

Institute for Computational and Experimental Research in Mathematics

# Annual Report August 1, 2012 – July 31, 2013

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#### 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**

ТҮРЕ	TITLE	DATE	# ATTENDED
Summer	Summer@ICERM: Geometry and	June 18 - August	14 (NSF funded
Program	Dynamics	10, 2012	10)
Topical	Bridging Scales in Computational	August 6-10, 2012	23
Workshop	Polymer Chemistry		
Semester	Computational Challenges in	September 5 -	58 (long-term
Program	Probability	December 7, 2012	visitors, a visit
			lasting 9 days or
		~	more)
Program	Bayesian Nonparametrics	September 17 - 21,	92
Workshop		2012	
Program	Uncertainty Quantification	October 9 - 13,	88
Workshop		2012	0.0
Program	Monte Carlo Methods in the	October 29 -	80
Workshop	Physical and Biological Sciences	November 2, 2012	50 (
Special Event	Public Lecture: A Tale of Two Climaton "Professor Christopher	November 8, 2012	50 (pre-
	K R T Jones		registered)
Special Event	Blackwell-Tania Conference 2012	November 9 - 10	121
Special Event	Diackwen-Tapia Conference 2012	2012	121
Special Event	Public Lecture: "Physics in	November 15, 2012	97 (pre-
	Animation and Visual Effects,"		registered)
	Ron Henderson		
Program	Performance Analysis of Monte-	November 28 - 30,	78
Workshop	Carlo Methods	2012	
VI-MSS	Winter School and Conference on	December 10 - 21,	7 (funded by
	Computational Aspects of Neural	2012	ICERM)
	Engineering		
Topical	Reproducibility in Computational	December 10 - 14,	70
Workshop	and Experimental Mathematics	2012	
VI-MSS	Workshop and Conference on	January 2 - 11,	5 (funded by
	Limit Theorems in Probability	2013	ICERM)
Semester	Automorphic Forms,	January 28 - May	79 (long-term
Program	Combinatorial Representation	3, 2013	visitors, a visit
	Theory and Multiple Dirichlet		lasting 9 days or
	Series		more)

ICERM's scheduled programs and events through June 2013

Program Workshop	Sage Days: Multiple Dirichlet series, combinatorics, and representation theory	February 11 - 15, 2013	80
Program Workshop	Crystals and Whittaker Functions	March 4 - 8, 2013	117
Special Event	The Brown University Symposium for Undergraduates in the Mathematical Sciences (SUMS): "Math and Strategy, Competition, and Cooperation" (co-sponsored by ICERM)	March 9, 2013	110
Special Event	Public Lecture: "Scratching the Surface in Dynamic Visual Effects," Professor Robert Bridson	March 11, 2013	72
Program Workshop	Combinatorics, Multiple Dirichlet Series and Analytic Number Theory	April 15 - 19, 2013	102
Topical Workshop	Issues in Solving the Boltzmann Equation for Aerospace Applications	June 3 - 7, 2013	38 (as of 5/1/13)
Summer Program	Summer@ICERM: Geometry and Dynamics	June 17 - August 9, 2013	15 (as of 5/1/13)
Summer Program	IdeaLab 2013: Weeklong Program for Early Career Researchers	July 15 - 19, 2013	13 (as of 5/1/13)
Summer Program	Research Experiences for Undergraduate Faculty (REUF) (co-sponsored by ICERM and AIM)	July 22 - 26, 2013	TBA (as of 5/1/13)

## 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

### **Participating Institutions and Organizations**

## 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
- Indian Institute of Science Education and Research (IISER), Pune
- Institute of Mathematical Sciences (IMSc), Chennai
- Indian Statistical Institute (ISI), Kolkata, Delhi, Bangalore
- Tata Institute of Fundamental Research (TIFR), Mumbai
- University of Delhi (DU), Delhi

ICERM is also collaborating with ICTS.

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

## Participant Summaries by Program Type

For this reporting terms (May 2, 2012 to May 1, 2013) 635 unique participants were enrolled in two semester long programs and/or nine workshops and Summer@ICERM. Of the 635, 713 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. All data below includes organizers, and is as of May 2, 2013. ICERM Funded Participants

				-	Gende	r and E	Ethnicity	,			-	G	eograph	nical P	oint 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
Sumn	ner@ICERM 2012	10	5	10	0	0	0	1	10	0	5	1	2	1	0	1	0	0	0
	Semester Program	68	15	54	0	0	9	2	34	3	17	3	10	0	4	0	31	0	0
12	Workshop 1	55	15	39	0	0	13	2	28	1	16	8	11	0	2	0	16	1	0
ter	Workshop 2	56	11	40	1	0	15	0	33	3	14	4	15	0	3	0	17	0	0
nest	Workshop 3	51	10	43	0	0	14	2	34	2	16	5	7	0	4	1	16	0	0
Sen	Workshop 4	50	9	36	0	0	11	2	25	1	16	5	4	0	3	2	19	0	0
all	Total Unique	142	28	103	1	0	26	6	80	8	34	19	25	0	4	3	46	2	0
Ĩ	% of Unique # Reporting		27%		1%	0%	33%	8%		6%	24%	13%	18%	0%	3%	2%	32%	1%	0%
3	Semester Program	80	14	49	0	0	14	2	44	5	30	4	10	0	7	9	12	0	3
er '1	Workshop 1	61	12	45	1	0	11	2	38	8	21	5	7	0	2	7	8	0	3
mest	Workshop 2	61	15	64	0	0	19	4	59	13	32	8	9	0	4	5	10	0	4
g Se	Workshop 3	67	9	35	0	0	11	2	31	6	29	3	8	0	6	2	10	1	2
ring	Total Unique	133	22	89	1	0	23	5	80	18	43	10	13	0	11	10	22	1	5
$\mathbf{S}\mathbf{p}$	% of Unique # Reporting		25%		1%	0%	17%	4%		14%	32%	8%	10%	0%	8%	8%	17%	1%	4%
- c	8/6/12 wrkshp	22	2	20	0	0	4	1	13	5	5	4	2	0	2	1	3	0	0
pica - '1	12/10/12 wrkshp	32	4	21	0	0	2	3	20	3	9	3	12	0	0	2	2	0	1
Tof '12	Total	54	6	41	0	0	6	4	33	8	14	7	14	0	2	3	5	0	1
• •	% of # Reporting		15%		0%	0%	18%	12%		15%	26%	13%	26%	0%	4%	6%	9%	0%	2%

A Semester Program Participant is defined as anyone who was at a workshop for 10+ days or those who came outside the workshop dates.

					Gena	ler and Ethni	city			Geographi of Or	cal Point igin
S	Program Type	Total Partici pants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
Sun	hmer@ICERM 2012	14	4	14	0	0	3	1	14	14	2
	Semester Program	151	27	89	0	0	21	2	60	113	38
'12	Workshop 1	95	24	68	0	0	19	3	49	71	24
ter	Workshop 2	88	17	69	1	0	23	0	52	63	25
nest	Workshop 3	80	17	68	1	0	23	2	50	54	26
Ser	Workshop 4	78	16	60	0	0	19	2	43	50	28
all	Total Unique	287	51	188	2	7	57	7	151	215	72
I	% of Unique # Reporting		27%		1%	5%	38%	5%		75%	25%
3	Semester Program	104	18	65	0	1	21	2	59	66	38
er '1	Workshop 1	80	16	61	1	1	15	2	51	55	25
iest	Workshop 2	117	23	94	0	1	32	4	86	85	32
Sen	Workshop 3	105	14	66	2	1	26	2	61	69	36
ng	Total Unique	206	36	149	3	1	46	5	137	131	75
Spri	% of Unique # Reporting		24%		2%	1%	35%	4%		64%	36%
'13	8/6/12 wrkshp	23	2	21	0	0	4	1	14	16	7
1 12 -	12/10/12 wrkshp	71	9	49	0	0	4	3	45	55	16
pical	Total	94	11	70	0	0	8	4	59	71	23
Tol	% of # Reporting		16%		0%	0%	14%	7%		76%	24%

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

A Semester Program Participant is defined as anyone who was at a workshop for 10+ days or those who came outside the workshop dates.

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
Sum	mer@ICERM 2012	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	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
12	Workshop 1	24	4	13	0	0	2	1	10	1	5	4	5	0	0	0	8	1	0
ter '	Workshop 2	23	4	15	0	0	3	0	11	1	5	2	7	0	0	0	8	0	0
nest	Workshop 3	11	1	9	0	0	2	1	6	2	2	1	2	0	1	3	0	0	0
Sei	Workshop 4	10	0	5	0	0	0	0	2	1	2	0	2	0	0	1	4	0	0
Fall	Total Unique	68	8	40	0	0	7	2	28	5	15	9	14	0	1	1	22	1	0
, ,	% of Unique # Reporting		20%		0%	0%	25%	7%		7%	22%	13%	21%	0%	1%	1%	32%	1%	0%
13	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
er '	Workshop 1	9	4	8	0	0	0	0	7	0	2	0	2	0	0	1	3	0	1
nest	Workshop 2	18	3	11	0	0	3	0	10	4	5	2	2	0	0	1	2	0	2
Sen	Workshop 3	20	2	3	0	0	2	0	3	2	7	0	2	0	5	0	5	0	0
ing	Total Unique	47	9	22	0	0	5	0	20	6	14	2	6	0	5	2	10	0	3
Spr	% of Unique # Reporting		41%		0%	0%	25%	0%		13%	30%	4%	13%	0%	11%	4%	21%	0%	6%
'13	8/6/12 wrkshp	16	2	14	0	0	3	0	9	2	2	4	2	0	1	1	3	0	0
12 -	12/10/12 wrkshp	17	1	10	0	0	0	2	9	0	5	2	7	0	0	0	1	0	1
pical '	Total	33	3	24	0	0	3	2	18	2	7	6	9	0	1	1	4	0	1
To	% of # Reporting		13%		0%	0%	17%	11%		6%	21%	18%	27%	0%	3%	3%	12%	0%	3%

## **ICERM Funded Speakers** - *N*/*A* = *None Attended*

				Geographi of Or	cal Point igin						
Sun	Program Type	Total Speakers	Female	# Reporting Gender	African American	American Indian 0	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
Jui	Semester Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	Workshop 1	28	4	15	0	0	1	1	12	10	9
r 1	Workshop 2	26	4	17	0	0	4	0	12	18	8
leste	Workshop 3	13	1	9	0	0	2	1	6	8	5
Sem	Workshop 4	11	0	6	0	0	0	0	2	6	5
all	Total Unique	78	8	45	0	0	9	2	31	52	26
H	% of Unique # Reporting		18%		0%	0%	29%	6%		67%	33%
3	Semester Program	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
er '1	Workshop 1	9	4	8	0	0	0	0	7	4	5
lest	Workshop 2	19	3	11	0	0	3	0	10	13	6
Sen	Workshop 3	21	2	3	0	0	2	0	3	12	10
ing	Total Unique	<b>49</b>	9	22	0	0	5	0	20	29	20
Spr	% of Unique # Reporting		41%		0%	0%	25%	0%		59%	41%
'13	8/6/12 wrkshp	17	2	15	0	0	3	0	10	11	6
12 -	12/10/12 wrkshp	28	3	16	0	0	0	2	15	23	5
ical	Total	45	5	31	0	0	3	2	25	34	1
Top	% of # Reporting		16%		0%	0%	12%	8%		76%	24%

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

## **ICERM Funded Postdocs**

				Gende	r and	Ethnicit	y		Geographical Point of Origin									
Program Type Fall '12 Semester	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	u US - West	Africa	Asia	Canada	Europe	Latin & South America	o Oceania
Program	25	11	21	1	0	6	3	19	2	6	3	5	0	0	1	8	0	0
% of # Reporting		52%		5%	0%	32%	16%		8%	24%	12%	20%	0%	0%	4%	32%	0%	0%
Spring '13 Semester Program	21	3	15	0	0	6	3	13	1	6	2	1	0	1	3	6	0	1
% of # Reporting		20%		0%	0%	46%	23%		5%	29%	10%	5%	0%	5%	14%	29%	0%	5%

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

				Geographical Point o Origin						
Program Type	Total Partici pants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
Fall '12 Semester Program	33	12	29	1	0	10	3	26	24	9
% of # Reporting		41%		4%	0%	38%	12%		73%	27%
Spring '13 Semester Program	33	4	26	0	0	12	3	24	16	17
% of # Reporting		15%		0%	0%	50%	13%		48%	52%

## **ICERM Funded Graduate Students**

				Gende	r and E	thnicity			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 '12 Semester Program	15	6	15	0	0	8	0	15	0	4	1	3	0	1	0	5	1	0
% of # Reporting		40%		0%	0%	53%	0%		0%	27%	7%	20%	0%	7%	0%	33%	7%	0%
Spring '13 Semester Program	23	4	22	0	0	6	1	19	6	10	1	4	0	0	0	1	0	1
% of # Reporting		18%		0%	0%	32%	5%		26%	43%	4%	17%	0%	0%	0%	4%	0%	4%

11: Fall '12 graduate students in residence12: Spring '13 graduate students in residence

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

			Gender and Ethnicity							Geographical Point of Origin	
Program Type	Total Partici pants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based	
Fall '12 Semester Program	<mark>8</mark> 7	22	57	1	0	27	0	55	73	14	
% of # Reporting		39%		2%	0%	49%	0%		84%	16%	
Spring '13 Semester Program	54	12	50	1	1	17	1	45	46	8	
% of # Reporting		24%		2%	2%	38%	2%		85%	15%	

## **ICERM Funded VI-MSS Attendees**

				Gender	ender and Ethnicity Geographical Point					oint of (	nt 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
During Fall Semester '12																		
Long-term research	2	1	1	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0
12/10/12 workshop	7	0	0	0	0	0	0	0	0	2	1	4	0	0	0	0	0	0
Total	9	1	1	0	0	0	0	1	0	4	1	4	0	0	0	0	0	0
% of # Reporting		100%		0%	0%	0%	0%		0%	44%	11%	44%	0%	0%	0%	0%	0%	0%
						Dui	ing Sp	ring Sei	nester '	13								
Long-term research	5	2	5	0	0	3	0	5	0	4	0	0	0	0	0	1	0	0
1/2/13 workshop	4	1	2	0	0	0	0	1	0	1	0	1	0	0	0	2	0	0
Total	9	3	7	0	0	3	0	6	0	5	0	1	0	0	0	3	0	0
% of # Reporting		43%		0%	0%	50%	0%		0%	56%	0%	11%	0%	0%	0%	33%	0%	0%

Data below indicates ICERM funded participants who traveled to India for research and workshops.

