	Kyoto Institute of Technology	Mathematical and Statistical Sciences	7
Alina	Ostafe	Macquarie University	Mathematical and Statistical Sciences	14
Frank	Palladino	University of Rhode Island	Mathematical and Statistical Sciences	96
Donghoon	Park	Korea Advanced Institute of Science and Technology (KAIST)	Unknown	61
Carsten	Petersen	Roskilde University Center	Mathematical and Statistical Sciences	7
Kevin	Pilgrim	Indiana University	Unknown	13
Jorge	Pineiro	Bronx Community College, CUNY	Mathematical and Statistical Sciences	98
Bjorn	Poonen	Massachusetts Institute of Technology	Mathematical and Statistical Sciences	11
Lukas	Pottmeyer	Universität Regensburg	Mathematical and Statistical Sciences	42
Remus	Radu	Cornell University	Mathematical and Statistical Sciences	12
Jamie	Rahr	University of Rochester	Mathematical and Statistical Sciences	6
Paul	Reschke	University of Illinois	Mathematical and Statistical Sciences	5
Juan	Rivera-Letelier	Pontificia Universidad Catolica de Chile	Mathematical and Statistical Sciences	97
John	Roberts	University of New South Wales	Mathematical and Statistical Sciences	15

Bastien	Rossetti	Institut de Mathématiques de Toulouse	Mathematical and Statistical Sciences	29
Robert	Rumely	University of Georgia	Mathematical and Statistical Sciences	67
Adriana	Salerno	Bates College	Mathematical and Statistical Sciences	12
Thomas	Scanlon	University of California, Berkeley	Mathematical and Statistical Sciences	3
Zachary	Scherr	University of Michigan	Mathematical and Statistical Sciences	96
Dierk	Schleicher	Jacobs University	Mathematical and Statistical Sciences	41
Nikita	Selinger	Jacobs University	Unknown	12
Thomas	Sharland	University of Warwick	Mathematical and Statistical Sciences	89
Mitsuhiro	Shishikura	Kyoto University	Mathematical and Statistical Sciences	7
Joseph	Silverman	Brown University	Mathematical and Statistical Sciences	98
Martin	Sombra	University of Barcelona	Mathematical and Statistical Sciences	6
Katherine	Stange	Stanford University	Mathematical and Statistical Sciences	7
William	Stein	University of Washington	Mathematical and Statistical Sciences	5
Michael	Stoll	Universität Bayreuth	Mathematical and Statistical Sciences	31
Brian	Stout	City University of New York (CUNY)	Mathematical and Statistical Sciences	11
Scott	Sutherland	Stony Brook University	Mathematical and Statistical Sciences	7
Lucien	Szpiro	City University of New York (CUNY)	Mathematical and Statistical Sciences	23
Raluca	Tanase	Cornell University	Mathematical and Statistical Sciences	9
Michael	Tepper	Pennsylvania State University, Ogonitz Campus	Mathematical and Statistical Sciences	14
Lubos	Thoma	University of Rhode Island	Mathematical and Statistical Sciences	5
Bianca	Thompson	University of Hawaii at Manoa	Mathematical and Statistical Sciences	99
Adam	Towsley	University of Rochester	Mathematical and Statistical Sciences	15
Eugenio	Trucco	Universidad Austral de Chile	Mathematical and Statistical Sciences	6
Thomas	Tucker	University of Rochester	Mathematical and Statistical Sciences	87
Eva	Uhre	Stony Brook University	Mathematical and Statistical Sciences	36
Bianca	Viray	Brown University	Mathematical and Statistical Sciences	122
Paul	Vojta	University of California,	Mathematical and	96

		Berkeley	Statistical Sciences	
Jose	Voloch	University of Texas at Austin	Mathematical and Statistical Sciences	6
Xiaoguang	Wang	Chinese Academy of Sciences	Mathematical and Statistical Sciences	122
Chi-Hao	Wang	National Central University	Mathematical and Statistical Sciences	96
Lloyd	West	City University of New York (CUNY)	Mathematical and Statistical Sciences	5
Siman	Wong	University of Massachusetts	Mathematical and Statistical Sciences	7
Elizabeth	Wulcan	Chalmers University of Technology	Mathematical and Statistical Sciences	12
Kazuhiko	Yamaki	Kyoto University	Mathematical and Statistical Sciences	14
Yu	Yasufuku	Nihon University	Mathematical and Statistical Sciences	14
Tianjun	Ye	Georgia Tech College of Computing	Mathematical and Statistical Sciences	5
Hexi	Ye	University of Illinois	Unknown	5
Jean-Christophe	Yoccoz	Collège de France	Mathematical and Statistical Sciences	13
Xinyi	Yuan	Princeton University	Mathematical and Statistical Sciences	6
Shou-Wu	Zhang	Princeton University	Mathematical and Statistical Sciences	10
Liang	Zhao	City University of New York (CUNY)	Mathematical and Statistical Sciences	6
Ilies	Zidane	The Toulouse Mathematics Institute	Mathematical and Statistical Sciences	59
Michael	Zieve	University of Michigan	Mathematical and Statistical Sciences	98

\* Includes ICERM Institute and Semester Postdoctoral Fellows

\*\*Xavier Buff was awarded a Clay Senior Scholar to enable him to participate in this semester program at ICERM.

\*\*\* While at ICERM, semester program speaker and workshop organizer Xander Faber began a large-scale project with two graduate students, searching for preperiodic structures for  $z^2+c$  over quadratic fields. The institute provided him access to Brown's High Performance Computing (HPC) cluster for the month of March. Their computations were directly related to the themes of the CAD semester at ICERM, and the methods and results of their calculations will provide tools and data with which to make further conjectures and formulate proofs. Faber's report can be found in Appendix J.

Here follows a sample of the most substantive comments from our long-term visitors.

#### **CAD: Organizer Comments:**

*"In my opinion, the CAD program was a resounding success. The long-term visitors forged many new connections and, if the intense conversations I constantly saw in the common areas is any indication, worked on a large number of interesting new research projects. There was, I believe, a*

good amount of interaction among the senior researchers, postdocs, and graduate students, although there are probably ways in which this could have been further increased. The number and quality of the mathematicians who visited ICERM for extended periods was, to me, breathtaking; and if one also counts the people who came to one or more of the workshops, it seemed that virtually everyone in the world working in arithmetic dynamics, and a large percentage of the people who work in discrete complex dynamics, visited ICERM. I expect a huge number of projects and papers to arise as a direct result of the CAD program, plus a Sage dynamical package that will be a tool for researchers in dynamics for years to come. On a personal note, with what I learned, with the connections that I made, and with the projects that I've started, I expect that the ICERM CAD program has provided me with enough major research projects to last a decade."

"Matt Baker (from the number theory side) and I have a new project that finally took a serious step forward this semester. During the first workshop, we spoke with Dragos Ghioca and Tom Tucker and exchanged ideas: our complex-analytic trick helps them solve their problem and they helped us extend the method to handle more of our problem. Then, during the second workshop, I spoke with Alice Medvedev (from the model theory group), and she explained how her work with Tom Scanlon applies to another piece of my project with Matt. Putting all the pieces together gives us the first provable setting for our Dynamical Andre-Oort Conjecture; the proof uses both arithmetic dynamics and complex dynamics in crucial ways. We will thank ICERM in the preprint we write up this summer."

"It was one of the best workshops or conferences I've ever been to as far as interesting collections of talks, a fantastic collection of experts, a great balance of chances to collaborate with colleagues, and general atmosphere for research."

"I had extended opportunities to meet with colleagues in my own research area, and with new colleagues from another area. The physical space lends itself well to such interactions."

#### **CAD: Long-Term Participant Comments:**

"I expected lots of time to work on my research. I actually had less "sit and write" time compared to what I expected. But the excitement of working with folks here, bouncing ideas around, generating new projects...it was just amazing and beyond what I could have expected. One I stopped thinking of this semester as a time to complete projects and instead thought of it as a time to set up my research agenda for the next 5 - 10 years, then I really began to appreciate what we had here. I've never had a better (or even close) professional experience."

"There have been lots of opportunities to talk with experts in related areas and share ideas. I haven't seen any conferences that had more experts in this area of research than this ICERM workshop."

"I recently completed a project in another area of mathematics which I had been working on for many years. I had gotten very stale mathematically, and I feel as if I had been mathematically reborn. I learned a lot of things, and got interested in new problems which will be the main focus of my research over the next few years."

#### **CAD: Postdoc Comments:**

"The mix of seminars, workshops and lot of time in between provided huge opportunities for collaboration and to gain new knowledge from experts in the field. The number of experts and the fact that many researchers stayed for a long time played a key role in the success of the program, but also the organization and the staff supporting the program played a great role. Also the building itself with lot of collaborate space and blackboards everywhere and nice design and atmosphere certainly

*contributed to make the program into such a great success. I also appreciated very much the shared housing that ICERM provided for me. Through this I also gained new collaborators and friends in the field. Thank you all for a very good time at ICERM!"*

**CAD: Graduate Student Comments:**

*"Before my visit, I only expected to learn a few open questions in the area. Now, not only do I know a handful of them, I actually collaborated with a few other visitors to solve some of them."*

*"It was amazing to be in an environment for so long filled with people who understand what you are doing. Whenever I was puzzled about a problem or concept introduced in a talk, instead of waiting for the opportunity to discuss it with my adviser, I was able to walk into the common area and a few of us could work through the idea. I was not expecting this to be how the program worked. It was wonderful to have the opportunity to hear talks by speakers who have contributed so much to the field. It was good to get a chance to meet them."*

*"The program gives an opportunity to put both complex dynamics people and  $p$ -adic dynamics people in one place, all together. I learned many things from  $p$ -adic people, by talks, and by discussions. My interest is so enlarged!"*

For upcoming programs (including semester, topical workshops, VI-MSS workshops, and workshops hosted at ICERM but provided with outside funding), please see Appendix B.

## **Topical Workshops**

At its November 2010 meeting, the Scientific Advisory Board selected three workshops, among the five proposals presented.

### **1. Solicitation of Topical Workshop Proposals:**

Proposals for topical workshops contain:

- a description of the program area/theme (written with a general mathematical audience in mind),
- a list of organizers (normally around 4-7),
- a main contact (chair) of organizing committee,
- a discussion of the experimental and computational aspects of the program,
- the expected benefits of the proposed program,
- plans for ensuring the participation of underrepresented groups (organizers are expected to work with ICERM Directors on diversity issues),
- White paper encouraged

### **2. Proposal Selection:**

The Science Advisory Board (SAB) approves the topical workshops. The deadline for proposals is early October, prior to the annual November SAB meeting. Approved program dates will be scheduled with details posted on the ICERM website and various on-line math organization calendars (SIAM, AMS, European Mathematical Society, National Math Institutes).

From this point on, applications for graduate students and workshop participants will be considered; the chair of the workshop organizing committee (or other designated organizer) will assist ICERM staff by providing appropriate program images for web and print ads, and may be asked to review marketing materials.

### **3. Recommendation of Speakers**

The organizers will propose a ranked list of 15 to 20 speakers, which the ICERM Directors will approve and/or suggest additions or re-rankings in consultation with SAB members.

### **4. Invitations to Speakers**

Once the list of workshop speakers has been finalized and funding determined, an invitation will be sent to each. The invitation will describe the workshop and outline the support to be provided. Using its Discovery database, ICERM will track demographic information about, and all interactions with, speakers.

### **5. Application Process**

Once the organizers and Directors agree there is enough critical mass in terms of confirmed speakers, the on-line application for that particular workshop will be opened on the ICERM website. All applications will automatically be synced with ICERM's Discovery database.

### **6. Applicant Selection**

The Discovery database allows workshop organizers, ICERM Directors and staff to view each candidate's application. Every two weeks or so, the organizers will be asked to recommend a ranking of applicants for their program (graduate students, participants). ICERM Directors will review the ranked list, re-rank as appropriate and make the final selections, taking into consideration the remaining budget for the program, diversity, participant support requested. ICERM staff will then update the applicant about their status, and any support they are eligible for, as appropriate. This process continues until funds for the program run out. At some point in the future, this rolling application process will be replaced by one that has deadlines.

### **Financial Decisions for Topical Workshops**

Financial decisions are made by ICERM Directors based on discussions with organizers. There is support for housing and travel support for around 20-25 speakers (including organizers), who stay for 1 week. The institute reserves some funds to support uninvited applicants.

There were two topical workshops in August 2011. Since these were ICERM's first events, they were smaller than we typically expect.

## VI-MSS Topical Workshops

The application process for topical workshops for VI-MSS is a work in progress. The January 2-11 workshop in Kolkata was organized by Jeffrey Hoffstein (ICERM) and Bimal Roy (ISI). Hoffstein consulted with several members of the cryptography community (Shafi Goldwasser, MIT and Tal Rabin, IBM) to finalize the list of invited speakers. Although neither Goldwasser nor Rabin could attend the event, they helped to find other key participants for the conference. Hoffstein has received a book contract from AMS to publish the proceedings of the conference.



## Topical Workshops in 2011-2012

ICERM has hosted 3 workshops in 2011-2012. They focus on topics of current interest in the mathematical sciences.

### Topical Workshop #1: Mathematical Aspects of P versus NP and its Variants

August 1-5, 2011

Participants: 37

#### Organizing Committee:

Saugata Basu, Purdue University

JM Landsberg, Texas A&M

J. Maurice Rojas, Texas A&M

## Speakers:

Eric Bach, University of Wisconsin

Lenore Blum, Carnegie Mellon University

Jin Yi Cai, University of Wisconsin

Qi Cheng, University of Oklahoma

Kirsten Eisenträger, Pennsylvania State University

Josh Grochow, University of Chicago

Leonid Gurvits, Los Alamos National Laboratory

Sean Hallgren, Pennsylvania State University

Pascal Koiran, École Normale Supérieure de Lyon

Shrawan Kumar, University of North Carolina

Jeffrey Lagarias, University of Michigan

Jason Ryder Morton, Pennsylvania State University

Peter Scheiblechner, Rheinische Friedrich-Wilhelms-Universität Bonn

Michael Shub, Instituto Argentino de Matemática (IAM) CONICET

Milind Sohoni, Indian Institute of Technology

Leslie Valiant, Harvard University

Jerzy Weyman, Northeastern University

Ke Ye, Texas A & M University

Thierry Zell, Lenoir-Rhyne

**Description:**

This workshop will bring together computer scientists and mathematicians to examine the P v. NP problem and its variants from the perspectives of algebra, geometry, and number theory, and to introduce the mathematical aspects of these questions to a larger audience. Diverse researchers working on different aspects of these problems will clarify connections between different approaches.

There will be two main topics: Analogues of P v. NP (*e.g., Valiant's conjectures, the Mulmuley-Sohoni Conjecture, the BSS model, and other computational models*); and Algebraic, Number Theoretic, and Geometric Aspects of P v. NP (*e.g., Holographic algorithms, characterizations of NP in terms of sheaf cohomology, sparse polynomials, and other arithmetic approaches*).

The workshop will emphasize the "work" aspect, so there will be few scheduled lectures, with extensive discussion periods, and follow-up lectures scheduled impromptu as needed.

**Topical Workshop (P vs NP) Participants**

First Name	Last Name	Organization	Primary Interest	Visit Length
Dan	Abramovich	Brown University	Mathematical and Statistical Sciences	5
Eric	Bach	University of Wisconsin	Computer Science	6
Saugata	Basu	Purdue University	Mathematical and Statistical Sciences	6
Jonah	Blasiak	University of Michigan	Mathematical and Statistical Sciences	6
Lenore	Blum	Carnegie Mellon University	Computer Science	6
Jin Yi	Cai	University of Wisconsin	Computer Science	6
Arkadev	Chattopadhyay	University of Toronto	Mathematical and Statistical Sciences	6
Qi	Cheng	University of Oklahoma	Computer Science	6
Edward	Dunne	American Mathematical Society	Mathematical and Statistical Sciences	5
Kirsten	Eisentrager	Pennsylvania State University	Mathematical and Statistical Sciences	6
Josh	Grochow	University of Chicago	Mathematical and Statistical Sciences	6
Leonid	Gurvits	Los Alamos National Laboratory	Mathematical and Statistical Sciences	6
Sean	Hallgren	Pennsylvania State University	Computer Science	6
Sherwin	Han	Bolt Beranek and Newman (BBN) Laboratories, Inc.	Life Sciences	5
Harlan	Kadish	University of Michigan	Mathematical and Statistical Sciences	7
Delaram	Kahrobaei	City University of New York (CUNY)	Mathematical and Statistical Sciences	7
Ryan	Kinser	Northeastern University	Mathematical and Statistical Sciences	1

Pascal	Koiran	Ecole Normale Supérieure de Lyon	Computer Science	6
Michael	Krul	University of Rhode Island	Mathematical and Statistical Sciences	5
Shrawan	Kumar	University of North Carolina	Mathematical and Statistical Sciences	6
Jeffrey	Lagarias	University of Michigan	Computer Science	6
Joseph	Landsberg	Texas A & M University	Mathematical and Statistical Sciences	6
Jason	Morton	Pennsylvania State University	Mathematical and Statistical Sciences	6
Maurice	Rojas	Texas A & M University	Mathematical and Statistical Sciences	6
Korben	Rusek	Texas A & M University	Mathematical and Statistical Sciences	6
Steven	Sam	Massachusetts Institute of Technology	Mathematical and Statistical Sciences	5
Peter	Scheiblechner	Rheinische Friedrich-Wilhelms-Universität Bonn	Mathematical and Statistical Sciences	6
Michael	Shub	Instituto Argentino de Matematica (IAM), CONICET	Mathematical and Statistical Sciences	6
Milind	Sohoni	Indian Institute of Technology	Engineering	6
Jeremy	Teitelbaum	University of Connecticut	Mathematical and Statistical Sciences	5
Lubos	Thoma	University of Rhode Island	Mathematical and Statistical Sciences	5
Jacob	Turner	Pennsylvania State University	Mathematical and Statistical Sciences	7
Leslie	Valiant	Harvard University	Computer Science	6
Jerzy	Weyman	Northeastern University	Mathematical and Statistical Sciences	6
Wei	Wu	Brown University	Mathematical and Statistical Sciences	5
Ke	Ye	Texas A & M University	Mathematical and Statistical Sciences	6
Thierry	Zell	Lenoir-Rhyne	Mathematical and Statistical Sciences	6

Note: an arXiv.org publication resulted from this workshop: “Report on Mathematical Aspects of P vs. NP and its Variants.” (<http://arxiv.org/abs/1203.2888>). See Appendix J for this and all self-reported publications and collaborations resulting from ICERM programs to date.

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

**Some workshop organizer comments:**

*“We brought together researchers from the geometry, representation theory, number theory, and complexity theory communities and had them discuss and listen to each other’s talks.”*

*“Main goal was met: establishing communication was fully met. Some secondary goals: putting certain computer science questions on more solid mathematical ground, putting other questions in more geometric language were partially met.”*

*“ICERM could give stronger guidance regarding the schedule. We ended up having too many talks in the view of many participants, and the time for small discussion groups was too limited. Also (this due to our inexperience), the schedule (times of breaks) varied daily in a way that confused some participants.”*

In response to the last comment, we note that P vs. NP was the institute’s first workshop and many processes were still being developed.

### Some workshop participant comments:

*“Relevant and highly up-to-date topics of talks relevant to my research. Flawless organization by the ICERM staff. Thank you!”*

*“Meeting people from diverse areas of mathematics and computer science. Extra time to collaborate and lots of discussions during talks.”*

*“Conference was great, in every way! ICERM setup, local arrangements, interactions with participants ....ICERM staff very helpful. Workshop venue gives opportunity to meet people and interact.”*

The poster is for the ICERM workshop "Cluster Algebras and Statistical Physics" held from August 15-19, 2011. It features the ICERM logo at the top left, which includes a stylized cube and the text "ICERM Institute for Computational and Experimental Research in Mathematics". To the right of the logo are the logos for NSF and Brown University. The main title "Cluster Algebras and Statistical Physics" is prominently displayed, followed by "TOPICAL WORKSHOP • AUGUST 15-19, 2011". Below this, the "Organizing Committee" lists Lauren Williams (UC Berkeley) and David Wilson (Microsoft Research). A "Description" section explains that cluster algebras are commutative algebras with a distinguished set of generators grouped into overlapping subsets of fixed cardinality, and that the workshop will explore the connection between cluster algebras and various topics in statistical physics. A "Confirmed Speakers" section lists 14 participants from various institutions. At the bottom, there is a "Participation" section with details about the workshop's focus on research and teaching, and a "About ICERM" section describing its mission and location at Brown University. The URL "http://icerm.brown.edu" is printed vertically on the left side of the poster.

### Topical Workshop #2: Cluster Algebras and Statistical Physics

August 15-19, 2011

Participants: 38

### Organizing Committee:

Lauren Williams, UC Berkeley

David Wilson, Microsoft Research

### Speakers:

Philippe di Francesco, Commissariat à l'Énergie Atomique Saclay (CEA)

Michael Gekhtman, University of Notre Dame

Max Glick, University of Michigan

Andrew Hone, University of Kent at Canterbury

Rinat Kedem, University of Illinois at Urbana-Champaign

Bernhard Keller, Université de Paris VII (Denis Diderot)

Richard Kenyon, Brown University

Yuji Kodama, Ohio State University

Kyungyong Lee, Wayne State University

Karola Meszaros, Massachusetts Institute of Technology

Jim Morrow, University of Washington

Gregg Musiker, University of Minnesota  
Tomoki Nakanishi, Nagoya University  
James Propp, University of Massachusetts  
Ralf Schiffler, University of Connecticut  
Michael Shapiro, Michigan State University  
Kelli Talaska, University of California, Berkeley  
Dylan Thurston, Columbia University  
Lauren Williams, University of California, Berkeley  
David Wilson, Microsoft Research  
Andrei Zelevinsky, Northeastern University

### **Description:**

Cluster algebras are commutative algebras with a distinguished set of generators grouped into overlapping subsets of fixed cardinality; the generators and the relations among them are not given from the outset, but are produced by an iterative process of successive mutations. These algebras were developed in an attempt to create an algebraic framework for dual canonical bases and total positivity in semisimple groups. Another motivation came from the “Laurent phenomenon,” in which certain a priori rational functions defined by “exchange relations” turn out to always be Laurent polynomials. Cluster algebras encode a surprisingly widespread range of phenomena in settings as diverse as quiver representations, Teichmüller theory, invariant theory, tropical calculus, Poisson geometry, and polyhedral combinatorics. This workshop will explore the connection between cluster algebras and various topics in statistical physics, including the dimer model on surfaces, integrable systems such as the KP equation, and certain dynamical systems (Y- and Q-systems) which play an important role in the theory of the thermodynamic Bethe Ansatz.

### **Topical Workshop (Cluster Algebras) Participants**

<b>First Name</b>	<b>Last Name</b>	<b>Organization</b>	<b>Primary Interest</b>	<b>Visit Length</b>
Melody	Chan	University of California, Berkeley	Mathematical and Statistical Sciences	5
Philippe	di Francesco	Commissariat Energie Atomique Saclay (CEA)	Mathematical and Statistical Sciences	6
Michael	Gekhtman	University of Notre Dame	Mathematical and Statistical Sciences	6
Max	Glick	University of Michigan	Mathematical and Statistical Sciences	6
Andrew	Hone	University of Kent at Canterbury	Mathematical and Statistical Sciences	5
Theo	Johnson-Freyd	University of California, Berkeley	Mathematical and Statistical Sciences	6
Adrien	Kassel	Ecole Nationale Supérieure de Telecommunications (ENST)	Mathematical and Statistical Sciences	5
Rinat	Kedem	University of Illinois at Urbana-Champaign	Mathematical and Statistical Sciences	6
Bernhard	Keller	Université de Paris VII (Denis Diderot)	Mathematical and Statistical Sciences	6
Richard	Kenyon	Brown University	Mathematical and	6

			Statistical Sciences	
Ryan	Kinser	Northeastern University	Mathematical and Statistical Sciences	2
Yuji	Kodama	Ohio State University	Mathematical and Statistical Sciences	6
Christian	Korff	University of Glasgow	Mathematical and Statistical Sciences	6
Chul-hee	Lee	University of California, Berkeley	Mathematical and Statistical Sciences	6
Kyungyong	Lee	Wayne State University	Mathematical and Statistical Sciences	6
Nan	Li	Massachusetts Institute of Technology	Mathematical and Statistical Sciences	6
Kenichi	Maruno	University of Texas Pan American	Mathematical and Statistical Sciences	7
Karola	Meszaros	Massachusetts Institute of Technology	Mathematical and Statistical Sciences	6
Jim	Morrow	University of Washington	Mathematical and Statistical Sciences	6
Gregg	Musiker	University of Minnesota	Mathematical and Statistical Sciences	6
Tomoki	Nakanishi	Nagoya University	Mathematical and Statistical Sciences	6
James	Propp	University of Massachusetts	Mathematical and Statistical Sciences	5
Pavlo	Pylyavskyy	University of Minnesota	Mathematical and Statistical Sciences	8
Steven	Sam	Massachusetts Institute of Technology	Mathematical and Statistical Sciences	6
Ralf	Schiffler	University of Connecticut	Mathematical and Statistical Sciences	6
Michael	Shapiro	Michigan State University	Mathematical and Statistical Sciences	6
Linhui	Shen	Yale University	Mathematical and Statistical Sciences	6
Salvatore	Stella	Northeastern University	Mathematical and Statistical Sciences	6
Nike	Sun	Stanford University	Mathematical and Statistical Sciences	5
Kelli	Talaska	University of California, Berkeley	Mathematical and Statistical Sciences	6
Dylan	Thurston	Columbia University	Mathematical and Statistical Sciences	6
Peter	Tingley	Massachusetts Institute of Technology	Mathematical and Statistical Sciences	6
Zhen	Wei	University of Virginia	Mathematical and Statistical Sciences	7
Harold	Williams	University of California, Berkeley	Mathematical and	7

			Statistical Sciences	
Lauren	Williams	University of California, Berkeley	Mathematical and Statistical Sciences	6
David	Wilson	Microsoft Research	Computer Science	6
Wei	Wu	Brown University	Mathematical and Statistical Sciences	2
Andrei	Zelevinsky	Northeastern University	Mathematical and Statistical Sciences	6

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

**Some workshop organizer comments:**

*"I was really happy about the support we received from ICERM before and during the conference!"*

*"The talks were really interesting, and the long breaks allowed participants to have many mathematical discussions."*

**Some workshop participant comments:**

*"World experts in the field, ample "breaks" to network/ask questions/collaborate, funding for grad students, nice and convenient accommodations, awesome whiteboard -- really nice conference!"*

*"Good location and great facilities; generous breaks between talks; good mixture of talks including some excellent introductory ones; nice idea to include software demonstrations, very practical!"*

*"Very friendly and open atmosphere. Good balance of more experienced and young researchers. The staff was friendly and helpful. The "writing wall" was very neat and helpful."*



**ICERM**  
The Institute for Computational and Experimental Research in Mathematics

2012–2013 Topical Workshops

**About ICERM**  
The Institute for Computational and Experimental Research in Mathematics (ICERM) is a National Science Foundation Mathematics Institute at Brown University in Providence, RI. Its mission is to broaden the relationship between mathematics and computation, specifically to expand the use of computational and experimental methods in mathematics, to support theoretical advances in computation, and address problems posed by the existence and use of the computer through mathematical study, research and innovation.