During this time, 4 people were sent to ICERM from India's Department of Science and Technology to conduct long-term research at Brown University or attend an ICERM program.

#### **Additional Participant Data**

The charts below display breakdowns of ICERM's confirmed participants (including organizers) by category during the reporting period for all funded programs. Note that VI-MSS program data is no included.



## Figure 1







## Figure 3



**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 (SAB) meets annually in November, and schedules conference calls as needed throughout the year. The 2012 meeting resulted in the selection of semester programs and topical workshops through Spring 2015. Gabor Szekely. NSF, attended the SAB meeting.

The semester program selection process follows these steps:

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

ICERM hosts two semester programs per year. Each has 4-7 organizers and typically incorporates three week-long associated workshops. Semester program proposers are asked to contact the ICERM Director to discuss program ideas prior to starting a pre-proposal.

#### **Pre-Proposal Requirements**

A 2-3 page document which describes the scientific goals, lists the organizers of the program, and identifies the key participants.

#### **Pre-Proposal Deadline**

All pre-proposals should be submitted to the ICERM Director no later than September 1st. The ICERM directors and a subcommittee of the Scientific Advisory Board (SAB) review all pre-proposals. Proposers receive feedback within a few weeks of their submission or by September 15th.

#### **Semester Program Full Proposal Requirements**

Full Proposals for semester programs consist of 6-10 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), most of whom will be in residence for the semester program,
- 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 (tutorials at the beginning of the program and/or before workshops, weekly student/postdoc seminars, advising and other structured mentoring activities from the senior participants),
- 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).

#### Semester Program Full Proposal Deadline

All full proposals need be submitted to the ICERM Director no later than November 1st. The ICERM directors and the Scientific Advisory Board (SAB) review all proposals. Proposers receive feedback within a few weeks of their submission or by December 15th.

## 2. Proposal Selection

The Science Advisory Board (SAB) approves the semester programs. The deadline for proposals is November 1st, prior to the annual November SAB meeting. Proposals are 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 and the organizers are provided with a semester program planning timeline. 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). Program and/or workshop ads are placed in appropriate publications if recommended by the organizers and directors. 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 an initial ranked list of 15-20 possible speakers, but throughout the invitation process may need to provide as many as 25 to 30 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**

- Opening reception on first day of program
- Morning: 2-3 day event at the beginning of the semester program; includes talks related to upcoming workshops, and IT tutorial by ICERM staff
- Afternoon: 15-minute presentations by the postdocs, plus 5-minute presentations by the grad students, designed to get everyone acquainted

#### Weekly Seminar

• The weekly seminar includes talks by visitors in residence at ICERM. Program organizers are provided with names and dates to facilitate scheduling.

#### **Optional Mini-Series**

• Mini-courses or other multi-session events are encouraged.

#### 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

#### Note: Sample tutorial schedule can be found in Appendix A

#### **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
- A poster session is scheduled midweek, usually in the early evening with refreshments
- 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
- Closing reception

#### 2012-2013 Semester Programs

**Fall Semester 2012: Computational Challenges in Probability** September 5, 2012 - December 7, 2012

#### **Organizing Committee**

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

#### **Program Description**

Modern explorations in science, technology and medicine increasingly demand complex stochastic models. Computational and theoretical advances are needed in order to formulate, analyze, apply and interpret these models. Recent years have witnessed a remarkable interplay between computation and probability. On the one hand, probabilistic techniques have led to powerful computational methods such as Markov chain Monte Carlo algorithms, while on the other hand the calculation of probabilistic quantities such as modes and marginals of high-dimensional distributions and the analysis of data from random samples has posed several computational challenges.

The Fall 2012 Semester on "Computational Challenges in Probability" aims to bring together leading experts and young researchers who are advancing the use of probabilistic and computational methods to study complex models in a variety of fields. The goal is to identify common challenges, exchange existing tools, reveal new application areas and forge new collaborative efforts. The semester includes four workshops - Bayesian Nonparametrics, Uncertainty Quantification, Monte Carlo Methods in the Physical and Biological Sciences and Performance Analysis of Monte Carlo Methods. In addition, synergistic activities will be planned throughout the duration of the semester. In particular, there will be several short courses and plenary invited talks by experts on related topics such as graphical models, randomized algorithms and stochastic networks, regular weekly seminars and relevant film screenings.

#### **Workshop 1: Bayesian Nonparametrics**

September 17-21, 2012 Number of Participants: 92

#### **Organizing Committee**

Kassie Fronczyk, UT MD Anderson Cancer Center/Rice University Stuart Geman, Brown University Matthew Harrison, Brown University Michael Jordan, UC Berkeley Peter Mueller, University of Texas, Austin Erik Sudderth, Brown University

#### Speakers

Ryan Adams, Harvard University Tamara Broderick, University of California, Berkeley Lawrence Carin, Duke University David Dahl, Brigham Young University Pierpaolo De Blasi, Universita di Torino Finale Doshi-Velez, Harvard Medical School David Dunson, Duke University Marian Farah, MRC Biostatistics Unit Emily Fox. University of Washington Michele Guindani, University of Texas M. D. Anderson Cancer Center Nils Hjort, University of Oslo Chris Holmes, University of Oxford Antonio Lijoi, Universita di Pavia Steve MacEachern, Ohio State University Jeffrey Miller, Brown University Peter Mueller, University of Texas at Austin Long Nguyen, University of Michigan Andriy Norets, Princeton University Peter Orbanz, Columbia University Igor Pruenster, Universita di Torino Fernando Quintana, Pontifical Catholic University of Chile Abel Rodriguez, University of California, Santa Cruz Judith Rousseau, Universita de Paris-Dauphine Daniel Roy, University of Cambridge Suchi Saria, Stanford University Jayaram Sethuraman, Florida State University Surya Tokdar, Duke University Sinead Williamson, Carnegie Mellon University

#### **Workshop Description**

Data-rich investigations need advanced tools for allowing data to inform and interact with models. Bayesian Nonparametrics is a rapidly growing subfield of statistics and machine learning that provides a framework for creating complex statistical models that are both expressive and tractable. Recent, successful applications of nonparametric Bayesian models across a variety of domains suggests that these models have the potential for wide use. The challenge of constructing and using models on very high dimensional or even infinite dimensional spaces creates many opportunities for fruitful interactions between mathematicians, statisticians and computer scientists. Areas of interest include prior construction, posterior inference, posterior asymptotics, algorithmic development, and practical applications.

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**

"Created an environment for exchange of ideas between researchers working in nonparametric Bayesian statistics, machine learning, computer learning and related fields."

"We had a great turn out: a good mix of theory, machine learning, and other applications."

"We succeeded in recruiting a world-class group of speakers and participants, who gave an excellent set of talks and made for very interactive poster sessions and breaks. I received very positive comments from visitors about the ICERM facilities, and the nearby Providence area."

#### **Some Workshop Participant Comments**

"I liked that it was a small gathering where both junior and senior statisticians had the opportunity to present their research. The length of the talks was just right. The participants were respectful and

supportive. Also, the administrative staff and the local organizers where extremely helpful and nice. I would love to come back."

"I really liked the single-track format. Especially when we're all working on nonparametric Bayes, it's nice to share the same set of ideas and experiences throughout the workshop."

"Very good mix of statisticians, computer scientists and mathematicians. Good amount of time for discussions."

### Workshop 2: Uncertainty Quantification

October 9-13, 2012 Number of Participants: 88

#### **Organizing Committee**

Roger Ghanem, University of Southern California George Karniadakis, Brown University Boris Rozovsky, Brown University Marta Sanz-Sole, Universitat de Barcelona

#### Speakers

H.T. Banks, North Carolina State University Sonjoy Das, University at Buffalo (SUNY) Anne de Bouard, Ecole Polytechnique Alireza Doostan, University of Colorado Roger Ghanem, University of Southern California Tom Hou, California Institute of Technology Dionissios T.Hristopulos, Technical University of Crete Peter Eris Kloeden, Johann Wolfgang Goethe-Universität Frankfurt Chia Ying Lee, University of North Carolina Dong Li, Princeton University Guang Lin, Pacific Northwest National Laboratory Sergey Lototsky, University of Southern California Didier Lucor, Université de Paris VI (Pierre et Marie Curie) Youssef Marzouk, Massachusetts Institute of Technology Hao Ni, University of Oxford Ivan Nourdin, Université de Lorraine Houman Owhadi, California Institute of Technology Marta Sanz-Sole, University of Barcelona Themistoklis Sapsis, Massachusetts Institute of Technology Daniel Tartakovsky, University of California, San Diego Michael Tretyakov, University of Nottingham Daniele Venturi, Brown University Xiaoliang Wan, Louisiana State University Dongbin Xiu, Purdue University Nicholas Zabaras, Cornell University Zhongqiang Zhang, Brown University

#### **Workshop Description**

Rapid growth in computational resources has heightened the expectation that scientific knowledge can indeed be a driver for societal well-being and betterment. At the same time, our ability to measure the natural and social world around has significantly increased, aided by technological development in

sensors, the internet, and other modalities of communication. Science is thus faced, simultaneously, with a complex description of reality at an unprecedented resolution, and the possibility to describe this reality with mathematical models of increasing complexity. Probabilistic formulations of physical problems can be viewed as attempts to adapt rational procedures to this complexity, while tackling the conceptual challenges they inevitably present. As a testament to the significance of this confluence of mathematics, science, and technology, Uncertainty Quantification is arguably one of the fastest growing sub-disciplines in mechanics.

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

"Diversity of topics presented."

#### **Some Workshop Participant Comments**

"Possibility to learn about the state of the art of UQ methods via direct meeting with the people - ability to ask questions, find common interests which in turn will significantly influence (planning and directions of) my future research. Thank you for the chance to participate!"

"The level of the presentations and the opportunities to meet colleagues."

Workshop 3: Monte Carlo Methods in the Physical and Biological Sciences

October 29, 2012 - November 2, 2012 Number of Participants: 80

#### **Organizing Committee**

Bruce Berne, Columbia University Maria Cameron, University of Maryland Jimmie Doll, Brown University Paul Dupuis, Brown University Eric Vanden-Eijnden, New York University

#### Speakers

David Ceperley, University of Illinois Pierre Del Moral, INRIA James Gubernatis, Los Alamos National Laboratory Hannes Jonsson, University of Iceland Kay Kirkpatrick, University of Illinois at Urbana-Champaign Jun Liu, Harvard University Jianfeng Lu, Duke University Markus Meuwly, Universitat Basel Nuria Plattner, Universitat Basel Cristian Predescu, D. E. Shaw Research Weiqing Ren, National University of Singapore Konstantinos Spiliopoulos, Boston University Art Voter, Los Alamos National Laboratory

#### **Workshop Description**

Monte Carlo methods are one of the main tools used to study the properties of complex physical, chemical and biological systems. Since their introduction in the late 1940s, these methods have undergone a remarkable expansion and are now used in many other fields, including statistical inference, engineering,

and computer science. However, the design and theoretical understanding of Monte Carlo methods is still a challenging topic, especially for those problems where rare events play the key role in determining algorithm performance. The aim of the workshop is to bring together specialists in the application areas who understand the specific challenges posed by realistic problems and have developed sophisticated tools to tackle these problems, and mathematicians developing methods for algorithm analysis, abstraction, and optimization.

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

"Many of the speakers made a real effort to speak to a broad audience that included people not in their area. This was essential to the goals of introducing new questions and issues to mathematicians and new techniques and theory to the applied people. However, if all the speakers had done so it would have been much better. Ways to encourage this for similar workshops in the future, such as an explicit recommendation of some kind (e.g., spend the first 5-10 minutes of the talk explaining in the language of an science undergrad the problems you will discuss in detail later on), might be helpful."

### **Some Workshop Participant Comments**

"I was very pleased with varieties of talks subjects during the workshop. In addition, I liked a lot that the breaks were long enough to allow me to connect people after their talks and ask them questions or just make connections with them, that maybe useful for my or their future research work."

### Workshop 4: Performance Analysis of Monte Carlo Methods

November 28, 2012 – November 30, 2012 *Number of Participants: 78* This workshop was externally funded by the ASFOR.