[icerm.brown.edu](http://icerm.brown.edu)



Institute for Computational and Experimental Research in Mathematics  
2012 Topical Workshops

**Synchronization reducing and Communication-reducing Algorithms and Programming Models for Large-scale Simulations**  
January 9–13, 2012

As concurrency in scientific computing pushes beyond a million threads, and performance of individual threads becomes less reliable for hardware-related reasons, attention of mathematicians, computer scientists, and a growing number of users and suppliers inevitably focuses on reducing communication and synchronization bottlenecks. Though convenient for succinctness, reproducibility, and stability, heuristic coding in contemporary codes is commonly unexploited. This workshop attempts to outline evolution of simulation codes from today's infrastructure to the ultra-scalable and to encourage reuse of ideas from other areas of computer science into numerical algorithms, new inventors, and programming model generalization.

**Organizing Committee**  
David Hestenes, The University of Chicago  
Kathleen Yelick, University of California at Berkeley and NERSC

**NSF/CBMS Conference: Finite Element Exterior Calculus (FEEC)**  
June 11–15, 2012

FEEC is a recent advance in the mathematics of finite element methods that employs differential complexes to construct stable numerical schemes for several important types of application problems. It has aroused great interest because it both presents interesting mathematical problems and offers great potential for application in computational science and engineering. The concentrated sequence of lectures in this program will provide participants with an understanding of the mathematical issues required to fully grasp the concepts in FEEC. ICERM is pleased to host this NSF/CBMS Regional Research Conference.

**Principal Speaker**  
Douglas Arnold, University of Minnesota

**Organizing Committee**  
Neil Glicks, University of Kentucky  
Jeffrey Jost, Brown University

**ICERM**  
ICERM encourages women and members of underrepresented minorities to apply and participate.

Front and back of flier advertising initial offerings for 2012-2013 Topical Workshops



**ICERM**  
The Institute for Computational and Experimental Research in Mathematics

**Upcoming Topical Workshops**

**Heterostructured Nanocrystalline Materials**  
May 30, 2012 – June 1, 2012  
Organizers:  
Tim Schulte, University of Tennessee  
Vivek Shenoy, Brown University  
Peter Smerka, University of Michigan

**NSF/CBMS Conference: Finite Element Exterior Calculus (FEEC)**  
June 11–15, 2012  
Organizers:  
Alan Demlow, University of Kentucky  
Johnny Guzmán, Brown University  
Dmitry Leykekhman, University of Connecticut  
Speakers:  
Keynote: Douglas Arnold, University of Minnesota  
Richard Falk, Rutgers University  
Ami Hiran, University of Illinois

**Bridging Scales in Computational Polymer Chemistry**  
August 6–10, 2012  
Organizers:  
Andrew J. Christlieb, Michigan State University  
Cecilia Clementi, Rice University  
Keith Promislow, Michigan State University  
Mark Tuckerman, New York University  
Zhengfu Xu, Michigan Tech

**To learn more** about these and other programs, organizers, confirmed participants, and to submit an application, please go to our website:  
<http://icerm.brown.edu>

**Participation:** ICERM welcomes applications for long and short-term visitors. Support for local expenses may be provided. Applications may be submitted at any time and will be considered as long as funds and space remain available. ICERM encourages women and members of underrepresented minorities to apply.

**About ICERM** The Institute for Computational and Experimental Research in Mathematics is a National Science Foundation Mathematics Institute at Brown University in Providence, RI. Its mission is to broaden the relationship between mathematics and computation.

**NSF** **BROWN**

Advertisement for additional 2012-2013 Topical Workshops

## **Topical Workshop #3: Synchronization-reducing and Communication-reducing Algorithms and Programming models for Large-scale Simulations**

January 9-13, 2012

### **Organizing Committee:**

David Keyes, KAUST and Columbia University  
Matthew Knepley, The University of Chicago  
Katherine Yelick, University of California at Berkeley and NERSC

### **Speakers:**

Mark Adams, Columbia University  
Grey Ballard, University of California, Berkeley  
Lorena Barba, Boston University  
Jed Brown, Argonne National Laboratory  
John Cavazos, University of Delaware  
Jonathan Cohen, NVIDIA Corporation  
Victor Eijkhout, University of Texas at Austin  
Bill Gropp, University of Illinois at Urbana-Champaign  
John Gunnel, IBM  
Jeff Hammond, Argonne National Laboratory  
Dinesh Kaushik, King Abdullah University of Science & Technology  
David Keyes, King Abdullah University of Science & Technology  
Hatem Ltaief, King Abdullah University of Science & Technology  
Gary Miller, Carnegie Mellon University  
John Owens, University of California, Davis  
Keshav Pingali, University of Texas at Austin  
Jack Poulson, University of Texas at Austin  
Rich Vuduc, Georgia Institute of Technology  
Katherine Yelick, University of California, Berkeley

### **Program Description:**

Twin motivations for this interdisciplinary workshop are the necessities of taking scientific simulations beyond their contemporary high-water marks of concurrency and of porting them to execution environments of less scheduling reliability.

As concurrency in scientific computing pushes beyond a million threads towards a billion, and as the performance of individual threads becomes less reliable for hardware-related reasons, attention must focus on communication and synchronization bottlenecks in contemporary simulation codes. A fine-grained partial ordering on computational tasks based on the availability of input arguments is imposed by physical causality, but much communication overhead in the form of start-up latency and synchronization delay in popular algorithms is artifactual. Attempts to ameliorate inefficiency due to communication range from increased message aggregation in tightly scheduled algorithms to a fine-grained separation of computational tasks into execution priority ranks, allowing those that are on the critical path to execute whenever their operands are ready, and rebalancing or deferring other tasks for times when tasks on the critical path are waiting, or until the consequences of further deferral are algorithmically detrimental. The evolution of today's simulation codes from the infra-petascale to the ultra-exascale requires importing ideas from other areas of computer science into numerical algorithms, possibly inventing some new ones, and generalizing programming models.

**Topical Workshop (Synchronization-reducing and Communication-reducing Algorithms and Programming models for Large-scale Simulations) Participants**

<b>First Name</b>	<b>Last Name</b>	<b>Organization</b>	<b>Primary Interest</b>	<b>Visit Length</b>
Mark	Adams	Columbia University	Mathematical and Statistical Sciences	5
Grey	Ballard	University of California, Berkeley	Mathematical and Statistical Sciences	5
Lorena	Barba	Boston University	Engineering	4
Jed	Brown	Argonne National Laboratory	Unknown	5
Xiao-Chuan	Cai	University of Colorado	Unknown	5
John	Cavazos	University of Delaware	Unknown	5
Edmond	Chow	Georgia Institute of Technology	Computer Science	5
Jonathan	Cohen	NVIDIA Corporation	Mathematical and Statistical Sciences	2
Felipe	Cruz	Nagasaki University	Computer Science	5
Jack	Dongarra	University of Tennessee	Computer Science	2
Victor	Eijkhout	University of Texas at Austin	Computer Science	7
Fariba	Fahroo	US Air Force Office of Scientific Research	Unknown	5
Laura	Grigori	INRIA Saclay	Computer Science	5
Bill	Gropp	University of Illinois at Urbana-Champaign	Mathematical and Statistical Sciences	5
John	Gunnels	IBM	Unknown	5
Jeff	Hammond	Argonne National Laboratory	Unknown	5
David	Hardy	University of Illinois at Urbana-Champaign	Computer Science	5
Jan	Hesthaven	Institute for Computational and Experimental Research in Mathematics (ICERM)	Mathematical and Statistical Sciences	5
Huda	Ibeid	King Abdullah University of Science & Technology	Unknown	5
Dinesh	Kaushik	King Abdullah University of Science & Technology	Computer Science	5
David	Keyes	King Abdullah University of Science & Technology	Mathematical and Statistical Sciences	6
Andreas	Klockner	Courant Institute of Mathematical Sciences	Mathematical and Statistical Sciences	5
Matt	Knepley	Argonne National Laboratory	Computer Science	6
Simon	Layton	Boston University	Engineering	2
Hatem	Ltaief	King Abdullah University of Science & Technology	Unknown	5
Gary	Miller	Carnegie Mellon University	Computer Science	5
Richard	Mills	Oak Ridge National Laboratory	Computer Science	5

Esmond	Ng	Lawrence Berkeley National Laboratory	Computer Science	4
Theodore	Omtzigt	Stillwater Supercomputing, Inc.	Unknown	2
John	Owens	University of California, Davis	Computer Science	5
Keshav	Pingali	University of Texas at Austin	Unknown	3
Jack	Poulson	University of Texas at Austin	Engineering	5
Rob	Schreiber	HP (Hewlett-Packard)	Unknown	5
James	Sexton	IBM	Physical Sciences	5
Andy	Terrel	University of Texas at Austin	Computer Science	5
Martin	van Gijzen	Technische Universiteit te Delft	Mathematical and Statistical Sciences	5
Rich	Vuduc	Georgia Institute of Technology	Computer Science	4
Tao	Xiong	Brown University	Unknown	5
Qinwu	Xu	Brown University	Unknown	5
Ulrike	Yang	Lawrence Livermore National Laboratory	Computer Science	5
Katherine	Yelick	University of California, Berkeley	Engineering	6
Rio	Yokota	King Abdullah University of Science & Technology	Engineering	5
Xinghui	Zhong	Brown University	Unknown	5
Xueyu	Zhu	Brown University	Unknown	5

The exit survey comments below represent some that were positive as well as those that were found to be particularly constructive.

**Workshop organizer comment:**

*“Your staff have been unfailingly kind, responsive, and anticipative. Our colleagues enjoy the space, the support, and of course the chance to meet with each other on the topic that we are charged to research. Our international colleagues seem especially pleased to be wrapped up into the US effort, which is matched by theirs in intent and (in some ways) in content...”*

**Some workshop participant comments:**

*“Excellent set of attendees, with diverse perspectives. As a result, picked up a number of new ideas that I am directly applying. Also, I am a pre-tenure faculty member; this meeting was a critically important networking opportunity (soliciting future potential letter writers and exposure to such an audience via my talk).”*

*“I enjoyed the working groups and the copious number of breaks that gave ample time to network with potentially new collaborators.”*

*“The workshop was well balanced, the number of participants allowed for very dynamic discussions. Moreover, all of the participants were experts in their fields and had varied research backgrounds.”*

*“A bit frustrating that so many people did not stay for the whole week. The promise was that just about everyone would be coming for the whole week, but then I'd find person X, whom I'd really hoped to talk with, was just popping in for a day or two.”*

For upcoming programs (including semester, topical workshops, VI-MSS workshops, and workshops hosted at ICERM but provided with outside funding), please see Appendix B.



Front and back of flier advertising January 2012 VI-MSS workshop in Kolkata, India

## VI-MSS Workshops

ICERM has scheduled, to date, 3 workshops in India.

### Workshop: Mathematical and Statistical Aspects of Cryptography (Kolkata, India)

January 12-14, 2012

#### Organizing Committee:

Jeff Hoffstein, ICERM, Brown University  
Jill Pipher, ICERM, Brown University  
Bimal Roy, Indian Statistical Institute

#### Speakers:

Dan Bailey, RSA Laboratories  
Daniel Bernstein, University of Illinois  
Rishiraj Bhattacharyya, Indian Statistical Institute  
Sanjit Chatterjee, Indian Institute of Science  
Abhijit Das, Indian Institute of Technology  
Benne de Weger, Technische Universiteit Eindhoven  
Leo Ducas, École Normale Supérieure  
Praveen Gauravaram, Indian Statistical Institute  
Dorian Goldfeld, Columbia University  
Vipul Goyal, Microsoft Research India  
Sourav Sen Gupta, Indian Statistical Institute  
Nadia Heninger, University of California, San Diego  
Jeffrey Hoffstein, Brown University  
Mahvir Prasad Jhanwar, Advanced Institute of Mathematics, Statistics and Computer Science  
Rajeeva Karandikar, Chennai Mathematical Institute  
Tanja Lange, Technische Universiteit Eindhoven  
Sumit Pandey, Indian Statistical Institute  
C. Pandurangan, Indian Institute of Technology  
Tal Rabin, IBM

Ananth Raghunathan, Stanford University  
 Somindu Ramanna, Indian Statistical Institute  
 Palash Sarkar, Indian Statistical Institute  
 Santanu Sarkar, Hooghly Sarat Centenary College  
 Ashutosh Saxena, Infosys  
 John Schanck, Security Innovation  
 Joop van de Pol, University of Bristol  
 William Whyte, Security Innovation

### Description:

This workshop focuses on mathematical and statistical aspects of public key cryptography. The main ingredients from mathematics so far include discrete logarithms and factoring over the integers, generalizations of the discrete logarithm to elliptic curves, hyperelliptic curves and further generalizations, aspects of infinite non-abelian groups, and closest vector problems (CVP) in integer lattices. Cryptanalysis in all of these areas can involve analyses of patterns in vast amounts of data, hence the need for statistical methods. One goal of this workshop, though not the only one, is to focus attention on the problem of quantifying the complexity of lattice-based problems, for example extrapolating the difficulty of solving a CVP in an integer lattice as a function of its dimension and other parameters.