#### **Organizing Committee**

Jose Blanchet, Columbia University Gersende Fort, CNRS Henrik Hult, University of Copenhagen Jingchen Liu, Columbia University

#### Speakers

Mylene Bedard, University of Montreal Paul Dupuis, Brown University James Fill, Johns Hopkins University Krzysztof Łatuszyński, University of Warwick Xiao-Li Meng, Harvard University Sean Meyn, University of Illinois at Urbana-Champaign Eric Moulines, Centre National de la Recherche Scientifique (CNRS) Dana Randall, Georgia Institute of Technology Christian Robert, Universita de Paris-Dauphine Gareth Roberts, University of Warwick Ramon van Handel, Princeton University

#### **Workshop Description**

Monte Carlo methods have become increasingly important in Engineering and the Sciences. These application areas have posed challenges and opportunities in the analysis of modern Monte Carlo algorithms. The workshop's main focus is on: a) the mathematical techniques and aspects that have been

key in the analysis of these algorithms, and b) the identification of techniques that are likely to play a role in future analysis.

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 attracted an outstanding collection of speakers and other participants and in addition the quality of the talks were excellent. In my opinion this is probably the best workshop I have ever participated in when it comes to scientific excellence and innovation."

"Because of the excellent support staff it was very easy to organize this workshop. All we had to do was to focus on the selection of speakers and design the program. All other issues were effectively handled by the ICERM staff."

#### **Some Workshop Participant Comments**

"The small size, high quality participants, and the ample breaks in the schedule to talk in small groups."

"Quality of speakers was excellent! Really enjoyed being exposed to cutting edge work!"

#### All Visitors to Fall 2012 Semester Program

Orange highlight represents anyone staying over 9 days

Name	Organization	Time Spent at ICERM (days)
Adams, Loyce	University of Washington	107
Adams, Ryan	Harvard University	5
Agbanusi, Ikemefuna	Boston University	5
Aghajani, Mohammadreza	Brown University	94
Ala-Nissila, Tapio	Brown University	7
Allen, Rosalind	University of Edinburgh	5
Almada Monter, Sergio Angel	University of North Carolina	6
Andrade, Julio Cesar Bueno de	University of Bristol	263
Archibald, Rick	Oak Ridge National Laboratory	4
Arriola, Leon M	University of Wisconsin	7
Bacallado, Sergio Andra	Stanford University	6
Banerjee, Anjishnu	Duke University	5
Banks, H.T.	North Carolina State University	2
Barta, Winfried	George Washington University	3
Bedard, Mylene	University of Montreal	3
Befekadu, Getachew K	University of Notre Dame	7
Berger, Marsha	Courant Institute of Mathematical Sciences	2
Blanchet, Jose	Columbia University	87
Borgs, Christian	Microsoft Research	1

Broderick, Tamara	University of California, Berkeley	8
Buller, Mark	Brown University	2
Busic, Ana	INRIA	6
Cai, Wei	University of North Carolina - Charlotte	2
	Virginia Polytechnic Institute and State	
Cao, Yang	University	5
Cargill, Daniel S	New Jersey Institute of Technology	106
Carin, Lawrence	Duke University	5
Carpenter, Bob	Columbia University	5
Ceperley, David	University of Illinois	5
Cerquetti, Annalisa	Universita di Roma "La Sapienza"	26
Chatterjee, Sabyasachi	Yale University	4
Chayes, Jennifer	Microsoft Research	2
Chen, Jiang	University of North Carolina	7
Chan Dana	Ecole Polytechnique Fadarale de Lausanne	5
Chen, Peng	(EPFL)	3
Chen, Xinyun		8/
	University of Massachusetts	8
Chen, Y1	Purdue University	5
Cheng, Juan	Brown University	<u> </u>
Cheng, Oliver	Brown University	2
Chernyk, Donna	Springer	3
Childers, David Benjamin	Yale University	1
Cho, Heyrim	Brown University	1
Choi, Minseok	Brown University	1
Clements, Cynthia	Army Research Laboratory	2
Collins, Anne	Brown University	2
Compiani, Giovanni	Yale University	1
Craiu, Radu	University of Toronto	5
Cui, Tiangang	Massachusetts Institute of Technology	6
Cui, Xia	Brown University	1
Dahl, David B.	Brigham Young University	5
Das, Sonjoy	University at Buffalo (SUNY)	5
De Blasi, Pierpaolo	Universita di Torino	5
de Bouard, Anne	Ecole Polytechnique	7
Debussche, Arnaud	Ecole Normale Superieure de Cachan	13
Del Moral, Pierre	INRIA	8
Doll, Jimmie	Brown University	6
Dong, Hongjie	Brown University	1
Dong, Jing	Columbia University	94
Doostan, Alireza	University of Colorado	5
Doshi-Velez, Finale	Harvard Medical School	5

Dunne, Edward	American Mathematical Society	1
Dunson, David	Duke University	5
Duong, Xuan	Macquarie University	5
Dupuis, Paul	Brown University	94
Duvenaud, David Kristjanson	University of Cambridge	7
Fahroo, Fariba	US Air Force Office of Scientific Research	6
Farah, Marian	MRC Biostatistics Unit	7
Fatkullin, Ibrahim	University of Arizona	92
Feinberg, Jonathan	Simula School of Research and Inovation	6
Fellingham, Gilbert	Brigham Young University	7
Fill, James	Johns Hopkins University	3
Fleming, Wendell	Brown University	5
Fort, Gersende	Centre National de la Recherche Scientifique (CNRS)	3
Foss, Sergey	Heriot-Watt University	6
Foti, Nicholas	Dartmouth College	6
Fox, Emily	University of Washington	5
Freer, Cameron Eric	Massachusetts Institute of Technology	1
Freiberger, Walter	Brown University	1
Fronczyk, Kassie	Rice University	5
Gamarnik, David	Massachusetts Institute of Technology	5
Gan, Zecheng	Shanghai Jiaotong University	95
Ganesh, Mahadevan	Colorado School of Mines	6
Ganguly, Arnab	Swiss Federal Institute of Technology	122
Gantert, Nina	TU Munchen	16
Ghanem, Roger	University of Southern California	8
Ghosh, Soumya	Brown University	2
Gitelman, Daniel	Brown University	1
Gittelson, Claude Jeffrey	Purdue University	6
Goldberg, David Alan	Georgia Institute of Technology	7
Gorur, Dilan	Yahoo! Inc.	15
Gray-Davies, Tristan Daniel	University of Oxford	7
Gray, Genetha Anne	Sandia National Laboratories	3
Gubernatis, James	Los Alamos National Laboratory	11
Gudmundsson, Thorbjorn	Royal Institute of Technology (KTH)	43
Guindani, Michele	University of Texas M. D. Anderson Cancer Center	5
Hampton, Jerrad	University of Colorado	5
Han, Shuo	California Institute of Technology	6
Han, Xiaoying	Auburn University	4
Harrison, Matthew	Brown University	94
Hedin, Florent	Universitat Basel	9

Henderson, Ron	DreamWorks Animation	1
Hernandez, Eric Manuel	University of Vermont	5
Hjort, Nils	University of Oslo	5
Hoang, Viet Ha	Nanyang Technological University	15
Holmes, Chris	University of Oxford	5
Homer, Mark L.	Brown University	1
Hou, Tom	California Institute of Technology	5
Hristopulos, Dionissios T	Technical University of Crete	7
Hu, Peng	Universita de Bordeaux I	122
Huan, Xun	Massachusetts Institute of Technology	5
Hughes, Michael	Brown University	2
Hult, Henrik	Royal Institute of Technology (KTH)	43
Janzamin, Majid	University of California, Irvine	65
Johnson, Dane Michael	Brown University	64
Johnson, Daniel	Brown University	2
Jones, David Edward	Harvard University	2
Jonsson, Hannes	University of Iceland	5
Juneja, Sandeep	Tata Institute of Fundamental Research	34
Kalligiannaki, Evangelia	University of Southern California	7
Karniadakis, George	Brown University	94
Kazez, Arianna	Brown University	1
Khaliq, Abdul Qayyum Masud	Middle Tennessee State University	6
Kim, Dae II	Brown University	2
Kim, Steven	Brown University	11
Kirkpatrick, Kay	University of Illinois at Urbana-Champaign	11
Klein, Daniel	Brown University	2
Klivans, Caroline	Brown University	1
Kloeden, Peter Eris	Johann Wolfgang Goethe-Universitat Frankfurt	5
Komarov, Olga	Technion-Israel Institute of Technology	8
Krylov, Nicolai	University of Minnesota	10
Kushner, Harold	Brown University	1
Łatuszyński, Krzysztof	University of Warwick	3
Law, Kody	University of Warwick	57
Lawrence, Charles	Brown University	1
Lee, Chia Ying	University of North Carolina	5
Lee, Kate	Auckland University of Technology	5
Letham, Ben	Massachusetts Institute of Technology	5
LeVeque, Randall	University of Washington	1
Li, Dong	Princeton University	5
Li, Hong-Xia	Brown University	1
Li, Juan	Columbia University	10

Li, Minghai	Clark University	5
Li, Xiaoou	Columbia University	5
Lijoi, Antonio	Universita di Pavia	34
Lin, Guang	Pacific Northwest National Laboratory	5
Lin, Ling	New York University	89
Liu, Jingchen	Columbia University	13
Liu, Jun	Harvard University	94
Liu, Tao	Brown University	5
Liu, Yufei	Brown University	92
Loper, Jackson	Brown University	2
Lototsky, Sergey	University of Southern California	5
Lu, Jianfeng	Duke University	5
Lucor, Didier	Universita de Paris VI (Pierre et Marie Curie)	6
Lynch, James Dennis	University of South Carolina	7
Lyons, Terry J	University of Oxford	17
MacEachern, Steve	Ohio State University	5
Madiman, Mokshay	Yale University	2
Magpantay, Felicia Maria Garcia	University of British Columbia	7
Mahmoody, Ahmad	Brown University	1
Makrides, Elizabeth Jane	Brown University	94
Marchenko, Maria	Yale University	1
Marzouk, Youssef	Massachusetts Institute of Technology	92
Mascagni, Michael	Florida State University	7
McQuighan, Kelly	Brown University	1
Meng, Xiao-Li	Harvard University	3
Meuwly, Markus	Universität Basel	42
Meyn, Sean	University of Illinois at Urbana-Champaign	3
Miller, Jeffrey	Brown University	6
Miro, Shorash	Ruhr-Universität Bochum	46
Moore, Richard Owen	New Jersey Institute of Technology	5
Morrison, Rebecca Elizabeth	University of Texas at Austin	7
	Centre National de la Recherche Scientifique	
Moulines, Eric	(CNRS)	3
Mueller, Peter	University of Texas at Austin	7
Murthy, Karthyek	Tata Institute of Fundamental Research	81
Nadkarni, Dahlia	Brown University	5
Narayan, Akil	University of Massachusetts	94
Neklyudov, Misha	Tuling on Universited	1
	Tubingen Universität	1
Ng, Stephen	University of Rochester	7
Ng, Stephen Nguyen, Long	University of Rochester University of Michigan	7
Ng, Stephen Nguyen, Long Ni, Hao	University of Rochester University of Michigan University of Oxford	7 7 103

Nourdin, Ivan	Universita de Lorraine	5
Nyquist, Pierre Kristoffer Ulf	Royal Institute of Technology (KTH)	43
Orbanz, Peter	Columbia University	10
Owhadi, Houman	California Institute of Technology	6
Pacheco, Jason	Brown University	7
Palla, Konstantina	University of Cambridge	7
Papadimitriou, Dimitrios	University of Ghent (UG)	6
Parizi, Sobhan Naderi	Brown University	1
Parks, Matthew	Brown University	2
Pemantle, Robin	University of Pennsylvania	4
Petralia, Francesca	Duke University	5
Petrovic, Ivana	Brown University	4
Pillai, Natesh	Harvard University	30
Plattner, Nuria	Universitat Basel	5
Porwal, Kamana	Indian Institute of Science	106
Predescu, Cristian	D. E. Shaw Research	5
Propp, James	University of Massachusetts	1
Pruenster, Igor	Universita di Torino	44
Quintana, Fernando	Pontifical Catholic University of Chile	5
Raissi, Maziar	George Mason University	7
Ramanan, Kavita	Brown University	94
Randall, Dana	Georgia Institute of Technology	3
Reinhold, Dominik	Clark University	8
Ren, Weiqing	National University of Singapore	5
Ren, Zhao	Yale University	1
Robert, Christian	Universita de Paris-Dauphine	3
	Institut National de Recherche en	
Robert, Philippe	Informatique Automatique (INRIA)	7
Roberts, Gareth	University of Warwick	7
Rodriguez, Abel	University of California, Santa Cruz	5
RomÃin, Jorge Carlos	Vanderbilt University	5
Rosenthal, Jeffrey	University of Toronto	5
Rousseau, Judith	Universita de Paris-Dauphine	5
Roy, Daniel	University of Cambridge	5
Rozovsky, Boris	Brown University	94
Ruggiero, Matteo	Universita di Torino	38
Rush, Cynthia	Yale University	2
Sanz-Sole, Marta	University of Barcelona	5
Sapsis, Themistoklis	Massachusetts Institute of Technology	5
Saria, Suchi	Stanford University	5
Schoergendorfer, Angela	IBM	6

Sethuraman, Jayaram	Florida State University	7
Shah, Devavrat	Massachusetts Institute of Technology	2
Sharma, Ankur	Yale University	2
Slastikov, Valeriy	University of Bristol	15
Slivinski, Laura	Brown University	78
Smith, Aaron Matthew	Stanford University	272
Sodomka, Eric	Brown University	2
Sousedik, Bedrich	University of Southern California	12
Sousi, Perla	University of Cambridge	4
Spiliopoulos, Konstantinos	Boston University	8
Srivastava, Sanvesh	Purdue University	6
Stein, Jerome L	Brown University	5
Sudderth, Erik	Brown University	71
Sun, Li	Brown University	1
Sun, Libin	Brown University	1
Sun, Xiang	Brown University	6
Swanson, Ben	Brown University	1
Tabak, Barbara L	The Broad Institute	9
	Institut National de Recherche en	
Talay, Denis	Informatique Automatique (INRIA)	4
Tao, Molei	New York University	5
Tartakovsky, Daniel	University of California, San Diego	5
Timofeyev, Ilya	University of Houston	7
Tokdar, Surya	Duke University	5
Trask, Nathaniel	Brown University	1
Tretyakov, Michael	University of Nottingham	85
Tsantili, Ivi Sevasti	National Technical University of Athens	35
Ulker, Fatma Demet	Massachusetts Institute of Technology	5
van Handel, Ramon	Princeton University	3
Vanden-Eijnden, Eric	New York University	2
Velez, Javier	Massachusetts Institute of Technology	5
Venkataramanan, Ramji	Yale University	2
Venturi, Daniele	Brown University	94
Voter, Art	Los Alamos National Laboratory	5
Wainwright, Martin	University of California, Berkeley	1
Wallace, Byron	Brown University	1
Wallwater, Aya	Columbia University	4
Wan, Xiaoliang	Louisiana State University	94
Wang, Liyao	Yale University	2
Wang, Xiaofei	Yale University	1
Wang, Xiaojing	University of Connecticut	3

Wang, Zhiran	Yale University	1
Ward, Lesley	University of South Australia-Levels Campus	5
Williamson, Sinead	Carnegie Mellon University	5
Wolny, Kasia	University of Warwick	57
Woo, Jaeoh	Yale University	2
Wu, Wei	Brown University	94
Xiu, Dongbin	Purdue University	5
Xu, Gongjun	Columbia University	7
Yan, Kai	Yale University	1
Yang, Hongxia	IBM	6
Yang, Xiao	Yale University	2
Yang, Yang	Brown University	1
Ye, Saier	Yale University	1
Ying, SeeChen	Brown University	6
Zabaras, Nicholas	Cornell University	5
Zenker, Sven	Rheinische Friedrich-Wilhelms-Universität Bonn	3
Zhang, Bo	IBM	11
Zhang, Xiaoxuan	IBM	15
Zhang, Zhongqiang	Brown University	9
Zheng, Mengdi Summer	Brown University	2
Zhong, Jie	University of Southern California	99
Zhou, Guangyao	Brown University	1
Zhu, Xueyu	Brown University	5
Zuffi, Silvia	Brown University	10

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

#### **Some Semester Organizer Comments**

"A main workshop (and in particular most of the tutorial talks) was hindered by the weather. On the other hand, many of the between-workshop presentations were very useful and in areas that I did not know so well."

## **Some Long-Term Participant Comments**

"The scientific program was perfect. The environment at ICERM is the best I could hope for when coming here. I have profitably worked on my own research and the support of the ICERM staff has been great. I've also enjoyed the high scientific quality workshops I could attend while being here, even the one which was not close to my research interests: I have been stimulated to look at some topics I am not familiar with."

"I did not know beforehand that there would be scientists attending the workshops that could give some of the important guidance our project needed. We were worried about how to deal with some of the epistemic uncertainties related to slip on fault planes during earthquakes. As a result of being at ICERM, we now have a plan for how to use importance sampling (we now appreciate what this is) to generate earthquake realizations in a way that is not prohibitive from a computational standpoint. This new strategy can also be done in a way that couples to our present strategy for dealing with the aleatoric uncertainty of the tides (it is unknown when in the tidal stage an earthquake will occur, but we have a probability distribution for this uncertainty)."

"I am not a specialist in probability. I am a user. For me, being able to ask questions was key. So, I appreciated the introductory talks in the workshop, especially the first days of a workshop that gave the vocabulary and set the stage for being able to ask questions."

"In between the workshops there were several very interesting talks which was more than I expected. In particular I appreciated the joint talk by J. Chayes and C. Borgs as well as the short course by R. Pemantle. The last two workshops were of high quality: in particular the last one "Performance Analysis of Monte Carlo Algorithms" attracted top level researchers. I also think the post-docs contributed significantly to a more active research environment at ICERM."

#### **Some Postdoc Comments**

"I am really glad I could participate in the program. There was a large number of great talks on the subject that I am interested in. I had a chance to talk to a lot of very good scientists in my area of interest and the discussions were definitely inspiring for my future research. I have started collaboration with some participants and I find it very important as I am at the beginning of my scientific career. I liked it that presentations at the workshops were not too short. There were meetings during the semester to discuss practical issues like writing and submitting papers or writing grant proposals which I found very useful."

"There were so many opportunities to discuss with professors in different fields. This is the best experience I have to learn and exchange the ideas."

## Some Graduate Student Comments

"This semester program concentrated on the use of probabilistic and computational methods to study complex models in a variety of fields, which fitted my research interests. The workshops and other synergistic activities provided a wide range of opportunities for me to broaden my vision and knowledge, and gain a better understanding of the existing ideas and tools."

"The methodologies discussed within the uncertainty quantification workshop represented the state of the art in this field, and that was main great interest. It gave me the opportunity to discuss about them with the leading experts in this field."

"The program met my expectations, which were very high, regarding hearing about what people in my own subfield are working on. Moreover, it far exceed my expectations in regards to hearing about new problems in adjacent fields/topics. In particular, the workshop on "Performance Analysis of Monte Carlo" was one of the best workshops/conferences I have attended both in terms of contents and diversity as well as the quality of the talks. As a young researcher this was a tremendous opportunity to hear about what problems the "leaders" of the different topics are working on and the different directions the field of stochastic simulation is going in."

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

## Spring Semester 2013: Automorphic Forms, Combinatorial Representation Theory and Multiple Dirichlet Series

January 28 - May 3, 2013

### **Organizing Committee**

Sara Billey, University of Washington Ben Brubaker, MIT and University of Minnesota 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

### **Program Description**

L-functions—vast generalizations of the Riemann zeta function— are fundamental objects of study in number theory. In the 1980's the idea emerged that it could be useful to tie together a family of related L-functions in one variable to create a "double Dirichlet series," which could be used to study the average behavior of the original family of L-functions. Double Dirichlet series soon became multiple Dirichlet series. It has gradually emerged that the local structure of these multiple Dirichlet series shows a rich connection to combinatorial representation theory.

This program will explore this interface between automorphic forms and combinatorial representation theory, and will develop computational tools for facilitating investigations. On the automorphic side, Whittaker functions on p-adic groups and their covers are the fundamental objects. Whittaker functions and their relatives are expressible in terms of combinatorial structures on the associated L-group, its flag variety, or Schubert varieties. In the combinatorial theory crystal graphs, Demazure characters, the Schubert calculus and Kazhdan-Lusztig theory all enter.

Recent progress in combinatorial representation theory has been facilitated by the development of computer programs by the Sage-Combinat group within the open-source mathematical software Sage. These tools have evolved in response to the research needs of the developers, but through a disciplined development process are general enough to have already found applications beyond their original intent. A major component of the program will be the further development and application of these resources, and it is hoped that they may be used to investigate the connection to multiple Dirichlet series and related combinatorics.

## Workshop 1: Sage Days: Multiple Dirichlet Series, Combinatorics, and Representation Theory

February 11 - 15, 2013 Number of Participants: 80

## **Organizing Committee**

Franco Saliola, University of Quebec Anne Schilling, UC Davis Nicolas Thiery, Université Paris Sud

## Speakers

Elizabeth Beazley, Haverford College Sara Billey, University of Washington Daniel Bump, Stanford University Eva Curry, Acadia University Vincent Delecroix, Université de Paris VII (Denis Diderot) Allen Knutson, Cornell University Andrew Mathas, University of Sydney Viviane Pons, Université de Marne-la-Vallée Christian Stump, Universität Hannover

#### **Workshop Description**

Sage is a mathematics software system developed by and for the mathematics community, whose mission is to create a viable free open source alternative to Magma, Maple, Mathematica and Matlab. Its wide span of features, in particular in number theory, combinatorics, and representation theory, together with its friendly community based development, fosters collaborations across disciplines, from the design and implementation of new computer exploration tools to research.

This workshop will bring together experienced Sage and Sage-Combinat developers and experts of multiple Dirichlet series and computational algebraic combinatorics. Like every workshop in the Sage Days series, it will welcome whoever wants to discover Sage, learn more about it, or contribute to it.

As the first meeting for the ICERM Semester Program on"Automorphic Forms, Combinatorial Representation Theory and Multiple Dirichlet Series", this workshop will focus on Sage training and on the design and planning of new computational features of central interest for the semester, around Weyl groups, Hecke algebras and their representations, crystals, posets, combinatorial data visualization, etc.

The workshop will consist of mathematical presentations, presentations on Sage and coding sprints. The mathematical presentations will include talks introducing the relevant mathematics for the entire audience and more advanced talks for interested participants. The Sage presentations will begin with introductory tutorials and progress to more advanced topics, including software development in Sage. There will be ample time allotted for design discussions and coding sprints to implement the developed algorithms.

#### **Some Workshop Organizer Comments**

"I was thrilled to see that many people started becoming comfortable working with, contributing to and improving Sage"

"I was very impressed with the enthusiasm and the vigor of some workshop participants to learn and contribute to the goals of the workshop. The actual contributions varied from participant to participant, including designing, planning and coding of new computational tools. Another highlight was the scientific collaborations that I began during the workshop."

"New people were trained. Lots of design discussions occurred. People work hard on implementing new features they needed for their research"

#### **Some Workshop Participant Comments**

"I was very happy with the opportunity to meet and work with people from a variety of branches of math with varying levels of Sage experience. I learned both new mathematical concepts and learned how to program better in Sage."

"I am completely new to Sage. I was very impressed at how willing the participants were to answer any questions I had. I also enjoyed watching the collaborative process, even though I'm not yet at a level to really contribute. Some day I hope I will be able to contribute to Sage development!"
"The opportunities to break into small groups to actually work on a coding project were very useful and stimulating."

# Workshop 2: Whittaker Functions, Schubert calculus and Crystals

March 4-8, 2013 Number of Participants: 117

# **Organizing Committee**

Sara Billey, University of Washington Daniel Bump, Stanford University Cristian Lenart, University at Albany

# Speakers

David Anderson, Institute of Pure and Applied Mathematics (IMPA) Alexander Braverman, Brown University Benjamin Brubaker, Massachusetts Institute of Technology Patricia Hersh, North Carolina State University Joel Kamnitzer, University of Toronto Thomas Lam, University of Michigan Anthony Licata, Australian National University Jennifer Morse, Drexel University Sergey Oblezin, Institute of Theoretical and Experimental Physics Nicolas Perrin, Heinrich-Heine-Universität Düsseldorf Arun Ram, University of Melbourne Victor Reiner, University of Minnesota Siddhartha Sahi, Rutgers University Anne Schilling, University of California, Davis Mark Shimozono, Virginia Polytechnic Institute and State University Peter Tingley, Loyola University Monica Vazirani, University of California, Davis Martha Yip, University of Pennsylvania Alexander Yong, University of Illinois at Urbana-Champaign

# **Workshop Description**

Schubert calculus is the modern approach to classical problems in enumerative algebraic geometry, specifically on flag varieties and their many generalizations. Crystals are combinatorial tools based on quantum groups which arise in the study of representations of Lie algebras. Whittaker functions are special functions on Lie groups or p-adic groups, for example GL(n,F) where F might be the real or complex numbers, or a p-adic field. The area of intersection between these three topics is combinatorial representation theory. Common tools such as Demazure operators, the Bruhat partial order, and Macdonald polynomials appear in all three areas. Some connections between these three areas are quite new. This workshop will explore these connections.

# Some Workshop Organizer Comments

"Bringing together people in various areas, who shared their unique perspective on the newly discovered connections. Many opportunities for learning new things and for new collaborations. Very good attendance."

### **Some Workshop Participant Comments**

"The topics were not in my area, but my collaborator was visiting. ICERM provided a great space to talk and research. We were able to embark on a new project together. This is a very impressive space that motivates you to work."

"Panel of speakers and participants is extremely high and is represented by almost all the most exciting directions in the subject of the workshop"

"The format of high quality talks with sufficient break times for collaboration was fantastic. I gained several new ideas for my research from the talks, and several more ideas for my research from the collaborative process. This has been the most useful workshop that I have attended, as far as giving direction for future research."

"All talks and participants were extremely interesting. I had many opportunities to collaborate with people during the workshop. I think it is extremely important to leave some free time for collaboration between or after the talks."

"There were many interesting talks, and the workshop was well set up to allow for informal discussion with the speakers in the breaks. The space at ICERM is also incredibly well set-up to encourage collaboration!"