### 2012 VI-MSS Workshop (Mathematical and Statistical Aspects of Cryptography)

#### Participants

First Name	Last Name	Organization	Primary Interest	Visit Length
Dan	Bailey	RSA Laboratories	Unknown	3
Daniel	Bernstein	University of Illinois	Unknown	3
Rishiraj	Bhattacharyya	Indian Statistical Institute	Unknown	3
Sanjit	Chatterjee	Indian Institute of Science	Unknown	3
Abhijit	Das	Indian Institute of Technology	Unknown	3
Benne	de Weger	Technische Universiteit Eindhoven	Computer Science	3
Leo	Ducas	École Normale Supérieure	Unknown	3
Praveen	Gauravaram	Indian Statistical Institute	Unknown	3
Dorian	Goldfeld	Columbia University	Unknown	3
Vipul	Goyal	Microsoft Research India	Computer Science	3
Sourav Sen	Gupta	Indian Statistical Institute	Unknown	3
Nadia	Heninger	University of California, San Diego	Computer Science	3
Jeffrey	Hoffstein	Brown University	Unknown	3
Mahvir Prasad	Jhanwar	Advanced Institute of Mathematics, Statistics and Computer Science	Unknown	3
Rajeeva L.	Karandikar	Chennai Mathematical Institute	Unknown	3
Thijs	Laarhoven	Technische Universiteit Eindhoven	Mathematical and Statistical Sciences	3

Tanja	Lange	Technische Universiteit Eindhoven	Unknown	3
Subhamoy	Maitra	Indian Statistical Institute	Unknown	3
Sumit	Pandey	Indian Statistical Institute	Unknown	3
C.	Pandurangan	Indian Institute of Technology	Unknown	3
Tal	Rabin	IBM	Unknown	3
Ananth	Raghunathan	Stanford University	Computer Science	3
Somindu C.	Ramanna	Indian Statistical Institute	Unknown	3
Palash	Sarkar	Indian Statistical Institute	Unknown	3
Santanu	Sarkar	Sarat Centenary College, Hooghly	Unknown	3
Ashutosh	Saxena	Infosys	Unknown	3
John	Schanck	Security Innovation	Unknown	3
Damien	Stehlé	École Normale Supérieure de Lyon	Computer Science	3
Joop	van de Pol	University of Bristol	Computer Science	3
William	Whyte	Security Innovation	Unknown	3

**Note:** there were no surveys collected for this program. All future VI-MSS programs will be surveyed.

For upcoming programs (including semester, topical workshops, VI-MSS workshops, and workshops hosted at ICERM but provided with outside funding), please see Appendix B.

### **Semester Program and Topical Workshop Promotion**

ICERM programs and events are marketed through a variety of outlets: its website, dedicated Facebook page and Twitter account, targeted blast emails (to include a bi-annual newsletter in 2012-2013), posters mailed to purchased targeted university and college lists, placement of advertisements in mathematical journals and newsletters, Director participation in conferences and exhibits, upcoming program fliers and announcements provided to all ICERM participants, and various on-line math organization calendars (SIAM, AMS, European Mathematical Society, National Math Institutes, and Conference Service Mandl).

This year, the ICERM event staff created an email database of higher education math departments in both the US and overseas, total institutions numbering close to 2,000. Posters for ICERM's summer undergraduate research program (Summer@ICERM) were mailed to institutions known to have undergraduate programs in mathematics, applied math, and computer science.

All program advertising emphasizes diverse participation and uses language encouraging minority and under-represented students to apply. More details about this can be found in the "Outreach/Diversity" section of this report.

## Organization/Infrastructure

ICERM's governing body is a Board of Trustees. The Scientific Advisory Board, or SAB oversees all scientific activities of the Institute and selects the scientific programs. The Education Advisory Board, or EAB coordinates the oversight of educational activities at all levels at ICERM.

## Board of Trustees (BoT)

The Board of Trustees (1) leads a search for and approves the appointment of the Director (which is also a faculty appointment at Brown), (2) reviews and advises on the budget for the coming year, and (3) takes a leadership role in fundraising and public awareness.

Initial terms of appointment are three to five years, with staggered appointments. Future appointments of the board will be for three years. Chairs from the Scientific Advisory Board and the Education Advisory Board, as well as the ICERM Directors, act as ex officio members. The board meets in person once a year in April. There may be additional conferences and consultation.

## ICERM Board of Trustees

Name	Institution
Barbara Keyfitz (Chair)	Ohio State University
Sir John Ball	University of Oxford
Jennifer Chayes	Microsoft Research
Peter Jones	Yale University
David Keyes	Columbia University/KAUST
David McLaughlin	New York University
David Mumford	Brown University
Srinivasa Varadhan	New York University

Minutes from the April 13, 2012 Board of Trustees annual meeting can be found in Appendix C. Highlights from this meeting include:

- Discussion of challenges in securing long-term visitors, especially from applied math culture; suggestion made to add semester buy-outs to next budget proposal cycle.
- Discussion of challenges in recruiting women participants.
- Clarifying role of BoT for board appointments; to approve appointments of all three ICERM boards: Board of Trustees, Scientific Advisory Board and Education Advisory Board.
- Discussion about the role the BoT and Brown University will play in approving the appointments of any new ICERM Directors.
- Introduction of the VI-MSS program.
- Discussion about growing the BoT to include more representatives from industry, finance, labs, and statistics.
- Announcing immediate need to replace two members who will rotate off in January 2013: David McLaughlin and David Mumford.

### Scientific Advisory Board

The Scientific Advisory Board (SAB) is responsible for approving the programs and scientific activities of the Institute. In addition, through direct communication with the Directors, Science Board members will be involved in shaping the direction of the scientific enterprise through specific suggestions of thematic programs, program organizers and participants.

Terms are three years, staggered for the initial appointments. Three of the seats on this Board are reserved for senior representatives of Google Research, IBM, and Microsoft Research. The ICERM Directors act as ex officio members of this committee.

### ICERM Scientific Advisory Board

Name	Institution
Andrea Bertozzi (Chair)	University of California at Los Angeles
Henry Cohn	Microsoft Research
Tom Dean	Google
Brenda Dietrich	IBM
David Gabai	Princeton University
Richard Kenyon	Brown University
Jun Liu	Harvard University
Juan Meza	University of California at Merced
Andrew Odlyzko	University of Minnesota
Robert Pego	Carnegie Mellon University
George Papanicolaou	Stanford University
Donald Saari	University of California at Irvine
Bernd Sturmfels	University of California at Berkeley
Eli Upfal	Brown University

See Appendix D for the minutes of the November 11-12, 2011 SAB meeting to review the selection process for the 2012-2013 semester and workshop proposals. Gabor Szekely, (Program Director, NSF) was present for this meeting. See Appendix E for the minutes from the May 1, 2012 mid-year conference call. In addition to discussing and recommending upcoming ICERM programs, highlights from both meetings are summarized below:

- Suggestions for improving the program proposal process (including asking organizers to name a “lead” person), and posting “how to propose a program” and mentoring plan on the web site.
- Suggestions to add tutorial sessions and/or work with publishers to publish tutorial series.
- Forming a nomination sub-committee (Bob Pego/chair, Andrea Bertozzi, Juan Meza and Bernd Sturmfels) and formalizing nomination process.
- Announcing Rick Kenyon and Eli Upfal will be rotating off the SAB in January 2013.
- Announcing Don Saari will step down in May 2012 in anticipation of chairing the NRC Board of Math Sciences and Applications.
- Discussion of board’s role in encouraging researchers to propose programs, help get the word out, and assist with suggesting speaker names to ensure diversity.

### Education Advisory Board

The Educational Advisory Board (EAB) is charged with the oversight of educational activities at all levels at ICERM. Principally, the focus of the EAB will be the educational activities pertaining to Undergraduates, Secondary and Primary school students, Teachers in STEM fields, and the community at large. Subcommittees will have oversight over the following activities:

- **Summer Undergraduate Research Programs:** Oversight includes the task of reviewing and rank-ordering proposals for summer undergraduate research programs from faculty.
- **Outreach Activities:** Oversight includes proposing and reviewing all projects and programs involving the interaction between ICERM and the communities listed above. Review of such programs will include advice on assessment and evaluation.
- **External Funding:** The EAB will explore opportunities for external funding for outreach activities, and, where possible, facilitate and pursue such funding opportunities.
- **Public Outreach:** The EAB will identify potential speakers and topics for public lectures to the community at large.
- **Dissemination and Evaluation:** This subcommittee will recommend external evaluators and review evaluation processes.

Terms are three years, staggered for the initial appointments. The ICERM Directors act as ex officio members of this committee.

### ICERM Education Advisory Board

Name	Institution
Thomas Banchoff (Chair)	Brown University
Karen Haberstroh	Brown University
Irina Mitrea	Institute for Mathematics and its Applications
Frank Morgan	Williams College
David Mumford	Brown University
Mary Ann Snider	Rhode Island Department of Education
Philip Uri Treisman	University of Texas
Kenneth Wong	Brown University

Minutes from the January 18, 2012 EAB conference call can be found in the Appendix F, which defines the EAB subcommittees. Appendix G includes minutes from the May 23, 2012 EAB meeting. Highlights from both meetings are summarized as follows:

- Formalizing the committee's charge (being involved with training and mentoring at all levels). Several suggestions were made and subsequently accomplished (between annual meetings): add professional development seminars for young researchers, hold tutorial/introductory sessions, etc.).
- Discussion of summer undergraduate research program and its proposal process.
- Discussion of outreach and K-12 research related activities and related challenges; challenging without specific funding and staffing to take on a portfolio of outreach tasks.
- Formalizing sub-committees for: Summer Undergraduate Research program, K-12 Activities, External Funding, Public Outreach, Dissemination and Evaluation.

### Mathematics Institute Directors Meeting (MIDs)

ICERM hosted the annual MIDs meeting May 11-12, 2012. The minutes from this meeting can be found in Appendix H.

### Postdoctoral Program

ICERM's postdoctoral program brings early career mathematicians to the institute in order to support and expand their research and to create lasting career collaborations and connections. ICERM supports postdoctoral researchers in two different ways: postdoctoral fellows, who participate in a single semester program and are supported by a stipend, and a smaller number of institute fellows, who stay at ICERM for one year and are supported by a salary for 9 months with the possibility of additional summer support.

### 2011-2012 ICERM Postdoctoral Cohort:

#### ICERM Postdoctoral Fellows (4 months; funds for travel to and from institute)

Name	Previous Institution	Semester
Emre Esenturk	University of Pittsburgh	Fall 2011 KTC
Jeffrey Haack	University of TX-Austin	Fall 2011 KTC
Ahmed Kaffel	Virginia Tech	Fall 2011 KTC
Daniela Tonon	SISSA-ISAS	Fall 2011 KTC
Dongming Wei*	University of Wisconsin-Madison	Fall 2011 KTC
Cécile Armana	Max-Planck-Institut für Mathematik	Spring 2012 CAD
Anupam Bhatnagar	City University of New York	Spring 2012 CAD
Bianca Viray	Brown University	Spring 2012 CAD
Xiaoguang Wang	LAREMA, Université d'Angers	Spring 2012 CAD

#### Institute Fellows (9 months w/benefits; summer support may be available)

Name	Previous Institution	Semester
Andong He	Penn State University	2011-12: focus Fall KTC
Alon Levy	Columbia University	2011-12: focus Spring CAD

\*The institute was able to offer a fifth postdoctoral fellowship to Dongming Wei due to the fact that the postdoctoral fellows budget for fall 2011 allowed for one additional position.

### Recruiting and Selection for 2012-2013 Postdocs:

ICERM's postdoctoral positions were widely advertised using MathJobs.org, the Society for Industrial and Applied Mathematics News, Notices of the American Mathematical Society, the Association of Women in Mathematics, with the Society for the Advancement of Chicanos and Native Americans in Science, and on the ICERM website. These positions were also advertised at the NSF Institute Reception at the joint meetings of the AMS/MAA in January 2012.

ICERM conducted its search via Mathjobs.org, an online job application service provided by the American Mathematical Society. Note that most applicants applied for both ICERM's postdoctoral fellowship and the institute fellowship positions.

The total number of applicants in the pool for the 2012-2013 semester programs included many who were not qualified in the sense that their research field did not fit within the research parameters of the semester program. The Directors reviewed the list of applicants and determined that 51 applicants were fully qualified for the "Computational Challenges in Probability" (CCP) program. Of those, 16 applied for both the institute fellow and postdoctoral positions, 29 applied just for the institute fellow position, and 6 applied for just the postdoctoral

fellow position. In addition, 37 applicants were judged to be fully qualified for the "Automorphic Forms, Combinatorial Representation Theory and Multiple Dirichlet Series" (MDS) program. Of those, 17 applied for both the institute fellow and postdoctoral fellow position, 13 applied just for the institute fellow position, and 7 applied for just the postdoctoral fellow position.

### Postdoctoral Fellows

In all written material sent out, it was emphasized that Brown is an EEO/AA Employer and that ICERM is interested in women and minority candidates. 27% of the applicant pool were women (a 4.91% increase from the previous year). This is comparable to the ratio of women to men math PhDs in the United States. We strongly encouraged applications from women and minorities, and gave them careful consideration.

Total number of qualified applicants for the fall 2012 and spring 2013 positions together: **88**.  
Based on available information, the applicant pool broke down as follows:

	<i>Male</i>	<i>Female</i>	<i>TOTAL</i>
Asian/Pacific Islands	26	9	
Black	0	1	
Other	0	0	
White	35	11	
Hispanic/Latino	0	0	
American Indian/Alaskan Native	0	0	
Unknown*	<u>2</u>	<u>2</u>	
<b>GRAND TOTAL</b>	<b>63</b>	<b>23</b>	<b>= 86</b>

**\* 2 additional applicants did not identify race or gender = 88**

The Search Committee consisted of the ICERM Semester Program organizers for its fall 2012 "Computational Challenges in Probability" (CCP) program: Jose Blanchet (Columbia University), Paul Dupuis (Brown University), Roger Ghanem (University of Southern California), George Karniadakis (Brown University), Kavita Ramanan (Brown University), Boris Rozovsky (Brown University), Eric Vanden-Eijnden (New York University), and the ICERM Semester Program organizers for its spring 2013 "Automorphic Forms, Combinatorial Representation Theory and Multiple Dirichlet Series" (MDS) program: Sara Billey (University of Washington), Ben Brubaker (MIT), Daniel Bump (Stanford University), Gautam Chinta (City College of New York), Sol Friedberg (Boston College), Dorian Goldfeld (Columbia University), Jeff Hoffstein (Brown University), Anne Schilling (UC Davis), Nicolas M. Thiéry (Université Paris Sud). ICERM Directors, Jeff Brock (AA Representative), Jill Pipher (Chair), Jan Hesthaven and Bjorn Sandstede made up the rest of the committee.