**Workshop 3: Combinatorics, Multiple Dirichlet Series and Analytic Number Theory** April 15 - 19, 2013

Number of Participants: 105

# **Organizing Committee**

Gautam Chinta, CUNY Adrian Diaconu, University of Minnesota Dorian Goldfeld, Columbia University Ozlem Imamoglu, Eidgenössische Technische Hochschule Zürich

### Speakers

Cristina Ballantine, College of the Holy Cross Valentin Blomer, University of Goettingen Young Ju Choie, Pohang University of Science and Technology (POSTECH) Brian Conrey, American Institute of Mathematics Nikolas Diamantis, University of Nottingham Paul Garrett, University of Minnesota Kyu-Hwan Lee, University of Connecticut Min Lee, Brown University Winnie Li, Pennsylvania State University Xiaoqing Li, University at Buffalo (SUNY) Kohji Matsumoto, Nagoya University Peter McNamara, Stanford University Stephen Miller, Rutgers University Omer Offen, Technion-Israel Institute of Technology Vicentiu Pasol, Institute of Mathematics "Simion Stoilow" of the Romanian Academy Samuel Patterson, Georg-August-Universität zu Göttingen Jyoti Sengupta, Tata Institute of Fundamental Research Takashi Taniguchi, Kobe University Nicolas Templier, Princeton University

Yangbo Ye, University of Iowa Lei Zhang, Boston College

# **Workshop Description**

Recent years have seen a flurry of activity in the field of Weyl group multiple Dirichlet series. Surprising and unexpected connections between these multiple Dirichlet series and several different fields of mathematics have emerged. This workshop will survey recent results and set the stage for future developments which further interrelate analytic number theory, automorphic forms and combinatorial representation theory.

Particular focus will be given to applications of Weyl group multiple Dirichlet series to the following areas:

- Average value and nonvanishing results for families of L-functions
- Periods of automorphic forms
- Connections between characters sums over function fields and characters of affine root systems
- Metaplectic Casselman-Shalika formulae and deformations of the Weyl character formula

# All Visitors to Spring 2013 Semester Program

Orange highlight represents anyone staying over 9 days

Name	Organization	Time spent at ICERM (days)
Amzad, Razia	Springer	5
Anderson, David	Institute of Pure and Applied Mathematics (IMPA)	5
Andersson, Johan	University of Stockholm	32
Andrade, Julio Cesar Bueno de	University of Bristol	263
Ayyer, Arvind	University of California, Davis	11
Ballantine, Cristina Maria	College of the Holy Cross	96
Beazley, Elizabeth	Haverford College	100
Beineke, Jennifer	Western New England University	6
Benkart, Georgia M.	University of Wisconsin	5
Berenstein, Arkady	University of Oregon	37
Berg, Chris	University of Quebec	55
Bertiger, Anna	Cornell University	13
Billey, Sara	University of Washington	22
Bischof, Bryan Edward	Kansas State University	7
Blomer, Valentin	University of Goettingen	5
Boland, Pat	University of Michigan	5
Borie, Nicolas	Université de Marne-la-Vallée	5
Braverman, Alexander	Brown University	5
Briggs, Carly J. A.	University at Albany (SUNY)	10
Bröker, Reinier	Brown University	96
Brubaker, Benjamin	Massachusetts Institute of Technology	99
Buciumas, Valentin	Stanford University	7

Bump, Daniel	Stanford University	17
Chari, Vyjayanthi	University of California, Riverside	96
Chatterjee, Tapas	Institute of Mathematical Sciences	32
Chhaibi, Reda	Universität Zürich	10
Chinta, Gautam	City College, CUNY	98
Cho, Peter Jaehyun	University of Toronto	5
Choi, Youn-Seo	Korea Institute for Advanced Study (KIAS)	7
Choie, Young Ju	Pohang University of Science and Technology (POSTECH)	31
Choiy, Kwangho	Oklahoma State University	121
Collins, Voula Christina	Cornell University	7
Conrey, Brian	American Institute of Mathematics	5
Crisman, Karl-Dieter	Gordon College	5
Csar, Sebastian Alexander	University of Minnesota	5
Curry, Eva	Acadia University	8
Dalal, Avinash J.	Drexel University	7
Daugherty, Zajj B.	Dartmouth College	121
DeCelles, Amy Therese	Goshen College	7
DeFranco, Mario Anthony	Massachusetts Institute of Technology	94
Delecroix, Vincent	Université de Paris VII (Denis Diderot)	5
Diaconu, Adrian	University of Minnesota	99
Diamantis, Nikos	University of Nottingham	5
Dilks, Kevin Michael	University of Minnesota	7
Drellich, Elizabeth	University of Massachusetts	7
Feinberg, Gabriel	University of Connecticut	102
Frechette, Sharon	College of the Holy Cross	5
Friedberg, Solomon	Boston College	98
Friedlander, Holley Ann	University of Massachusetts	96
Garland, Howard	Yale University	5
Garrett, Paul	University of Minnesota	5
Geleta, Hunduma Legesse	Addis Ababa University	7
Gerber, Thomas	Université de Tours (François Rabelais)	13
Ginzburg, David	Tel Aviv University	13
Goldfeld, Dorian	Columbia University	16
Goldmakher, Leo	University of Toronto	5
Grinberg, Darij	Massachusetts Institute of Technology	10
Guilhot, Jeremie	Université de Tours (François Rabelais)	30
Gunnells, Paul	University of Massachusetts	39
Hamel, Angele Marie	Wilfrid Laurier University	6
Hanusa, Christopher R H	Queens College, CUNY	4
Hasse, Abdul	Rowan University	6

Hersh, Patricia	North Carolina State University	5
Hill, David Edward	University of Virginia	7
Hoffstein, Jeffrey	Brown University	96
Hong, Jiuzu	Yale University	5
Hulse, Thomas Andrew	Brown University	96
Hundley, Joseph	Southern Illinois University	96
Huynh, Anh Trung	University of Washington	66
Imamoğlu, Özlem	Swiss Federal Institute of Technology	15
Ion, Bogdan	University of Pittsburgh	14
Jacon, Nicolas	Université de Franche-Comté (Besançon)	30
Johnson, Garrett Wayne	Catholic University of America	7
Jones, Brant	James Madison University	19
Joyce, Michael Orin	Tulane University	7
Kamnitzer, Joel	University of Toronto	5
Kang, Hyosang	Korea Institute for Advanced Study (KIAS)	7
Karabulut, Cihan	City University of New York (CUNY)	96
Kim, Henry H.	University of Toronto	9
Kim, Yeansu	Purdue University	6
King, Donald Raymond	Northeastern University	5
King, Ronald Curtis	University of Southampton	8
Kiral, Eren Mehmet	Brown University	127
Kiyomura, Yutaro	Kyushu University	29
Klivans, Caroline	Brown University	2
Knutson, Allen	Cornell University	5
Kuan, Chan Ieong	Brown University	109
Kuehn, Patrick	Universität Zürich	5
Kus, Deniz	Universität zu Köln	57
Lam, Thomas	University of Michigan	96
Lanini, Martina	University of Melbourne	121
Lecouvey, Cedric	Université de Tours (François Rabelais)	30
Lee, Jun Ho	Korea Institute for Advanced Study (KIAS)	7
Lee, Kyu-Hwan	University of Connecticut	89
Lee, Min	Brown University	130
Lee, Ting-Fang	National Taiwan University	5
Lenart, Cristian	University at Albany (SUNY)	34
LeVeque, Benjamin	Brown University	2
Li, Nan	Massachusetts Institute of Technology	7
Li, Winnie	Pennsylvania State University	12
Li, Xiaoqing	University at Buffalo (SUNY)	10
Licata, Anthony	Australian National University	15
Lim, Li-Mei	Brown University	96

Liu, Sheng-Chi	Texas A & M University	7
Lowry, David Joshua	Brown University	96
Lubovsky, Arthur	University at Albany (SUNY)	10
Ma, Xiaoguang	University of Illinois at Urbana-Champaign	7
Maga, Péter	Hungarian Academy of Sciences (MTA)	8
Martin, Yves	University of Chile	7
Mathas, Andrew	University of Sydney	5
Matsumoto, Kohji	Nagoya University	5
McNamara, Peter	Stanford University	12
Mihalcea, Leonardo Constantin	Virginia Polytechnic Institute and State University	7
Milicevic, Djordje	Bryn Mawr College	10
Miller, Stephen D.	Rutgers University	5
Monien, Hartmut	Rheinische Friedrich-Wilhelms-Universität Bonn	6
Morales, Alejandro Henry	University of Quebec	70
Morse, Jennifer	Drexel University	17
Musiker, Gregg	University of Minnesota	5
Muthiah, Dinakar	Brown University	96
Naito, Satoshi	Tokyo Institute of Technology	5
Nakasuji, Maki	Kitasato University	8
Nandakumar, Vinoth	Massachusetts Institute of Technology	9
Oblezin, Sergey	Institute of Theoretical and Experimental Physics	5
Offen, Omer	Technion-Israel Institute of Technology	35
Okada, Soichi	Nagoya University	10
Ortiz, Omar	University of Melbourne	8
Ou, Tzechun	University of Connecticut	5
Pankowski, Lukasz	Adam Mickiewicz University	10
Park, Yoon Kyung	Korea Institute for Advanced Study (KIAS)	110
Pasol Vicentiu	Institute of Mathematics "Simion Stoilow" of the Romanian Academy	5
Patnaik, Manish M.	University of Alberta	71
Patterson, Samuel J.	Georg-August-Universität zu Göttingen	16
Pechenik, Oliver Alan	University of Illinois at Urbana-Champaign	6
Perrin. Nicolas	Heinrich-Heine-Universität Düsseldorf	5
Peskin, Laura Rebecca	California Institute of Technology	6
Petrow, Ian Nicholas	Stanford University	6
Pollington, Andrew	National Science Foundation	5
Pons, Viviane	Université de Marne-la-Vallée	5
Propp, James	University of Massachusetts	2
Puskas, Anna	Columbia University	96
Qi, Zhi	Ohio State University	5
Ram, Arun	University of Melbourne	96

Raum, MartinETH27Reeder, MarkBoston College8Reiner, VictorUniversity of Minnesota5Reznikov, AndreBar-Ilan University6Richmond, EdwardUniversity of British Columbia34Romano, BethBoston College2Rowland, Eric SamuelUniversity of Quebec7Rubinstein, MichaelUniversity of Waterloo20Sagaki, DaisukeUniversity of Tsukuba7Sahi, SiddharthaRutgers University5Saliola, FrancoUniversity of Quebec5Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Ramer, Kevin Joseph	University at Albany (SUNY)	5
Reeder, MarkBoston College8Reiner, VictorUniversity of Minnesota5Reznikov, AndreBar-Ilan University6Richmond, EdwardUniversity of British Columbia34Romano, BethBoston College2Rowland, Eric SamuelUniversity of Quebec7Rubinstein, MichaelUniversity of Tsukuba7Sagaki, DaisukeUniversity of Tsukuba7Sahi, SiddharthaRutgers University5Sakellaridis, YiannisRutgers University5Saliola, FrancoUniversity of Quebec5Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Raum, Martin	ETH	27
Reiner, VictorUniversity of Minnesota5Reznikov, AndreBar-Ilan University6Richmond, EdwardUniversity of British Columbia34Romano, BethBoston College2Rowland, Eric SamuelUniversity of Quebec7Rubinstein, MichaelUniversity of Waterloo20Sagaki, DaisukeUniversity of Tsukuba7Sahi, SiddharthaRutgers University5Sakellaridis, YiannisRutgers University5Saliola, FrancoUniversity of Quebec5Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Reeder, Mark	Boston College	8
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Rowland, Eric SamuelUniversity of Quebec7Rubinstein, MichaelUniversity of Waterloo20Sagaki, DaisukeUniversity of Tsukuba7Sahi, SiddharthaRutgers University5Sakellaridis, YiannisRutgers University5Saliola, FrancoUniversity of Quebec5Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Romano, Beth	Boston College	2
Rubinstein, MichaelUniversity of Waterloo20Sagaki, DaisukeUniversity of Tsukuba7Sahi, SiddharthaRutgers University5Sakellaridis, YiannisRutgers University5Saliola, FrancoUniversity of Quebec5Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Rowland, Eric Samuel	University of Quebec	7
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Sahi, SiddharthaRutgers University5Sakellaridis, YiannisRutgers University5Saliola, FrancoUniversity of Quebec5Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Sagaki, Daisuke	University of Tsukuba	7
Sakellaridis, YiannisRutgers University5Saliola, FrancoUniversity of Quebec5Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Sahi, Siddhartha	Rutgers University	5
Saliola, FrancoUniversity of Quebec5Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Sakellaridis, Yiannis	Rutgers University	5
Salisbury, BenCity College, CUNY96Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Saliola, Franco	University of Quebec	5
Schaps, Mary ElizabethBar-Ilan University5Schilling, AnneUniversity of California, Davis98	Salisbury, Ben	City College, CUNY	96
Schilling, AnneUniversity of California, Davis98	Schaps, Mary Elizabeth	Bar-Ilan University	5
	Schilling, Anne	University of California, Davis	98
Scrimshaw, Travis ColeUniversity of California, Davis100	Scrimshaw, Travis Cole	University of California, Davis	100
Searles, Dominic NigelUniversity of Illinois at Urbana-Champaign5	Searles, Dominic Nigel	University of Illinois at Urbana-Champaign	5
Sengupta, JyotiTata Institute of Fundamental Research12	Sengupta, Jyoti	Tata Institute of Fundamental Research	12
Shabanskaya, Anastasia ViktorovnaEastern Connecticut State University6	Shabanskaya, Anastasia Viktorovna	Eastern Connecticut State University	6
Shavo, Kara LeePresbyterian College7	Shavo, Kara Lee	Presbyterian College	7
Shen, XinUniversity of Minnesota96	Shen, Xin	University of Minnesota	96
Virginia Polytechnic Institute and State		Virginia Polytechnic Institute and State	20
Shimozono, Mark University 29	Shimozono, Mark		29
Smith Asran Matthew Stanford University 272	Smith Agron Matthewy	MIII Stanford University	2
Sinitin, Aaron Matthew Stanfold University 212	Sinth, Aaron Matthew	Institute for Advanced Study	212
Stainbars Daniamin City Callage CUNN	Steinhang Deniamin	City College, CUNN	6
Stello Salvetere Northeastern University 5	Stelle, Selvetere	North contern University	6
Stella, Salvatore Northeastern University 5	Striker Jessie	Inortheastern University	12
Strikel, Jessica Oliversity of Milliesota 12 Stymp Christian Universität Hannover	Sturker, Jessica Sturm, Christian	Universität Hannover	12
Stump, Christian Oniversitat Hamover 5	Samuel Almort Daniel Ion	Durdue University	5
Szpiuch Alpert, Daniel Ian     Purdue University     0       Teipale Kaise     Cornell University     7	Toipolo Koico	Cornell University	8
Tanjauchi Takachi Kaba University 5	Tanjauchi Takashi	Kaba University	7
Tamplier Nicoles     Princeton University     5	Tampliar Nicolas	Princeton University	5
Thiery Nicolas Université de Paris XI (Paris Sud) 141	Thiery Nicolas	Université de Paris XI (Paris Sud)	141
There, Nicolas Oliversite de Falis Al (Falis-Sud) 141	Themas Anna	University of Sydney	141
Thomas, Anne Oniversity of Sydney 5 Thomas Frank Henry University of South Carolina 7	Thomas, Anne Thomas, Frank Henry	University of South Carolina	7
Tian Puoguang (Pager) University of California Davis	Tian Buoguang (Pager)	University of California Davis	96
Tian, Ruoguang (Roger)     Oniversity of camolina, Davis     90       Tierz Miguel     Universidad Complutance de Madrid     7	Tierz Miguel	Universidad Complutence de Madrid	90
Tingley Peter     Lovola University     7	Tingley Peter	Lovola University	7
Trongsiriwat Wuttisak Massachusetts Institute of Technology 6	Trongsiriwat Wuttisak	Massachusetts Institute of Technology	6