The program organizers reviewed all of the applications and provided a rank-ordered list to the ICERM Directors who then reviewed and approved the selections.

For the fall 2012 postdoctoral fellows positions, the committee made offers. Arnab Ganguly, Elina Kalpinelli, Daniel Cargill and Peng Hu, accepted the offers, but \*Elina withdrew after the search was closed. To fill the open position, the institute made a pre-select postdoctoral fellowship offer to Hao Ni, who accepted. In addition, ICERM was able to extend Arnab Ganguly's offer to a twelve-month position (4 months with ICERM) with additional funding from the Division of Applied Mathematics.

For the Spring 2013 postdoctoral fellows positions, the committee made offers. Martina Lanini, Ben Salisbury, Kwangho Choiy and Zaij Daughtery accepted the offers.

Based on available information, the postdoctoral fellow hires (combined fall 2012 and spring 2013 programs) broke down as follows:

	<i>Male</i>	<i>Female</i>
Black	0	0
Hispanic	0	0
American Indian/Alaskan Native	0	0
Asian/Pacific Islands	3	1
White	2	2
Other (specify)	0	0

**Postdoctoral Fellows (4 months; funds for travel to and from institute)**

<b>Name</b>	<b>Previous Institution</b>	<b>Field of Study*</b>	<b>Semester</b>
Daniel Cargill	NJ Institute of Technology	Probability theory and stochastic processes	Fall CCP
Arnab Ganguly	University of Wisconsin	Probability theory and stochastic processes	Fall CCP
Peng Hu	University of Bordeaux	Numerical analysis	Fall CCP
Hao Ni	Oxford University	Probability theory and stochastic processes	Fall CCP
Kwangho Cho	Purdue University	Number Theory	Spring MDS
Zajj Daugherty	University of Wisconsin	Associative rings and algebras	Spring MDS
Martina Lanini	Universitaet Erlangen-Neunberg	Combinatorics	Spring MDS
Benjamin Salisbury	UCONN	Combinatorics	Spring MDS

\*Field of study based on 2010 Mathematics Subject Classification (MSC) claimed on original application to ICERM.

**Institute Fellows**

As in the hiring of the postdoctoral fellows, all written material for the institute fellow positions emphasized that Brown is an EEO/AA Employer and that ICERM is interested in women and minority candidates. 18.87% of the applicant pool were women. We strongly encouraged applications from women and minorities, and gave them careful consideration.

Total number of applicants for position: **153**. Based on available information, the applicant pool broke down as follows:

	<i>Male</i>	<i>Female</i>	<i>TOTAL</i>
Asian/Pacific Islands	45	19	
Black	3	1	
Other	0	0	
White	57	13	
Hispanic	0	0	
American Indian/Alaskan Native	0	0	
Unknown*	7	2	
<b>GRAND TOTAL</b>	<b>112</b>	<b>35</b>	<b>= 147</b>

\*6 additional applicants did not identify race or gender = 153

The Search Committee consisted of the ICERM Semester Program organizers for its fall 2012 “Computational Challenges in Probability” (CCP) program: Jose Blanchet (Columbia University), Paul Dupuis (Brown University), Roger Ghanem (University of Southern California), George Karniadakis (Brown University), Kavita Ramanan (Brown University), Boris Rozovsky (Brown University), Eric Vanden-Eijnden (New York University), and the ICERM Semester Program organizers for its spring 2013 “Automorphic Forms, Combinatorial Representation Theory and Multiple Dirichlet Series” (MDS) program: Sara Billey (University of Washington), Ben Brubaker (MIT), Daniel Bump (Stanford University), Gautam Chinta (City College of New York), Sol Friedberg (Boston College), Dorian Goldfeld (Columbia University), Jeff Hoffstein (Brown University), Anne Schilling (UC Davis), Nicolas M. Thiéry (Université Paris Sud). ICERM Directors, Jeff Brock (AA Representative), Jill Pipher (Chair), Jan Hesthaven and Bjorn Sandstede made up the rest of the committee.

The program organizers reviewed all of the applications and provided a rank-ordered list to the ICERM Directors who then reviewed and approved the selections.

For the fall 2012 institute fellow position, the committee made an offer; Aaron Smith accepted.

For the spring 2013 institute fellow position, the committee made an offer; Julio Andrade accepted.

Based on available information, the institute fellow hires (combined fall 2011 and spring 2012 programs) broke down as follows:

	<i>Male</i>	<i>Female</i>
Black	0	0
Hispanic	0	0
American Indian/Alaskan Native	0	0
Asian/Pacific Islands	0	0
White	2	0
Other (specify)	0	0

**Institute Fellows (9 months w/benefits; summer support may be available)**

Name	Previous Institution	Field of Study*	Semester
Aaron Smith	Standord University	Probability theory and stochastic processe	Fall CCP
Julio Andrade	University of Bristol	Number theory	Spring MDS

\*Field of study based on 2010 Mathematics Subject Classification (MSC) claimed on original application to ICERM.

**Keeping Track of Former Postdocs (Institute and Semester)**

ICERM Research Fellows are supported with a stipend for one semester. We expect that these postdoctoral fellows will be on leave from, or have deferred the start of, another position. We were surprised therefore to find that two of the five postdoctoral fellows in the fall program had no follow-up position (Wei and Kaffel). Moreover, Andong He had no employment plans beyond May 2012. Wei continued to work with Shu at Brown, supported by Shu's grant. Wei has not responded to inquiries about his status, but had earlier indicated that he would only be searching for a job in the NY area. Kaffel found a postdoctoral position in the School of Engineering at Brown through May 2012 and expects to go to the Univ. of Maryland in the fall. Andong He found a postdoctoral position at Yale. All but one postdoctoral fellow in the Spring 2012 had employment plans before the semester at ICERM. X. Wang is presently searching for employment in China.

ICERM postdocs	Period of Stay	Plans After ICERM
Andong He	2011-2012	Postdoc at Yale University
Emre Esenturk	Fall 2011	Pohang University of Science and Technology (Korea)
Jeffrey Haack	Fall 2011	UT Austin
Ahmed Kaffel	Fall 2011	Brown Engineering (Petia Vlahovska), the U. Maryland
Daniela Tonon	Fall 2011	Université Pierre et Marie Curie
Dongming Wei	Fall 2011	Brown Applied Mathematics (Chi-Wang Shu); seeking a job in industry starting fall 2012
Alon Levy	2011-2012	Starting a two-year postdoc at UBC fall 2012
Bianca Viray	Spring 2012	NSF Postdoc at Brown Mathematics Department
Xiaoguang Wang	Spring 2012	In China; currently seeking employment
Cecile Armana	Spring 2012	Research Fellow at the Mathematisches Institut, University of Münster, Germany 2012-2013, though also interviewing for jobs in France.
Anupam Bhatnagar	Spring 2012	Tenure track position at Borough of Manhattan Community College, City University of New York starting Fall 2012

### **Graduate Students**

One special focus of this institute is early career training and mentorship. Therefore, the addition of postdoctoral fellows (as described above) and graduate students is essential to the success of these programs. Participation from graduate students is targeted at ten to twelve for each program, some of whom are provided funding from the institute, with this funding awarded via a competitive application process. ICERM support for graduate students during its first year and for 2011/2012 consists of travel or partial support of housing costs. Qualified graduate students who are able to present a poster at the workshops may be provided some support to attend.

### **Importance of Mentorship**

A special focus of the operations of the institute is the training and mentorship of younger and early career mathematicians, through specific outreach programs and directed opportunities for connections between mathematicians at different stages in their career. This includes ICERM's postdoctoral program, integration and support of graduate students in the context of semester programs, summer research programs for undergraduates, and IdeaLabs.

### **Preparing Senior Faculty Mentors**

Before ICERM ran its first semester program in September 2011, the institute provided all senior mentors with written guidelines that spelled out their responsibilities and those of mentees. The institute also provided mentors and mentees with the AAMC Compact and the FASEB Individual Development Plan (IDP) to help them clarify mutual expectation and guide them in developing and setting goals for the mentees. Associate Director Bjorn Sandstede coordinated these efforts and worked with the member of the Program Organizing Committee assigned to be responsible for mentorship.

In addition, at the beginning of ICERM's 2011-2012 semester programs, there were mentor/mentee introductory meetings. These meetings emphasized the idea that mentors should help mentees start to build a research cohort within a field, and help them create contacts and resources which will persist beyond the program and are important for their professional development.

### **Roundtable Discussions**

To prepare graduate students and postdocs better for their future careers, the institute also organizes regular roundtable discussions with long-term visitors and Brown faculty that, in the course of each semester, cover the following topics:

- Preparing job applications
- Writing and submitting papers
- Writing grant proposals
- Ethics in research (as required by NSF) – mandatory, attendance is taken
- Job opportunities in industry and government labs

Appendix I lists a typical roundtable discussion schedule and topics list.

### Assigning Postdoctoral Mentors

Incoming ICERM postdocs and senior long-term visitors are asked with whom they wish to be matched. Bjorn Sandstede works closely with them to ensure that each match is appropriate, taking into consideration the background of mentees and mentors. The mentors of ICERM's first two institute fellows Andong He and Alon Levy (2011-2012) were faculty at Brown and agreed to serve as mentors for the entire academic year. The same is true for the incoming 2012-2013 institute fellows, Aaron Smith and Julio Andrade. In general, the mentors of the institute postdocs during their non-program semester may not be local faculty. In that case, ICERM will facilitate their interaction by providing support for travel if necessary.

### 2011-2012 Postdoctoral Mentor Assignments

Postdoc	Mentor	Program
Emre Esenturk	Walter Strauss	Fall KTC ICERM Postdoctoral Fellow
Jeffrey Haack	Irene Gamba	Fall KTC ICERM Postdoctoral Fellow
Andong He	Walter Strauss, Aoki	Fall KTC ICERM Institute Postdoc
Ahmed Kaffel	Chi-Wang Shu	Fall KTC ICERM Postdoctoral Fellow
Daniela Tonon	Yan Guo	Fall KTC ICERM Postdoctoral Fellow
Dongming Wei	Chi-Wang Shu, David Levermore	Fall KTC ICERM Postdoctoral Fellow
Cecile Armana	Mike Zieve	Spring CAD ICERM Postdoctoral Fellow
Anupam Bhatnagar	Tom Tucker	Spring CAD ICERM Postdoctoral Fellow
Bianca Viray	Joe Silverman	Spring CAD ICERM Postdoctoral Fellow
Xiaoguang Wang	Adam Epstein, Xavier Buff	Spring CAD ICERM Postdoctoral Fellow
Alon Levy	Joe Silverman	Spring CAD ICERM Institute Postdoc
Tanya Firsova	Xavier Buff	Spring CAD Postdoc
Benjamin Hutz	Joe Silverman	Spring CAD Postdoc/Independent
Patrick Ingram	Joe Silverman	Spring CAD Postdoc/Independent
Chong Gyu Lee	Joe Silverman	Spring CAD Postdoc/Independent
Huibin Li*	Juan Rivera-Letelier	Spring CAD Postdoc
Karl-Olof Lindahl	Mike Zieve	Spring CAD Postdoc/Independent
Tom Sharland*	Adam Epstein, Xavier Buff	Spring CAD Postdoc

\* Advisor also attended the program

### 2012-2013 ICERM Postdoctoral Mentor Assignments

Postdoc	Mentor	Program
Daniel Cargill	Paul Dupuis, Bjorn Sandstede	Fall CCP ICERM Postdoctoral Fellow
Arnab Ganguly	Paul Dupuis	Fall CCP ICERM Postdoctoral Fellow
Peng Hu	Jose Blanchet	Fall CCP ICERM Postdoctoral Fellow
Hao Ni	Boris Rozovsky	Fall CCP ICERM Postdoctoral Fellow
Aaron Smith	Chip Lawrence, Kavita Ramanan	Fall CCP ICERM Institute Postdoc
Julio Andrade	Jeff Hoffstein	Spring MDS ICERM Institute Postdoc
Kwangho Choiy	TBD	Spring MDS ICERM Postdoctoral Fellow
Zajj Daugherty	TBD	Spring MDS ICERM Postdoctoral Fellow
Martina Lanini	TBD	Spring MDS ICERM Postdoctoral Fellow
Benjamin Salisbury	Anne Schilling	Spring MDS ICERM Postdoctoral Fellow

### Assigning Graduate Student Mentors

A similar mentor matching process is implemented for those graduate students who stay for more than 10 days at ICERM. Many graduate students attend the program with their advisor; in these cases the mentor/mentee relationship already exist. For those graduate students attending without an advisor, Bjorn Sandstede works closely with the program organizers and the students' advisors to make an appropriate mentor/mentee match.