Van Steirteghem, Bart	Medgar Evers College, CUNY	6
Vazirani, Monica	University of California, Davis	17
Venkateswaran, Vidya	Massachusetts Institute of Technology	31
Vinroot, Christopher Ryan	College of William and Mary	7
Virmaux, Aladin	Université de Paris XI (Paris-Sud)	96
Wakayama, Masato	Kyushu University	3
Walker, Alexander Weston	Brown University	1
Wang, Xin	University of Minnesota	7
Wen, Jun	Stony Brook University	96
Whitehead, Ian Michael	Columbia University	96
Wong, Siman	University of Massachusetts	72
Yang, Jae-Hyun	Inha University	7
Ye, Yangbo	University of Iowa	5
Ye, Zhilin	Ohio State University	5
Yip, Martha	University of Pennsylvania	10
Yong, Alexander	University of Illinois at Urbana-Champaign	5
Yoo, Hwanchul	Korea Institute for Advanced Study (KIAS)	7
Yoo, Meesue	Korea Institute for Advanced Study (KIAS)	19
Zhang, Lei	Boston College	12
Zhang, Qiao	Texas Christian University	99
Zhang, Yichao	University of Connecticut	5
Zhou, Fan	Columbia University	6

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

# **Some Semester Organizer Comments**

"Over the course of the semester I have seen many new collaborations form: between organizers in number theory and combinatorics as well as participants in both groups.

- Many new collaborations have started around Sage. Many patches regarding crystal bases got merged and are in progress due to these interactions (for example involving Ben Salisbury, Travis Scrimshaw, Brant Jones, Nicolas Thiery, Anne Schilling)
- Arun Ram started many interesting conversations with Ben Brubaker and Liz Beazley about alcove walks and relations to Whittaker functions.
- Cristina Ballentine had questions about Littlewood-Richardson coefficients that were tested using Sage and the conjectures passed. She also made interesting remarks about expander graphs which are of interest to people in combinatorics (in particular Markov chains).
- Thanks to new code on nonsymmetric Macdonald polynomials developed in a combined effort by Nicolas Thiery, Anne Schilling, Mark Shimozono, Bogdan Ion, some questions regarding the relations between nonsymmetric Macdonald polynomials and Whittaker functions got resolved by Ben Brubaker and Dan Bump."

"There were so many talks at first that it was impossible to get work done. After 5 or 6 weeks this got better. I think that the program worked very well for those who were able to be at ICERM for the entire semester. They had the time and space to have new collaborations (e.g. Ben B. plus Arun Ram). Also those who were here for the workshops or the workshops plus a week seemed to use the time well and have many interactions in terms of getting perspective on projects or starting projects."

### Some Long-Term Participant Comments

"ICERM has been like a candy store for mathematicians! There have been so many stimulating exchanges of ideas that I cannot mention them all."

"So here are two things that I am most excited about. First, ICERM is the first institution that is able to provide sufficiently powerful high performance computers with sufficiently recent compiler so that I can start collecting extensive data on vector valued modular forms. I am aiming at a precise conjecture about the associated Hecke modules. This lays ground for astonishing insights into the connections of modular forms with epsilon factors of L-series. I've been waiting quite some time for such an opportunity. Second, only at this semester program there are so many experts on multiple Dirichlet series that I can hope to discuss some of the exciting connections between those series and automorphic forms. I have precise idea about how to connect them, and any gain of knowledge could lead to fantastic consequences on the popular "Can you hear the shape of a dum?" problem."

"I wasn't sure that I came equipped with the language to jump into any collaborations with long-term participants in the program, but I quickly learned that there was common ground between my knowledge and both the related combinatorics and certain aspects of the number theory discussed this semester. In particular, I was able to start two new collaborations, one on each mathematical side of the scientific program."

### **Some Postdoc Comments**

"I was very impressed by the organizers ability to bring together a diverse group of researchers in such a cohesive way. There were always interesting people to talk with or listen to throughout the semester. Certain topics which I previously felt were outside my realm of expertise became much more accessible through informal discussions with experts, the informative instructional workshops, and, most importantly, the congenial environment the organizers created at ICERM throughout the semester."

"I was slightly disappointed about the (minor) number of people who do serious computer calculations for automorphic forms. But on the other hand, it is amazing how many experts in the the area of automorphic forms and the connected areas were present, and actually willing to talk openly. The latter was what I mainly hoped for, because I came here to forge connections. I think the list of things I have been working on confirms that I was successful in doing so."

# **Some Graduate Student Comments**

"The tutorials were very helpful in broadening my understanding of this area. Having experts readily available to discuss topics and answer questions was also a huge advantage. It was very nice to have other graduate students/postdocs there for the whole semester program to discuss ideas in a pressure free setting."

"It was a great way for me to broaden my view of the possible research areas. However, it was difficult for me to learn the specifics of any single topic, because of my limited background as a grad student."

#### **Topical Workshops**

ICERM hosts several topical workshops each year. These workshops typically last 5 days and focus on a timely and exciting theme of interest that aligns with ICERM's mission of supporting and broadening the relationship between mathematics and computation.

### **Pre-Proposal Requirements**

A 1-2 page pre-proposal document which describes the scientific goals, lists the organizers of the program, and identifies the key participants.

### **Pre-Proposal Deadline**

All pre-proposals should be submitted to the ICERM Director no later than September 1st or April 1st. The ICERM directors and a subcommittee of the Scientific Advisory Board (SAB) review all preproposals. Proposers receive feedback within a few weeks of their submission, or by September 15th or April 15th.

### **Topical Workshop Full Proposal Deadline**

All full proposals should be submitted to the ICERM Director. Target deadlines are October 15th and May 15th. All full proposals are considered by the Scientific Advisory Board (SAB) potentially after an external review. Decisions are typically reached within one-to-two months of the target deadlines.

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

A topical workshop proposal should be of 2-4 pages length and contain the following:

- 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).

#### **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 20-25 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.

### **Topical Workshops in 2012-2013**

ICERM has hosted 5 topical workshops in 2012-2013 to date. These workshops focus on topics of current interest in the mathematical sciences.

### **Topical Workshop 1: Heterostructured Nanocrystalline Materials**

May 30 - June 1, 2012 Number of participants: 39 This workshop was externally funded by FRG

# **Organizing Committee**

Tim Schulze, University of Tennessee Vivek Shenoy, Brown University Peter Smereka, University of Michigan

### Speakers

Arvind Baskaran, University of California, Irvine Henry Boateng, University of Michigan Eric Chason, Brown University Selim Esedoglu, University of Michigan Jim Evans, Iowa State University Irene Fonseca, Carnegie Melon University Carlos Garcia-Cervera, University of California, Santa Barbara Shaun Hendy, University of Wellington Jeff Hovt, McMaster University Robert Kohn, Courant Institute Joachim Krug, University of Koeln Marta Lewicka, University of Pittsburgh Mitch Luskin, University of Minnesota Dionisios Margetis, University of Maryland Normand Modine, Sandia National Laboratory Hoai Minh Nguyen, University of Minnesota Brian Spencer, University of Buffalo Ellad Tadmor, University of Minnesota Jerry Tersoff, IBM

Axel Voigt, University of Dresden Peter Voorhees, Northwestern Zhenyu Zhang, University of Tennessee

### **Workshop Description**

The theme of this workshop is the computation, modeling, and mathematical analysis of heterostructured nanocrystalline materials. This includes quantum dots, nanowires, graphene, and grain boundaries. These various phenomena will be discussed in the context of modeling and computation on different scales ranging from density functional theory to continuum mechanics. The workshop will also address various techniques that allow one to combine models on different scales to yield efficient computational methods. (Simulation of Stranski-Krastanov growth using kinetic Monte Carlo)

First	Last	Organization
Arvind	Baskaran	University of California, Irvine
Henry	Boateng	University of Michigan
Victor Wing Lam	Chan	University of Michigan
Eric	Chason	Brown University
Matt	Elsey	Courant Institute, New York University
Selim	Esedoglu	University of Michigan
Jim	Evans	Iowa State University
Brittan Alan	Farmer	University of Michigan
Irene	Fonseca	Carnegie Melon University
Carlos	Garcia-Cervera	University of California, Santa Barbara
Yong	Han	Iowa State University
Shaun	Hendy	University of Wellington
Jeff	Hoyt	McMaster University
Robert	Kohn	Courant Institute
Joachim	Krug	University of Koeln
Marta	Lewicka	University of Pittsburgh
Xingjie Helen	Li	University of Minnesota-Twin Cities
Jianfeng	Lu	Courant Institute, New York University
Mitch	Luskin	University of Minnesota
Irfan	Mansuri	Devi Ahilya University
Dionisios	Margetis	University of Maryland
Normand	Modine	Sandia National Laboratory
Marco	Morandotti	Carnegie Mellon University
Hoai Minh	Nguyen	University of Minnesota
Paul Nathan	Patrone	NIST Gaithersburg
Paolo	Piovano	Carnegie Mellon Universit
Nirand	Pisutha-Arnond	University of Michigan
Kristofer	Reyes	University Of Michigan
Tim	Schulze	University of Tennessee
Vivek	Shenoy	Brown

#### **Participants (Heterostructured Nanocrystalline Materials)**

Peter	Smereka	University of Michigan
Brian	Spencer	University of Buffalo
Ellad	Tadmor	University of Minnesota
Jerry	Tersoff	IBM
Axel	Voigt	University of Dresden
Peter	Voorhees	Northwestern
Benedikt	Wirth	Courant Institute, New York University
Zhenyu	Zhang	University of Tennessee
Barbara Maria	Zwicknagl	Carnegie Mellon University

This workshop was externally funded by FRG. No exit surveys were collected.

**Topical Workshop 2: Research Experiences for Undergraduate Faculty (REUF)** June 4-8, 2012 *Number of participants: 25* This workshop was externally funded by AIM

# **Organizing Committee**

Leslie Hogben, AIM and Iowa State University Roselyn Williams, FAMU Ulrica Wilson, Morehouse College

# **Workshop Description**

This workshop, sponsored by AIM, ICERM, and the NSF, will introduce undergraduate faculty to research opportunities in several fields of mathematics that will equip them with the tools to mentor students in undergraduate research in mathematics. Lectures at the workshop will provide background information and introduce open problems. The majority of the workshop will be spent working on problems, reporting on progress, and formulating plans for future work.

# **Participants (REUF)**

Participants (\*= Mathematical Leader) Alejandra Alvarado, Purdue University Johannes Andreas Harmse, Azusa Pacific University Adam Berliner, St. Olaf College Ghan Bhatt, Tennessee State University Naiomi Cameron, Lewis & Clark College Nathaniel Dean\*, Texas State University, San Marcos Stephan Garcia\*, Pomona College Edray Goins\*, Purdue University Chervl Grood, Swarthmore College Leslie Hogben\*, Iowa State University and the American Institute of Mathematics Jonelle Hook, Mount St. Mary's University Bonnie Jacob, National Technical Institute for the Deaf (NTID/RIT) Andrew Klimas, Xavier University of Louisiana Emille Lawrence, University of San Francisco Sean Lawton, The University of Texas-Pan American Torina Lewis, Bethune-Cookman University Alison Marr, Southwestern University Bryant Mathews, Azusa Pacific University

Aba Mbirika, Bowdoin College Cayla McBee, Providence College Sharon McCathern, Azusa Pacific University Jillian McLeod, U.S. Coast Guard Academy Luis Melara, Shippensburg University Karoline Null, University of Tennessee at Martin Pedro Poitevin, Salem State University Ellen Veomett, Saint Mary's College of California Roselyn Williams, FAMU Ulrica Wilson, Morehouse College

This workshop was externally funded by AIM. No exit surveys were collected.

Topical Workshop 3: NSF/CBMS Conference: Finite Element Exterior Calculus (FEEC)

June 11 – 15, 2012 *Number of participants:* 63 This workshop was externally funded by AFSOR.

# **Organizing Committee**

Alan Demlow, University of Kentucky Johnny Guzmán, Brown University Dmitriy Leykekhman, University of Connecticut

# Speakers

Douglas Arnold, University of Minnesota, *Keynote speaker* Richard Falk, Rutgers University Anil Hirani, University of Illinois

#### **Workshop Description**

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 shows 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 tools required to fully grasp the concepts in FEEC. ICERM is pleased to host this NSF-CBMS Regional Research Conference.

Douglas Arnold will deliver 10 lectures, one in the morning and one in the afternoon of each day of the workshop. Richard Falk and Anil Hirani will both give one presentation.

First Name	Last Name	Organization
Harbir	Antil	University of Maryland
Douglas	Arnold	University of Minnesota
Gerard	Awanou	Northern Illinois University
Constantin	Bacuta	University of Delaware
Jerome	Bonelle	CERMICS ParisTech
Carlos	Borges	Worcester Polytechnic Institute
Zhiqiang	Cai	Purdue University

#### **Participants (FEEC)**

Juan	Calvo	New York University
Fernando	Camacho	University of Kentucky
Shuhao	Cao	Purdue University
Fun	Chan	University of Delaware
Hongtao	Chen	Xiamen University
Shue-Sum	Chow	Brigham Young University
James	Collins	Colorado State University
Alan	Demlow	University of Kentucky
Thinh	Duc Le	Penn State University
Andrea	Dziubek	SUNY Insittute of Technology
Richard	Falk	Rutgers University
Andrew	Gillete	University of California, San Diego
Johnny	Guzman	Brown University
Holger	Heumann	University Nice-Sophia Antipolis
Anil	Hirani	University of Illinois at Urbana-Champaign
Xiaozhe	Hu	Penn State University
Kaushik	Kalyanaraman	University of Illinois Urbana-Champaign
James	Kamm	Sandia National Laboratories
Shelvean	Kapita	University of Delaware
Omid	Khanmohamadi	Florida State University
Saeja	Kim	University of Massachusetts Dartmouth
Matthew	Knepley	University of Chicago
Michael	Kraus	Max-Planck-Institute fur Plasmaphysik
Marc	Laforest	Ecole Polytechnique de Montreal
Young-Ju	Lee	Rutgers University
Dmitriy	Leykekhman	University of Connecticut
Martin	Licht	University of Bonn
Fernando	Lopez Garcia	Worcester Polytechnic Institute
Youli	Мао	Texas A&M University
Jun	Masamune	Pennsylvania State, Altoona
Michael	Neilan	University of Pittsburgh
Minah	Oh	James Madison University
Ashraf	Owis	Cairo University
Faranak	Pahlevani	Penn State University, Abington College
Edmond	Rusjan	SUNY Institute of Technology
Marcus	Sarkis	Worcester Polytechnic Institute
Francisco	Sayas	University of Delaware
Murugan	Selvan	Bharathiar University
Kapil	Sharma	Panjab University
Nicolas	Thorstensen	Computational Science Center
Carlos	Trenado	University of Houston

Gantumur	Tsogtgerel	McGill University
Manuel	Uribe	Brown University
Monika	van Leeuwen-Polner	University of Szeged
Umberto	Villa	Emory University
Andy	Wan	Ecole Polytechnique de Montreal
Ming	Wang	University of California, Irvine
Luwai	Wazzan	King Abdulaziz University
Li	Wu	University of Rhode Island
Takaharu	Yaguchi	Kobe University
Kai	Yang	Penn State University
Yang	Yang	Brown University
Thomas	Yu	Drexel University
Yi	Zhang	Lousiana State University
Lin	Zhong	University of California, Irvine
Frank	Zizza	Colorado State University, Pueblo

This workshop was externally funded by AFSOR. No exit surveys were collected.

### **Topical Workshop 4: Bridging Scales in Computational Polymer Chemistry**

August 6-10, 2012 Number of participants: 23

# **Organizing Committee**

Andrew J. Christlieb, Michigan State University Cecilia Clementi, Rice University Keith Promislow, Michigan State University Mark Tuckerman, New York University Zhengfu Xu, Michigan Tech

### Speakers

Giovanni Bussi, International School for Advanced Studies (SISSA/ISAS) Carme Calderer, University of Minnesota Cecilia Clementi, Rice University Kris Delaney, University of California, Santa Barbara Yannis Kevrekidis, Princeton University Sharon Loverde, University of Pennsylvania Jianfeng Lu, Duke University Mauro Maggioni, Duke University Marcus Muller, Georg-August-Universitat zu Guttingen Stephen Paddison. University of Tennessee Raffaello Potestio, Max Planck Institute for Polymer Research Keith Promislow, Michigan State University Jutta Rogal, Ruhr-Universitat Bochum An-Chang Shi, McMaster University Wataru Shinoda, National Institute of Advanced Industrial Science and Technology Mark Tuckerman, New York University Qiang Wang, Colorado State University

### **Workshop Description**

Many important advances in material and biomedical science will come from controlling the chemical properties and nanoscale morphology of polymer mixtures. Predicting the longtime continuum-level properties of such complex systems poses a canonical computational challenge due to the disparate length and time scales separating the molecular description from the macroscopic behavior, particularly the evolution of morphology. This workshop focuses on four overlapping approaches to bridging this gap: Accelerated Molecular Methods, Coarse-Graining of Molecular Dynamics, Computational Approaches to Self-Consistent Mean Field, and Coupled Molecular and Continuum-Variational models. The goal is to spur the development of hybrid computational methods with the capacity to identify and characterize the rare events and the driving forces which steer the systems towards equilibrium, and connect the burgeoning growth in parallel-computation techniques for particle-based systems with recently developed classes of continuum models.

First Name	Last Name	Organization
Giovanni	Bussi	International School for Advanced Studies (SISSA/ISAS)
Carme	Calderer	University of Minnesota
Andrew	Christlieb	Michigan State University
Cecilia	Clementi	Rice University
Kris	Delaney	University of California, Santa Barbara
Jaylan	Jones	Michigan State University
Yannis	Kevrekidis	Princeton University
Sharon	Loverde	University of Pennsylvania
Jianfeng	Lu	Duke University
Mauro	Maggioni	Duke University
Nicolas	Moreno Chaparro	King Abdullah University of Science & Technology
Marcus	Müller	Georg-August-Universität zu Göttingen
Stephen	Paddison	University of Tennessee
Kellen	Petersen	Courant Institute of Mathematical Sciences
Raffaello	Potestio	Max Planck Institute for Polymer Research
Keith	Promislow	Michigan State University
Jutta	Rogal	Ruhr-Universität Bochum
An-Chang	Shi	McMaster University
Wataru	Shinoda	National Institute of Advanced Industrial Science and Technology
Mark	Tuckerman	New York University
Eric	Vanden-Eijnden	New York University
Qiang	Wang	Colorado State University
Zhengfu	Xu	Michigan Technological University

#### **Participants: Bridging Scales in Computational Polymer Chemistry**

### Some Workshop Organizer Comments

"The primary goal was to bring together two communities, those working on continuum methods and those working on atomistic approaches. The long lecture format, I believe, helped participants in each area understand what was being done in the other because talks could be given in a pedagogical fashion."

### **Some Workshop Participant Comments**

"Very well prepared and clear presentation and ample time for interactions, excellent mix of topics and balance between mathematical and physical talks"

"Everything was extraordinarily well organized, simple, and neat. The schedule for talks and discussions was very relaxing and let room to understand things and discuss with people. This was an excellent conference!"

"The variety of topics around a major theme. There were numerical/computational talks and also a lot of modeling. The balance was great. The pace was also very good. Often workshops are very hectic, and with little opportunity to talk about research."

# **Topical Workshop 5: Reproducibility in Computational and Experimental Mathematics**

December 10-14, 2012 Number of participants: 70

### **Organizing Committee**

David H. Bailey, Lawrence Berkeley National Laboratory Jon Borwein, Centre for Computer Assisted Research Mathematics and its Applications Randall J. LeVeque, University of Washington Bill Rider, Sandia National Laboratory William Stein, University of Washington Victoria Stodden, Columbia University

# Speakers

Jeremy Avigad, Carnegie Mellon University David H. Bailey, Lawrence Berkeley National Laboratory Ronald Boisvert, National Institute of Standards and Technology Jonathan Borwein, University of Newcastle Brian Bot Sage Bionetworks Neil Calkin, Clemson University Timothy Clem, GitHub Andrew Davison, Centre National de la Recherche Scientifique (CNRS) David Donoho, Stanford University Katherine Evans, Oak Ridge National Laboratory Sergey Fomel, University of Texas at Austin Juliana Freire, New York University James Glimm, Stony Brook University Tom Hales, University of Pittsburgh Randall LeVeque, University of Washington Nicolas Limare, Ecole Normale Superieure de Cachan Ursula Martin, University of London Chris Mentzel, Gordon and Betty Moore Foundation Peter Norvig, Google Inc. Peter Olver, University of Minnesota

Fernando Perez, University of California, Berkeley Bill Rider, Sandia National Laboratories Todd Rosenquist, Intel Corporation Thomas Russell, National Science Foundation Loren Shure, The MathWorks, Inc. William Stein, University of Washington Victoria Stodden, Columbia University Greg Wilson, Software Carpentry

# **Workshop Description**

In addition to advancing research and discovery in pure and applied mathematics, computation is pervasive across the sciences and now computational research results are more crucial than ever for public policy, risk management, and national security. Reproducibility of carefully documented experiments is a cornerstone of the scientific method, and yet is often lacking in computational mathematics, science, and engineering. Setting and achieving appropriate standards for reproducibility in computation poses a number of interesting technological and social challenges. The purpose of this workshop is to discuss aspects of reproducibility most relevant to the mathematical sciences among researchers from pure and applied mathematics from academics and other settings, together with interested parties from funding agencies, national laboratories, professional societies, and publishers. This will be a working workshop, with relatively few talks and dedicated time for breakout group discussions on the current state of the art and the tools, policies, and infrastructure that are needed to improve the situation. The groups will be charged with developing guides to current best practices and/or

First Name	Last Name	Organization	
Aron	Ahmadia	Columbia University	
Dhavide	Aruliah	University of Ontario Institute of Technology	
Jeremy	Avigad	Carnegie Mellon University	
David	Bailey	Lawrence Berkeley National Laboratory	
Lorena	Barba	Boston University	
Blake	Barker	Indiana University	
Sara	Billey	University of Washington	
Ronald	Boisvert	National Institute of Standards and Technology	
Jonathan	Borwein	University of Newcastle	
Brian	Bot	Sage Bionetworks	
Andre	Brodtkorb	SINTEF Applied Mathematics	
Neil	Calkin	Clemson University	
Vincent	Carey	Harvard University	
Ryan	Chamberlain	Flywheel, LLC.	

### **Participants: Reproducibility in Computational and Experimental Mathematics**

Neil	Chue Hong	University of Edinburgh	
Timothy	Clem	GitHub	
Noah	Clemons	Intel Corporation	
Constantine	Dafermos	Brown University	
Andrew	Davison	Centre National de la Recherche Scientifique (CNRS)	
Nathan	DeBardeleben	Los Alamos National Laboratory	
Andrew	Dienstfrey	National Institute of Standards and Technology	
David	Donoho	Stanford University	
Katherine	Evans	Oak Ridge National Laboratory	
Sergey	Fomel	University of Texas at Austin	
Juliana	Freire	New York University	
James	Glimm	Stony Brook University	
Sigal	Gottlieb	University of Massachusetts	
Josh	Greenberg	Alfred P. Sloan Foundation	
Tom	Hales	University of Pittsburgh	
Nicolas	Hengartner	Los Alamos National Laboratory	
David	Ketcheson	King Abdullah University of Science & Technology	
Matt	Knepley	University of Chicago	
David	Коор	New York University	
Randall	LeVeque	University of Washington	
Sébastien	Li-Thiao-Té	Université de Paris XIII (Paris-Nord)	
Nicolas	Limare	École Normale Supérieure de Cachan	
Elizabeth	Loew	Springer	
Ursula	Martin	University of London	
Bruce	McHenry	ME, Inc	
Chris	Mentzel	Gordon and Betty Moore Foundation	
Sarah	Michalak	Los Alamos National Laboratory	
Ian	Mitchell	University of British Columbia	
Victor	Moll	Tulane University	

Hatef	Monajemi	Stanford University	
Akil	Narayan	University of Massachusetts	
Peter	Norvig	Google Inc.	
Travis	Oliphant	NumFOCUS	
Peter	Olver	University of Minnesota	
Geoffrey	Oxberry	Lawrence Livermore National Laboratory	
Fernando	Perez	University of California, Berkeley	
Konrad	Polthier	Freie Universität Berlin	
Bill	Rider	Sandia National Laboratories	
Robert	Robey	Los Alamos National Laboratory	
Todd	Rosenquist	Intel Corporation	
Michael	Rubinstein	University of Waterloo	
Thomas	Russell	National Science Foundation	
Fernando	Seabra Chirigati	New York University	
Benjamin	Seibold	Temple University	
Loren	Shure	The MathWorks, Inc.	
Philip	Stark	University of California, Berkeley	
William	Stein	University of Washington	
Victoria	Stodden	Columbia University	
Benjamin	Stubbs	Harvard Medical School	
Andrew	Sutherland	Massachusetts Institute of Technology	
Matthias	Troyer	ETH	
Jan	Verschelde	University of Illinois	
Stephen	Watt	University of Western Ontario	
Greg	Wilson	Software Carpentry	
Carol	Woodward	Lawrence Livermore National Laboratory	
Yihui	Xie	Iowa State University	

# Some Workshop Organizer Comments

"There was a great deal of discussion between different communities that haven't had enough contact in the past about common concerns. I think many new connections were made and ideas exchanged. The break-out groups achieved a great deal in grappling with various aspects of reproducibility, and a good start was made on writing a final report that we hope will be widely cited. Others are starting to work on writing articles or editorials based on this workshop. It was great to have participation from representatives of several funding agencies."