### 2011-2012 Graduate Student Mentors

Graduate Student/Postdoc	Mentor	Program
Giacomo Albi*	Lorenzo Pareschi	Fall KTC Graduate Student
Jose Alcantera Felix*	Simone Calogero	Fall KTC Graduate Student
Wei Guo*	Jing-Mei Qiu	Fall KTC Graduate Student
Ed Lee	Juhi Jang	Fall KTC Graduate Student
Jose Morales*	Irene M. Gamba	Fall KTC Graduate Student
Amelie Rambaud*	Francis Filbet	Fall KTC Graduate Student
Thomas Rey*	Francis Filbet	Fall KTC Graduate Student
Matthew Reyna*	Fengyan Li	Fall KTC Graduate Student
Minh-Binh Tran	Fengyan Li	Fall KTC Graduate Student
Kent Van Vels*	Irene Gamba	Fall KTC Graduate Student
Miles Wheeler*	Walter Strauss	Fall KTC Graduate Student
Bokai Yan*	Shi Jin	Fall KTC Graduate Student
He Yang*	Fengyan Li	Fall KTC Graduate Student
Andrew Bridy	Michael Zieve	Spring CAD Graduate Student
Derek Garton	Michael Zieve	Spring CAD Graduate Student
William Gignac	Juan Rivera-Letelier	Spring CAD Graduate Student
Jacqueline Anderson*	Joe Silverman*	Spring CAD Graduate Student
Fabrizio Barroero	Tom Tucker	Spring CAD Graduate Student
William Gignac	Juan Rivera-Letelier	Spring CAD Graduate Student
Jan-Li Lin	Joe Silverman	Spring CAD Graduate Student
Lukas Pottmeyer	Tom Tucker	Spring CAD Graduate Student
Zach Scherr*	Mike Zieve	Spring CAD Graduate Student
Bianca Thompson*	Michelle Manes	Spring CAD Graduate Student
Diane Yap*	Michelle Manes	Spring CAD Graduate Student

\* Advisor also attended the program

**Note:** The 2012-2013 cohort of graduate students is still to be determined.

### Graduate Students and Postdocs as Mentors

It is expected that some of the graduate students and postdocs may play an integral part in the Summer Undergraduate programs by supporting faculty in working with the undergraduate participants.

### **Summer Undergraduate Research Program**

ICERM will support its first undergraduate research summer program “Summer@ICERM: Geometry and Dynamics” starting June 18, 2012 until August 10, 2012. This program was organized and will be run by Dr. Sergei Tabachnikov of Penn State, and Dr. W. Patrick Hooper of CUNY. Two experienced graduate student TA’s, Diana Davis of Brown University and Tarik Aougab from Yale University, will be working with the students during the entire eight week program.

### **Summer Undergraduate Research Program Process**

The summer undergraduate research program selection process follows these steps:

#### **1. Solicitation of Proposals:**

(Ultimately, we will solicit and recruit proposals from faculty nationwide. Ideally, a successful summer program will run two consecutive years. We hope that the program in summer 2012 will also run in 2013). Faculty leading the program will spend a period of 8 weeks in Providence during the summer, teaching and supervising the undergraduates, with the assistance of graduate student TAs and/or postdoctoral fellows.

#### **2. Future Proposal Selection:**

Programs will be selected from proposals submitted to ICERM in an open competition. Successful programs will typically have a significant computational component. Summer research programs which pair with the semester programs will be especially encouraged, but not required. A subcommittee of the EAB and an Associate Director will vet proposals. External evaluations of proposals will be solicited. Preliminary decisions on summer programs will be made by the Directors and must be approved by the Scientific Advisory Board.

#### **3. Application Process:**

Undergraduates will apply to the program through MathPrograms.org and a ranked list of applicants will be made by the faculty program leaders and the Directors.

#### **4. Applicant Selection:**

Undergraduate participants will be selected by instructional staff of the summer research program and the selections will be finalized by ICERM Director(s). At all stages of recruitment, solicitation, and selection, committees will be instructed about the diversity goals of the National Science Foundation, and ICERM in particular. To ensure a diverse group of applicants, ICERM will advertise and recruit from minority serving organizations.

### **Financial Decisions for Program**

Each faculty member will receive either salary or expenses, or some combination of the two. Both regular faculty members and senior postdoctoral researchers will be eligible to serve as faculty mentors. An institute postdoc who wishes to participate in the summer program can receive summer support. Each graduate student supporting a program would receive a stipend commensurate with a summer teaching stipend. Undergraduate participants funded by ICERM receive a stipend, travel funds within the United States, and meals and accommodation in a Brown dormitory.

### Summer@ICERM

The inaugural “Summer@ICERM” program will run from June 18, 2012 through August 10, 2012 with a cohort of 14 students. Ten students will be funded through the NSF, two via a Brown University Undergraduate Training and Research Award (UTRA), one by a Brown University professor of mathematics, and another via a National University of Singapore research exchange program, co-funded by Brown, NUS, and Santander Bank.

One way this program is differentiated from other REU programs is through the planned use of mini courses. These mini-courses will be background for the research projects the students become involved with. Sarah Koch (Harvard), one of the postdocs who participated in our CAD program, will teach a mini course in the June 2012 Summer@ICERM program.

ICERM will continue to explore additional sources of funding for the undergraduate program. One such program, the Leadership Alliance (<http://www.theleadershipalliance.org>), supports minority participation in research projects at several dozen universities and colleges including Brown. An attempt was made to find a qualified student through the Leadership Alliance, and in fact one student was identified and recruited; however her research interests did not match this year’s Geometry and Dynamics topic and she declined to apply. Recommendations for casting the recruiting net wider were made by members of ICERM’s May 2012 Education Advisory Board meeting; they can be found under the “Outreach/Diversity” section of this report. ICERM will continue to network and create relationships with organizations that can help recruit minorities.

The selection committee consisted of the Summer@ICERM program organizers Sergei Tabachnikov and Pat Hooper and ICERM Directors, Jeff Brock and Jill Pipher.

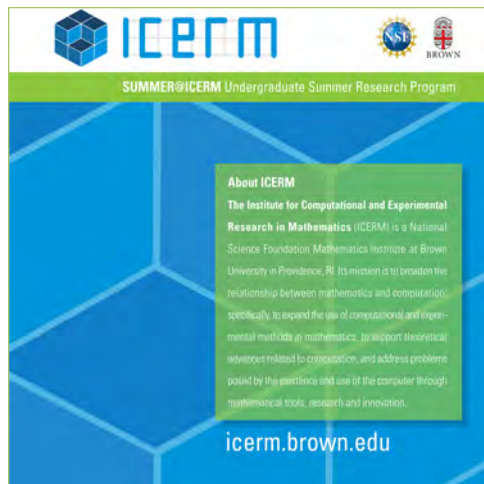
ICERM conducted its search via Mathprograms.org, an online math program service provided by the American Mathematical Society. The total number of applicants in the pool for the 2012 Summer@ICERM program included many who were not qualified in the sense that their research interests did not fit within the research parameters of the program, or they were no longer undergraduate students and thus disqualified. The selection committee reviewed the list of applicants and determined that 144 applicants were fully qualified for the Geometry and Dynamics program. With consideration towards diversity, a rank-ordered list was generated.

Based on available information, the 2012 Summer@ICERM cohort broke down as follows:

	<i>Male</i>	<i>Female</i>
Black	0	0
Hispanic	0	1
American Indian/Alaskan Native	0	0
Asian/Pacific Islands	3	0
White	6	4
Other (specify)	0	0

## 2012 Summer@ICERM Cohort

<b>FEMALES - NSF FUNDED</b>	
Katherine Engelman	Bryn Mawr College
Clara Hess	Reed College
Amy Nesky	Boston College
Desislava Nikolov	University of the Free State, South Africa
Julienne LaChance	Rensselaer
<b>MALES - NSF FUNDED</b>	
Dmitri Gekhtman	Harvard University
Francisc Bozgan	UCLA
Emmanuel Tsukerman	Stanford University
Andrew Kimball	Western Carolina University
Ian Alevy	University of Chicago
<b>BROWN FUNDED (All male)</b>	
Kevin Casto	Brown University
In-Jee Jeong	Brown University
Yilong Yang	Brown University
<b>OUTSIDE FUNDING/Santander Bank (Male)</b>	
Hai Bin Chang	National University of Singapore



Front and back of flier advertising 2012 Summer@ICERM undergraduate research program

## Summer 2012: Summer@ICERM: Geometry and Dynamics

June 18 – August 10, 2012

### Organizing Committee:

Pat Hooper, City College of New York

Sergei Tabachnikov, Pennsylvania State University

### Program Description:

The Summer@ICERM: Geometry and Dynamics program is designed for a select group of 10-12 undergraduate scholars. Students will work in small groups of two or three, supervised by a faculty advisor and aided by a teaching assistant. The faculty advisors will describe a variety of enticing open questions in geometry and in dynamical systems of geometric origin. Topics discussed will include Euclidean, hyperbolic and projective geometry, iteration of geometric constructions, and mathematical billiards. A variety of activities around these research themes will allow participants to engage in collaborative research, communicate and examine their findings in formal and informal settings, and report-out their findings with a finished product.

The planned activities and events for the June 2012 Summer@ICERM program will include:

### First Week Outline:

- ICERM orientation and welcome lunch
- Research topics introduction
- BearCore training (required NSF ethics training)
- Research group assignments

### Weekly Events Outline:

- Research groups and supervisors meet (M, T, Th, F)
- Wednesday special talks, working seminars, or mini-courses
- Professional development seminars (through Brown's REU programs)
- Special Events
- Professional development programs

### Planned Methods for Surveys and Evaluation

Faculty members in the Education Department at Brown, including Professor Kenneth Wong (Walter and Lenore Annenberg Chair for Education Policy and Chair of the Department), and Professor John Tyler have been leading the institute's initial internal evaluation component.

### Evaluation Design and Types

During its ramp-up year, the ICERM Directors worked with Professors Tyler and Wong to determine the types of surveys the institute would utilize. During its second year, the Directors hired Kathleen Banchoff, an accomplished marketing specialist with a Ph.D. in communications from The Ohio State University, as its external evaluator. Banchoff's role is to review and certify the methodology of the institute's internal process. She has helped to develop the institute's online survey for its pre-surveys, exit surveys, and organizer surveys. The "follow-up" and "control groups for longitudinal analysis of program participants" survey processes are still being developed.

In its first full year of program operation, ICERM intends to develop and test its evaluation program, following a "rapid prototyping" model for devising and improving

questionnaires with each iteration. The institute is also using the data collected from each survey to develop a coding scheme and a data analysis protocol relevant to the stated mission of ICERM, and likely to capture the most salient dimensions for successful participation in ICERM programs.

### Current Data Set

In this preliminary stage of survey development, the institute is looking for the best way to secure cooperation from all respondents (e.g., pre- and post-surveys from every respondent in the long programs) and to generate good data (e.g., complete and coherent data from each respondent, the best ways to measure “satisfaction” and “expectations” -- ratings, open-ends, or both) which will inform decisions about the effectiveness of a particular program or workshop, as well as overall performance with respect to mission.

In the 2011-2012 academic year, 4 ICERM topical workshop programs and 2 semester-long programs have been conducted; with a total of 665 participants. 452 online surveys were completed by participants and organizers, for an effective response rate of 68% overall. The data collected for each workshop and program have been aggregated only program by program, and analyzed for the purpose of improving the response rates, questions, and the questionnaire length and format (i.e., the proportion and usefulness of ratings and open-ends). The intention is to use the data from this year’s surveys only to settle on questionnaire formats, and to create a plan for the ongoing evaluation program.

This report includes several verbatim comments from participant and organizer surveys.

### Method of Analysis

In the coming year, ICERM will use content analysis to analyze the verbatim responses of program participants who responded to open-ended questions in online surveys made available to them in a timely way through a secure website. This method of analysis assigns labels to particular words or word phrases, and counts their occurrence, in the search for red flag and green-flag categories identified *a priori* as indicators, or measures of success. It represents a creative approach to identifying the variables that may influence participants’ evaluation of the variety of programs offered by ICERM. It relies on coding open-ended responses into categories using a priori definitions of what may be relevant to ICERM’s overall mission with regard to (1) new knowledge and (2) new collaborations. At this next stage, the institute will code open-ended responses to several key questions, looking for patterns across different types of programs (across topics, across program lengths, and /or across different types of participants).

- long-term visitors (semester-long faculty / researchers and post-doctoral fellows)
- short-term participants (those attending workshops and special events)
- organizers

This year, the institute has used the resulting data to refine wording, drop questions, and change the survey formats as well as develop ways to increase response rates (i.e., who sends out the memo, at what points in time?). In the upcoming months, the institute will create a plan for developing analysis, by looking at results for tabling the coded data and combining it with participants’ background information (i.e., students or faculty, professionals or pre-professionals, academic or industrial) and ratings data (satisfaction, expectations, level of knowledge of topic) for a fuller analysis of the overall effectiveness of ICERM programs. The institute will investigate the practicality and usefulness of building simple a word-search routine – or using computer-assisted qualitative data analysis software – to automate the task.

Content analysis method was developed in the social sciences in the 1960's as a grounded theory, and has been used since then by marketing research practitioners for the purpose of analyzing open-ended survey responses and other textual data. Specifically, it ‘systematically compresses many words of text into fewer categories based on explicit rules for coding’ (Steve Semler (2001), “An Overview of Content Analysis” in Practical Assessment, Research & Evaluation.)

### Pre-surveys

Pre-surveys (for long-term programs only) help determine any collaborations that existed prior to the program start, ask what made the participant choose to come to ICERM, and asks what the participant’s expectations are of the program. The pre-survey was not fully developed for ICERM’s inaugural semester program in Fall 2011, but was successfully distributed electronically via e-mail approximately one week prior to the beginning of spring 2012 semester program. The on-line survey is anonymous, but includes questions on the participants’ education background and career experience. The average return rate pre-surveys is 60%.

### Exit Surveys

The on-line exit surveys are distributed on or near a participant’s last day of any research and training activity at the institute. These surveys are purposefully short and to the point. The surveys are anonymous, but include questions on the participants’ education background and career experience. The average return rate for exit surveys is 75%.

#### **The exit survey is designed to answer the following questions:**

- *Connections made:* Have you made any new connections that you anticipate will become a part of your professional network? A scale is provided to allow the respondents to specify the number of new connections.
- *Learn something new:* Did you learn something new? A scale of 1-5 is provided to allow the respondents to specify the importance of the new skills and new knowledge in her/his field.
- *Topic or person you would have preferred to be included in the activity:* Given the topic, did the scientific program meet your expectations? If not, what would you have liked to have added?
- *Time allocation appropriateness:* Were you satisfied with the:
  - a) Length of talks
  - b) Opportunities to collaborate
  - c) Free time
  - d) Opportunities to ask questions

Postdoc and graduate students are included in all exit surveys. In addition, in the middle of and toward the end of each semester program Jill Pipher and Bjorn Sandstede meet with all postdocs and graduate students to get their feedback on the program. This informal feedback has helped inform several improvements. For example, feedback from the “job application” session resulted in a greater focus on jobs in industry.

Exit surveys are being developed for the Summer@ICERM undergraduate researchers and IdeaLab participants.

### Organizer Questionnaires

Organizer questionnaires measure the experience with ICERM for each specific activity. The questionnaires pay particular attention to several issues, including:

- *New Connections made:* What has been the experience in working with ICERM? A scale is

provided to allow the respondents to specify the number of new connections made.

- *Time Allocation:* Was the time allocation to topic, presentation and Q and A appropriate.
- *Topic Selection:* Did the organizer feel that the key topics were sufficiently covered? Did the organizer provide the participants with sufficient amount of information?
- *Future Collaboration:* Was the organizer satisfied with the experience with ICERM? Would the organizer propose future events to ICERM?

The average return rate for organizer questionnaires is 70%. This is not an acceptable rate of return for us, and we are working to correct it.

### Follow-up Surveys

Follow-up surveys, still in development, will be distributed two years following the completion of each semester program. As part of the database for the within-group evaluation, the on-line follow-up survey would longitudinally track college junior cohorts and researchers' scholarly activities, such as applications and success rates for grant competition, engagement in professional networks at the regional and national level, and connection with federal program Directors. A longer-term measure may consider the quality of the publications and the impact of the published research. One survey method being considered is sending an email that would, ideally, outline a participant's list of recent papers, and ask them to indicate how many of the listed publications they can attribute to their time at ICERM.

### Control Groups for Longitudinal Analysis of Program Participants

The evaluation design, still in development, will use two comparison groups against which the outcomes of the program participants will be compared. The first comparison group will be composed of the top postdoctoral applicants who were accepted but declined the institute's offer. A second comparison group will be comprised of the top three applicants who were just below the acceptance cutoff. Using this last group, in comparison to the three applicants just above the cutoff who were accepted into the program approximates a "regression discontinuity" design in a small sample, qualitative setting. The institute staff will make substantial efforts to make connections with the approximately six comparison group members annually in order to increase the probability that these individuals would be willing to contribute to the evaluation efforts. The plans are to track each comparison group's career path (for example, through on-line searches looking for promotions and getting counts of their publications, and in the ideal, through direct communication). At set intervals, the institute may also survey each person in the comparison groups using a personalized approach (such as phone calls). Ultimately, the institute will attempt to compare the career growth of the comparison groups with those of the hired ICERM postdocs. This same methodology would be used to track the impact of ICERM programs on graduate and undergraduate student participants.

### The Evaluation Process

- The institute's external evaluator, Kathleen Banchoff, was consulted in years one and two to review the internal evaluations process and assist with the design of the questionnaires and surveys. The estimated consulting time of 2-3 days per year for this was fairly accurate. During year three, Banchoff and/or another consultant will be brought in to advise on the construction of the results database and subsequent report and analysis design. Anticipated consulting time is 3-5 days.
- An external evaluator will return for a consultation in subsequent years to review data and assist in the preparation of reports for the renewal proposals.

- In year three, the Board of Trustees will begin to annually provide a short written evaluation of ICERM based on its own observations as well as on the data collected by the institute.

Professors Wong and Tyler will help ICERM Directors and staff coordinate the ongoing use of the data collected.

Appendix K provides samples of the institute's pre, exit, and organizer surveys.

### **Collaborations and Publications**

Annually, the Director sends a request to all long-term participants asking for updates on participant research projects and/or publications that arose during, or were enhanced by, participation in an ICERM program. In addition to actual publications, the request solicits comments on collaborations formed, or new directions for research facilitated by, the program.

This list of self-reported publications and collaborations formed to date is provided in Appendix J.

### **Corporate and Academic Sponsorship**

Several math institutes currently funded by the NSF employ corporate and university sponsored programs with tiered memberships. ICERM launched its own unique corporate and academic sponsorship programs this year.

The Corporate Sponsorship program was launched in October 2011. There is a \$5,000 membership fee.

Members:

- Simulia Dassault Systems
- Microsoft Research/Redmond

The Academic Sponsorship program was launched in February 2012. The fees are \$3,000 for domestic membership and \$5,000 international membership.

Members:

- Georgia Institute of Technology, School of Mathematics
- School of Mathematics at Michigan State University, Department of Mathematics

Michigan Technological University's Department of Mathematical Sciences has committed to membership starting September 1, 2012.

### External Support

The institute staff will continue to aggressively work to develop new sources of support for its programs. Assistant Director, Ruth Crane, has duties which include managing both public and private grants, finding new opportunities, managing the proposal process and ensuring that follow-up reporting is completed. Ruth also manages relations with the institute's sponsoring corporations and serves as a liaison to Brown's Division of Advancement, which unites Alumni Relations, Development, and International Advancement in a single, focused organization.

In addition to the funding provided by the NSF, ICERM receives substantial in-kind financial support from Brown University. The Director is released from teaching, and two Deputy Directors are released from half of their teaching responsibilities. In addition, ICERM is not charged for the use of its building or for custodial care which Brown values at \$670,500. Brown also provides an annual seed fund from the office of Vice President of Research through the institute's first 5 years.

### Other Funding Support 2011-2012

<i><b>Federal Grants</b></i>	<u><b>Year</b></u>	<u><b>Amount</b></u>
N/A	2011-2012	\$0.00
Sub-total		\$0.00

### ***University Funding Support***

VP or Research Support (Seed Fund)	2011-2012	\$40,000.00
Brown UTRA Program for Summer@ICERM	2011-2012	\$ 6,000.00
Sub-total		\$46,000.00

### ***Sponsor Support***

Georgia Institute of Technology	2011-2012	\$1,500.00
Michigan State University	2011-2012	\$1,000.00
Dassault Systèmes - Simulia	2011-2012	\$5,000.00
Sub-total		\$7,500.00

### ***Gifts***

Microsoft Corporation	2011-2012	\$5,000.00
Sub-total		\$5,000.00

TOTAL		\$58,500.00
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### ***Additional Workshops Held At ICERM***

Heterostructured Nanocrystalline Materials	2011-2012	\$30,000.00
Finite Element Exterior Calculus (TBD late June)	2011-2012	~ \$42,500.00
Sub-total		~ \$72,500.00

TOTAL		~ \$72,500.00
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### Outreach/Diversity

ICERM is a young institute, still creating processes and making connections. Even so, many successful public events and lectures have occurred this year, as indicated in the list below:

#### Community Outreach:

The following events and programs have helped to create awareness about the institute:

- David Levermore's series of public talks: Modeling Portfolios that Contain Risky Assets I: Risk and Return; Modeling Portfolios that Contain Risky Assets II: Efficient Frontiers for Various Models; Modeling Portfolios that Contain Risky Assets III: Stochastic Models and Optimization
- ICERM provided staff and facilities support for the annual meeting of the "Providence Foundation"
- The Brown University Symposium for Undergraduates in the Mathematical Sciences (SUMS): "Math and Strategy, Competition, and Cooperation" (co-sponsored by ICERM)
- ICERM provided facilities for RI Governor Lincoln Chaffee's "Knowledge Economy" meeting
- Special Lecture: "Spheres", Professor John Milnor
- Special Lecture: "Non-derivative optimization: the sound, the fury, and the bottom line", Professor Margaret Wright (Lefschetz Center for Dynamical Systems Special Seminar, joint with ICERM)
- Special Lecture: "Smooth topology-preserving approximations of rough domains", Professor John Ball (joint with Department of Applied Math)
- Movie screening of "Wolfgang Goebelin: A Mathematician Rediscovered"
- ICERM/Clay Mathematics Institute Special Lecture: "The Prevalence of Chaos", Professor Xavier Buff
- ICERM provided staff support and facilities for a STEM to STEAM mini-institute: "Seeing and Making Mathematical Paper Structures" workshop
- Hosted annual Mathematics Institute Directors (MIDs) meeting
- ICERM provided staff and facilities support for Brown University's inter-collegial "Day of Data"
- ICERM provided staff and facilities for "Providence Geeks" meeting: talks given by Brown Mathematics Professors Jeffrey Hoffstein and George Karniadakis

### Diversity

Every effort is made to include as diverse a population as possible in all of ICERM's programs and events. Several suggestions for broadening the institute's appeal and reaching target audiences more effectively were discussed at the May 2012 Education Advisory Board meeting:

- Coordinate minority recruitment with Brown University's Assistant Dean of Recruiting and Professional Development (Jabbar Bennett)
- Build on the Brown University – Tougaloo College Partnership (BTP)
- Create a shared lecture series with minority institutions
- Develop a recruiting council with invited ICERM alums

- Feature ICERM graduate student alums who can speak about their experiences at ICERM during conferences that attract minorities (SACNAS, NAM, Blackwell-Tapia)
- Continue to foster relationships with the Leadership Alliance at Brown University and the National Alliance
- Increase personal contact between Directors and members of underrepresented groups

#### Special Diversity Activities:

- ICERM supported and co-sponsored AWM's Anniversary Conference at Brown University: "40 Years and Counting: AWM's Celebration of Women in Mathematics".
- Modern Math Workshop (at SACNAS): Deputy Director Jeff Brock attended in 2011 with Jose Blanchett who gave a presentation to compliment the institute's upcoming Computational Challenges in Probability program for this Fall 2012.
- ICERM will host the 7th Blackwell-Tapia conference in November 2012. This series of biannual conferences honors David Blackwell and Richard Tapia, two seminal figures who inspired a generation of African-American, Native American and Latino/Latina students to pursue careers in mathematics.

#### Administration and Staff

ICERM Directors funded by the grant are: Jeffrey Brock, Jan Hesthaven, Govind Menon, Jill Pipher, and Bjorn Sandstede. Jeff Brock and Jan Hesthaven are committing 50% time to the institute as Deputy Directors, Jill Pipher is 100% time, Govind Menon and Bjorn Sandstede receive one month of salary support from the grant for special projects as Associate Directors. Jeff Hoffstein (the fifth PI on the grant) receives no financial support from the grant and volunteers his time for special projects at ICERM. Jeff Brock will be the Chair of the Mathematics Department starting January 1, 2013. We are actively searching for his replacement.

The ICERM staff includes:

**Ruth Crane, Assistant Director (hired in November 2010):** the outward face of ICERM; responsibilities include coordination and administrative aspects of all research programs of the Institute; supervision of institute staff; development and implementation of policies and procedures; external communications with various academic units, companies, and individuals; coordination of fundraising activities and grant proposals including proposal writing; organization of board meetings; assistance with reporting functions; oversight of web content; advertising management; oversight of functional aspects of undergraduate programs; and coordination of community outreach activities.

**Mathew Borton, IT Manager (hired in December 2011):** responsible for all daily IT/technology related operational activities in the institute; oversees all technical development and IT related service offerings; oversees IT staff management, ensures operational security and stability, provides service development, and continuity of the institute activities; acts as liaison to the institutional IT community, provides assistance with longer-term planning and resource development, and has continued awareness of external activities and resources of relevance to the mission of ICERM. Besides support of the scientific activities in the institute, the responsibilities

include support of administrative IT and A/V equipment, and development and support of web interfaces and databases.

**Juliet Duyster, Financial Manager, (starting in August 2011):** works under the direction of the Assistant Director to provide high-level administrative support and financial management to ICERM; sets policy and creates spending guidelines in accordance with Brown's Office of Sponsored Projects (OSP) and the Brown Accounting Office; oversees financial processes and administration; Prepare budget for multiple programs and workshops of ICERM; works with Director and Assistant Director to prepare contract and grant proposal budgets; provides data trend analysis for budget projection and prepare monthly and annual financial reports on multiple funding sources; approves high volume of Travel Express vouchers, purchase orders, subcontract agreements, intra-departmental, intercampus fund transfers and other financial transactions (endowment, gift funds, etc.); provides financial analyses and various reports on the status of the institute's operating funds required.

**Lauren Barrows, Program Manager (hired in February 2011):** is responsible for the implementation of the entire portfolio of ICERM's scientific research programs. The Program Manager manages a program timeline and program guide for each program, adhering to all programmatic deadlines and budgets. In addition, the Program Manager delivers exceptional service to over 1,000 annual program participants and organizers. Major responsibilities include coordinating the housing, arrival and orientation of long-term and short-term visitors; sending and tracking invitations and applications, assisting with creating a program schedule; assisting with creating marketing materials for distribution; coordinating special events, and solving problems as they arise.

**Shaun Wallace, Web Application Developer (hired in March 2011):** works under the direction of the IT Manager, the web application developer designs, implements and maintains websites and web based applications used to support and promote ICERM and its activities. The Web Application Developer assists the IT support team in routine maintenance and support as needed.

**Isani Cayetano, Technical Support Coordinator (hired in July 2011):** works under the direction of the IT Manager, the technical support coordinator supports and facilitates the technological needs of ICERM staff, visiting researchers, postdocs and guests (50-100 end-users). Besides support of the scientific research activities at the Institute, responsibilities include support of administrative IT and A/V equipment.

**Nicole Henrichs, Program Assistant (hired in September 2011):** works closely with ICERM's Program Manager and Assistant Director, and is the first point of contact for program participants, including scholars, students and visitors. Major responsibilities include front desk, event/visitor, and administrative support.

## Director Biographies:



**Jill Pipher** is a Professor of mathematics at Brown University, and Director of the Institute for Computational and Experimental Research in Mathematics (ICERM). She served as Chair of the Mathematics Department 2005-2008. Pipher received her Ph.D. from UCLA in 1985, and came to Brown as an Associate Professor in 1990 from the University of Chicago. Her research interests include harmonic analysis, partial differential equations and cryptography. She has published papers in each of these areas of mathematics, co-authored a cryptography textbook, and jointly holds four patents for the NTRU encryption and digital signature algorithms. She was a co-founder of Ntru Cryptosystems, Inc, now merged with Security Innovation, Inc. Her awards include an NSF Postdoctoral Fellowship, Presidential Young Investigator Award, Mathematical Sciences Research Institute Fellowship, and an Alfred P. Sloan Foundation Fellowship. Her research in harmonic analysis is currently supported by NSF, and she has recently received funding from the American Institute of Mathematics and from Banff International Research Station for her team research projects. In February 2011, she became the president of the Association for Women in Mathematics. She is a PI or co-PI on four grants awarded in 2011 from DOE, NSA, NSF, and ONR for AWM activities and events.



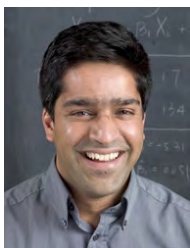
**Jeffrey Brock** is a Professor of mathematics at Brown University, and a Deputy Director of the Institute for Computational and Experimental Research in Mathematics. Brock's research focuses on low-dimensional geometry and topology, particularly on spaces with hyperbolic geometry. He received his undergraduate degree in mathematics at Yale University and his Ph.D. in mathematics from U.C. Berkeley, where he studied under Curtis McMullen. After holding postdoctoral positions at Stanford University and the University of Chicago, he came to Brown as an Associate Professor. He was awarded the Donald D. Harrington Faculty Fellowship to visit the University of Texas, and has had continuous National Science Foundation support since receiving his Ph.D. He was recently awarded a John S. Guggenheim Foundation Fellowship.



**Jan Hesthaven** is a Professor of applied mathematics at Brown University, and a Deputy Director of the Institute for Computational and Experimental Research in Mathematics. He received a M.Sc. in computational physics from the Technical University of Denmark (DTU) in August 1991 and a Ph.D. Following graduation in August 1995, he was awarded an NSF Postdoctoral Fellowship in Advanced Scientific Computing and was appointed visiting Assistant Professor in the Division of Applied Mathematics at Brown University. In December of 1996, he was appointed consultant to the Institute of Computer Applications in Science and Engineering (ICASE) at NASA Langley Research Center (NASA LaRC). In September 2000 he was awarded an Alfred P. Sloan Fellowship, in July 2001 he was awarded a Manning Assistant Professorship, and in March 2002, he was awarded an NSF Career Award. In May 2004, Hesthaven was awarded the Philip J. Bray Award for Excellence in Teaching in the Sciences. In October 2006 he was appointed Director of the Center for Computation and Visualization (CCV). From 2006 to 2009, Hesthaven also served as Associate chair of the Division of Applied Mathematics. He is on the editorial board of Journal of Scientific Computing (2003-) and the SIAM Journal of Scientific Computing (2005-). He is a permanent member of the scientific committee of several international conferences and serves as a reviewer for numerous journals and for both national and international funding agencies.



**Jeffrey Hoffstein** is Professor and chair of mathematics at Brown University, and an Associate Director of the Institute for Computational and Experimental Research in Mathematics. He received his PhD in mathematics from MIT in 1978. After holding postdoctoral positions at the Institute for Advanced Study, Cambridge University, and Brown University, he was an Assistant and Associate Professor at University of Rochester. He came to Brown as a full professor in 1989. His research interests are number theory, automorphic forms, and cryptography. Hoffstein has written over fifty papers in these fields, co-authored an undergraduate textbook in cryptography, and jointly holds seven patents for his cryptographic inventions. He was a co-founder of Ntru Cryptosystems, Inc, now merged with Security Innovation, Inc.



**Govind Menon** is a Professor in the Division of Applied Mathematics at Brown University, an Adjunct Professor at the Centre for Applicable Mathematics at the Tata Institute of Fundamental Research in Bangalore, India, and an Associate Director of special projects at the Institute for Computational and Experimental Research in Mathematics. He is a graduate of the Indian Institute of Technology at Kharagpu, Cornell University, and Brown University.



**Bjorn Sandstede** is Professor and chair of applied mathematics at Brown University, and an Associate Director of the Institute for Computational and Experimental Research in Mathematics. He studied mathematics at the University of Heidelberg and received his PhD in 1993 from the University of Stuttgart. After holding postdoctoral positions at the Weierstrass Institute in Berlin and at Brown University, he was a faculty member at the Ohio State University from 1997-2004, before moving in 2004 to the University of Surrey in England. In 2008, he joined the Division of Applied Mathematics at Brown University. He received an Alfred P Sloan Research Fellowship in 2000, was awarded the first JD Crawford Prize of the SIAM Activity Group on Dynamical Systems in 2001, and received a Royal Society Wolfson Research Merit Award in 2004. He is currently the Director of the Lefschetz Center for Dynamical Systems and will become the editor-in-chief of the SIAM Journal on Applied Dynamical Systems in January 2012.

### Facilities

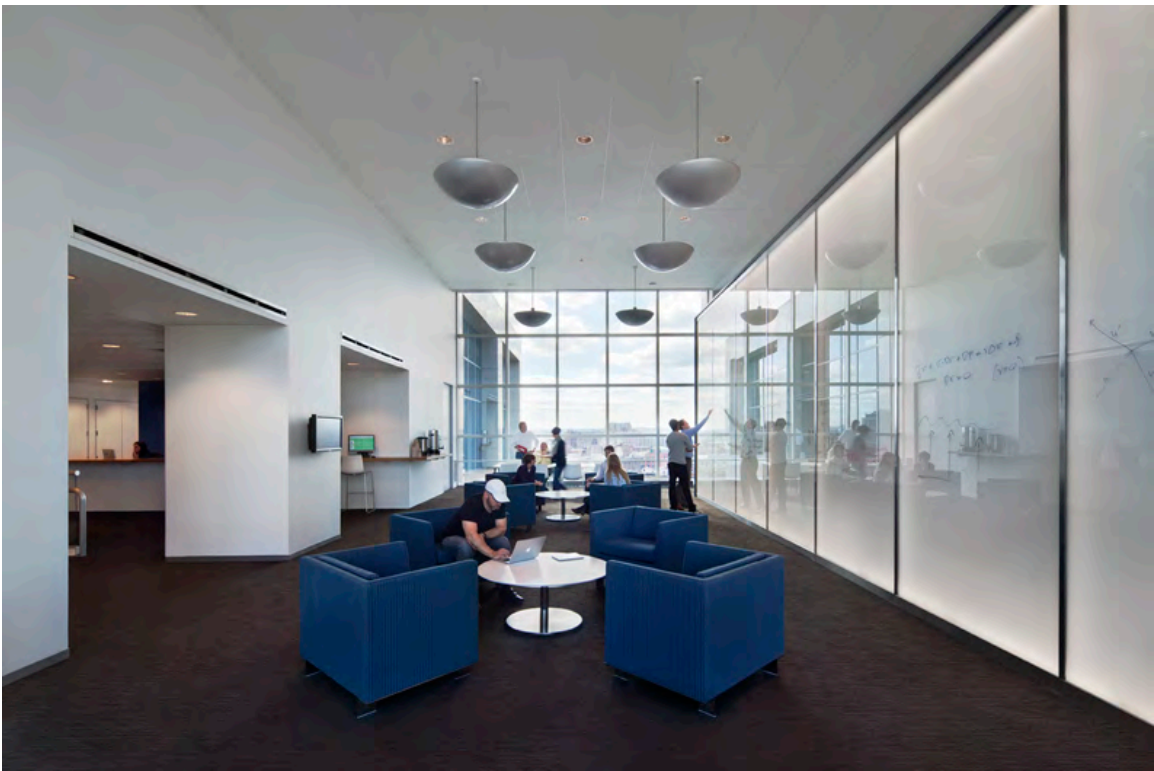
ICERM is located on the 10<sup>th</sup> and 11<sup>th</sup> floors of 121 S. Main Street, in a Brown owned building in downtown Providence, RI. Visitors to ICERM are within 10-minute walking distance of the Brown campus, the train station, major hotels, and a variety of restaurants and historic sites.

The space includes a 100-seat lecture hall, a 20-seat seminar room, a 20-seat conference room, an administrative suite, office space for 40-45 visitors, kitchen, and three large collaborative areas.

## Photos of ICERM



ICERM's main lobby



One of ICERM's many collaborative spaces (the feature wall is a glass "white board")



ICERM's lecture hall can seat up to 120



ICERM's conference room



ICERM features many collaborative areas with “writable walls”



Additional collaborative space



Long-term visitor office space

### Databases, Records, and Website

To keep track of all visitor-related data, ICERM uses a customized version of the Discovery database that was developed at the IMA and whose underlying design and web-interface was generously offered to us by the IMA. This database stores data for each person (names, degree data, gender, ethnicity, current email address, primary interest, etc.), each visit of a person to ICERM (address, countries of citizenship and residence, visit dates, visit roles, etc.), and all event-related data (which visit of which person is associated with what event, and in which capacity did the person participate). ICERM keeps track of the position of each visitor and other relevant information (such as whether the person is from an EPSCoR state or not) at the time when they attend. As a caveat, changes to person data (e.g. gender or ethnicity of a person) currently affect all past visits. Participants can select multiple boxes for race/ethnicity. We note whether these data were entered by ICERM staff or self-reported by the participant; participants are asked to confirm or edit their records when attending ICERM events.

Electronic application forms for long-term visitors, workshop participants, and graduate students are available on ICERM's website. Applications are stored, and permanently kept, in a separate Application database. Once an application is approved, the relevant application record is copied to the Discovery database; the latter therefore contains data of all persons who were invited or accepted as participants, including those who were invited but declined. Applications for postdocs are handled through Mathjobs. ICERM keeps a complete snapshot of all applications, including diversity information.

### **Rhode Island NSF EPSCoR**

The increased bandwidth provided to ICERM and other Brown buildings in Providence's Jewelry district is made possible by a Cisco optical communications support hardware allowing 10Gbit/sec connectivity. This connectivity was funded through the Rhode Island NSF EPSCoR Cyberinfrastructure Award from the National Science Foundation (EPS-1005789).

### **IT Resources**

ICERM's information technology group's mission is to provide the necessary tools for research, collaboration, and information dissemination required by the institute's participants and to support the administrative staff. This will be accomplished by providing flexible systems that can be quickly reconfigured to meet research needs and efficient administrative tools that allow the institute's staff to maintain high levels operational excellence.

### **Work Stations**

ICERM provides virtual desktop systems to all semester program participants using Virtual Bridges on Redhat Linux systems. The host operating system will be Redhat Linux Server, the guests use Redhat Linux workstation or Windows 7, and the client machines are thin clients using a thin version of Debian. Applications will be distributed as needed. It is anticipated that the application need will differ from program to program and researcher to researcher. Individuals will have administrative control over their own thin client desktops. Each user will be provided with a thin client terminal. Researchers will also be free to provide their own equipment (use their own laptop). The majority of the applications provided to laptop users will leverage existing Brown license agreements

### **Web Based Tools**

ICERM provides web-based tools for collaboration and to assist research. The institute hosts blog space, forums, and wikis for researcher use during the programs through Atrium. All previous talks and papers generated in the course of semester programs are archived and available for download and review via the website. A software repository will be maintained, containing open source tools for research, and separate, secure code repository will be available projects in development.

### **Multimedia Resources**

ICERM has state of the art audio/visual capabilities. The 100-seat lecture hall features dual projection screens, a centrally controlled AV system capable of displaying multiple media types, and a lecture capture system for recording presentations and streaming to the web. A smaller meeting room is equipped with a video conferencing system and includes a digital media projection system. The video conferencing system can also be leveraged to communicate with the lecture hall. A seminar room on the 10<sup>th</sup> floor provides basic multimedia presentation capability and contains a smart-board system. Digital signage screens throughout the institute are used to display important information to visitors and can be independently used as a peripheral display from a laptop.

### **Video Archives:**

ICERM digitally records semester and topical workshop talks and special lectures in High Definition using the Echo 360 lecture capture system. Presentations are then archived and made available for viewing on our website along with a PDF copy of the presenter's slides, when available.

## **Publications**

The institute has discussed opportunities to publish workshop proceedings with AMS and Springer. In both cases, the publishers are especially interested in monographs that include an expository introduction to the field or area, and develop the subject. AMS has approved Jeff Hoffstein's book proposal for a proceedings of the January Kolkata VI-MSS conference. ICERM encourages program and workshop organizers to use scribes and to designate one or more senior people to take responsibility for producing a manuscript or whitepaper. In the future, we will require semester organizers to produce a forward looking research summary of their program and some of its specific problems and goals.

For additional information about self-reported publications and collaborations from ICERM program participants, please see Appendix J.

## **NSF Required Materials Available in the Appendix**

**Appendix H: Mathematics Institute Directors (MIDs) Meeting Minutes**

**Appendix L: ICERM Participant List and Summary Table**

**Appendix M: ICERM Financial Support List**

**Appendix N: ICERM Income and Expenditure Report**

**Appendix O: VI-MSS Income and Expenditure Report**