# **Some Workshop Participant Comments**

"Good mix of scientists at different levels, clear avenues for progress, definite problems about which agreement is difficult to come by."

*"Great profile of the attending people, very motivating meeting, in a location and environment very flexible and stimulating."* 

"A really energised atmosphere, successfully bringing together people from diverse research communities who engaged productively rather than talking past each other. Great conversation and interaction, during talks and breaks, rather than people just sitting with noses in laptops! I've made lots of great new contacts and links."

"I was very impressed by the level of engagement by the participants at this workshop. I do not recall any workshop or conference at which the discussions were so lively."

"This was very different that a typical math conference. What I liked best about that was meeting people from industry and national labs that use computers to do mathematical computations. The bottom line was that we all have similar issues with reproducibility of computation. I learned a lot by seeing these issues in other context and how people handle them."

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

# **VI-MSS Workshops**

During 2012-2013, ICERM has held two topical workshops in India to date.

# **VI-MSS Topical Workshop #1: Computational Aspects of Neural Engineering** December 10-21, 2012 - Bangalore, India

# **Organizing Committee**

G. Rangarajan, IISc, Bangalore Rajesh Rao, University of Washington, Seattle

# Description

The course is directed at graduate students, postdoctoral fellows, and other researchers from the physical sciences (e.g. physics, mathematics, computer science, engineering) and the life sciences (e.g. neuroscience, biology, physiology). The course will offer participants the opportunity to learn about the foundations of neural engineering and brain-computer interfacing, and develop their skills in computational analysis of neural data for the control of external devices. The topics will range from primers on neuroscience, signal processing, and machine learning to brain-computer interfacing based on multi neuronal activity, electrocorticography (ECoG), and electroencephalography (EEG).

The course will consist of 3 hours of lectures each morning, followed by a 3-hour MATLAB-based computer laboratory in the afternoon. Participants will pair up for these laboratories, and an effort will be made to pair someone from the life sciences with someone from the physical sciences. All classes and laboratories will be held on the campus of the Indian Institute of Science (IISc).

Name	Organization
John Donoghue	Brown University
Jeffrey Ojemann	University of Washington
Rajesh Rao	University of Washington
Wilson Truccolo	Brown University
Peter Brunner	Wadsworth Center, NY State Dept of Health
Jeremiah Wander	University of Washington
Nitish Thakor	Johns Hopkins University

**VI-MSS/ICERM-Funded Participants (Computational Aspects of Neural Engineering)** 

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

# VI-MSS Topical Workshop #2: Limit Theorems in Probability

January 2-11, 2013 - Bangalore, India

# **Organizing Committee**

Manjunath Krishnapur, Indian Institute of Science, Bangalore Kavita Ramanan, Brown University, Providence

# Description

Ever since Jakob Bernoulli proved the law of large numbers for Bernoulli random variables in 1713, the subject of limit theorems has been a driving force for the development of probability theory as a whole. The elucidation of different flavours of laws of large number, central limit theorems and laws of iterated logarithm, their extensions to Markov chains or sums of weakly dependent or stationary processes, limit theorems for Banach space valued random variables, etc., have given rise to a rich theory as well as the basic tools for tackling any problem involving randomness.

Today, 300 years after the landmark result of Bernoulli, it is fruitful to look back at the way in which search for limit theorems has shaped the subject. It is also fruitful to consider how the emphasis has evolved over time from simple limit theorems to getting bounds on the rates of convergence or obtaining inequalities, which are of more immediate relevance in applications to nite samples. The current workshop and conference will focus on some of these topics, and also more broadly on issues of current interest in probability theory.

The workshop (January 2-8, 2013) will consist of five short courses on a variety of topics, aimed at the level of graduate students but also of potential interest to researchers in probability and related fields. After the workshop the conference (January 9-11, 2013) will have lectures on recent developments in various relevant fields of probability.

Name	Organization
Amir Dembo	Stanford
Jason Schweinsberg	USCD
Tim Austin	NYU
Arnab Ganguly	ICERM/Brown
Aaron Smith	ICERM/Brown
Kavita Ramanan	Brown University

# **VI-MSS/ICERM-Funded Participants (Limit Theorems in Probability)**

Name	Home Organization	Traveled To	Travel Dates
McQuighan,	Brown University	Tata Institute of	Oct 24, 2012 -
Kelly		Fundamental Research	Nov 3, 2012
		Centre (TIRF), Bangalore	
Rudolph, Maja	Massachusetts Institute	IISc, Bangalore	Jan 28, 2013 -
	of Technology		Feb 28, 13
Slivinski, Laura	Brown University	Tata Institute of	October 21,
		Fundamental Research	2012 - Nov 3,
		Centre (TIRF), Bangalore	2012
Slivinski, Laura	Brown University	Tata Institute of	March 13, 2013
		Fundamental Research	- March 28,
		Centre (TIRF), Bangalore	2013
Woo, Jae Oh	Yale University	IISc, Bangalore	Dec 2012 - May
			16, 2013

# VI-MSS Research Visits to India 2011-2013

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

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

# **Program Promotions**

ICERM programs and events are marketed through a variety of outlets: its website, dedicated Facebook page and Twitter account, targeted blast emails, 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).

ICERM's email database is now made up of former participants, ICERM board members, academic and corporate sponsors, and the department managers from higher education math departments in both the US and overseas. It currently has over 3,5000 contact emails. Posters for ICERM's summer undergraduate research program (Summer@ICERM) are target mailed to institutions known to have undergraduate programs in mathematics, applied math, and computer science.

In 2012-2013, ICERM has had a speaker, a booth and/or joint representation with other institutions at the following locations and national events:

- Coalition for National Science Funding (CNSF), Spring 2012, and again in Spring 2013 (Washington, DC)
- JMM, Winter 2012 (Boston, MA), and again in 2013 (San Diego, CA)
- MAA MathFest, Summer 2012 (Madison, WI), and again in 2013 (Hartford, CT)
- Mathematical Field of Dreams Conference, Fall 2012 (Tempe, AZ)
- Modern Math Workshop at SACNAS, Fall 2012 (Seattle, WA)
- SIAM CS&E, Winter 2013 (Boston, MA)

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 (BOT). The Scientific Advisory Board (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 oversees all institute activities. This includes being responsible for reviewing the budget for the coming year, developing policies and procedures, approving the appointment of the Director, and taking a leadership role in fundraising and public awareness. The Board of Trustees has a face-to-face meeting at ICERM for one day each year (usually in late spring), and one or two conference-call meetings if needed.

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 (SAB) and the Education Advisory Board (EAB), as well as the ICERM Directors, act as ex officio members. The board meets in person once a year in April or May. There may be additional conferences and consultation.

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
Yvon Maday (new member in 2013)	Université Pierre et Marie Curie
Srinivasa Varadhan	New York University
Bin Yu (new member in 2013)	University of California at Berkeley

# **ICERM Board of Trustees**

New members Yvon Maday and Bin Yu joined the BOT, replacing David McLaughlin and David Mumford who rotated off.

Note: at the time of this report, the annual Board of Trustees meeting had not been held (scheduled for May 17, 2013). The annual Board of Trustees meeting from April 2012 can be found in the 2011-2012 annual report.

# Scientific Advisory Board (SAB)

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.

Name	Institution	
Andrea Bertozzi (Chair)	University of California at Los Angeles	
Michael Brenner (new member in 2013)	Harvard University	
Henry Cohn	Microsoft Research	
Tom Dean	Google	
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	
Cynthia Phillips (new member in 2013)	Sandia	
Richard Schwartz (new member in 2013)	Brown University	
Yuri Tschinkel (new member in 2013)	University of California at Berkeley	
Peter Winkler	Dartmouth University	

# **ICERM Scientific Advisory Board**

New members Michael Brenner, Cynthia Phillips, Rich Schwartz and Yuri Tschinkel joined the SAB, replacing those rotating off: Brenda Dietrich, David Gabai, Don Saari, Bernd Sturmfels, Eil Upfal rotated off.

*Note: see Appendix C for the minutes of the November 30-December 1, 2011 annual Scientific Advisory Board meeting.* 

# **Education Advisory Board (EAB)**

The Education Advisory Board is charged with (1) oversight of the mentoring mechanisms and professional development of both graduate students and postdoctoral candidates, (2) oversight of undergraduate research programs, and helping to develop and identify successful proposals, and (3) developing proposals for K-12 outreach programs, including student internships and teacher education, and identifying alternative sources of funding.

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.

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

#### **ICERM Education Advisory Board**

Note: at the time of this report, the annual Education Advisory Board meeting had not been held (postponed until late summer due to member scheduling conflicts). The annual Education Advisory Board meeting from April 2012 can be found in the 2011-2012 annual report.

# **Mathematics Institute Directors Meeting (MIDs)**

At the time of this report, the minutes from the May 3-4, 2013 MIDS meeting were not completed.

# **ICERM's Early Career Training and 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 (Summer@ICERM), and starting in the summer of 2013, IdeaLabs. The addition of postdoctoral fellows (as described above) and graduate students is essential to the success of ICERM's programs.

# **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.

# **Recruiting and Selection of ICERM-Funded Postdocs**

ICERM's postdoctoral positions are widely advertised using MathJobs.org, print and online publications of the Society for Industrial and Applied Mathematics News, Notices of the American Mathematical Society, the Association of Women in Mathematics, the Society for the Advancement of Chicanos and Native Americans in Science, and on the ICERM website. These positions are also advertised at the NSF Institute Reception at the joint meetings of the AMS/MAA. ICERM collects applications via Mathjobs.org, an online job application service provided by the American Mathematical Society.

In all written material sent out, it is emphasized that Brown is an EEO/AA Employer and that ICERM encourages applications from women and minority candidates.

ICERM sets a mid-January deadline for postdoctoral applications. Application review begins immediately and continues until the positions are filled.

The Postdoctoral Fellow Search Committee consists of the ICERM Semester Program organizers for the upcoming programs and the ICERM Director and Deputy Directors.

The program organizers review all of the applications and provide a rank-ordered list to the ICERM Directors for each of the two types of positions (Institute and Semester postdocs). Directors review the total applicant pool and the ranked lists, and may suggest changes. The directors approve all offers, and Brown University's Dean of the Faculty generates the appointment paperwork.

ICERM Postdoctoral Fellows (4 months; funds for travel to and from institute)			
Name	<b>Previous Institution</b>	Semester	
Daniel Cargill	New Jersey Institute of	Fall 2012 CCP	
	Technology		
Arnab Ganguly	Automatic Control Laboratory at	Fall 2012 CCP	
	ETH Zurich (Postdoc)		
Peng Hu	INRIA	Fall 2012 CCP	
Hao Ni	University of Oxford	Fall 2012 CCP	
Kwangho Choiy	Oklahoma State University/	Spring 2013 MDS	
	Stillwater (Visiting Professor)		
Zajj Daugherty	Dartmouth College (Wesley	Spring 2013 MDS	
	Young Research Instructor)		
Martina Lanini	University of Melbourne,	Spring 2013 MDS	
	Australia (Postdoc)		
Ben Salisbury	University of Connecticut	Spring 2013 MDS	

# 2012-2013 ICERM Postdoctoral Cohort

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

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

Name	Previous Institution	Semester
Aaron Smith	Stanford University	2012-13: focus Fall CCP
Julio Andrade University of Bristol		2012-13: focus Spring
		MDS

Based on available information, the ICERM-funded postdocs for 2012-2013 break down as follows:

	Male	Female
Black	0	0
Hispanic	1	0
American Indian/Alaskan Native	0	0
Asian/Pacific Islands	3	1
White	3	2
Other (specify)	<u>0</u>	+ <u>0</u>
	7	3 = 10 Total

# 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. The institute makes every effort to keep in touch with its postdoctoral alums in order to track their professional growth.

ICERM-funded postdocs (to date)	Period of Stay	Plans After ICERM
Emre Esenturk	Fall 2011	Pohang University of Science and Technology (Korea)
Jeffrey Haack	Fall 2011	University of Texas/Austin
Andong He	Fall 2011- Spring 2012	Yale University
Ahmed Kaffel	Fall 2011	University of Maryland
Daniela Tonon	Fall 2011	Université Pierre et Marie Curie
Dongming Wei	Fall 2011	VP at PNC Bank
Cecile Armana	Spring 2012	University of Franche-Comté
Anupam Bhatnagar	Spring 2012	Tenure track at Borough of
		Manhattan Community
		College, CUNY
Alon Levy	Fall 2011 – <i>Spring 2012</i>	University of British
		Colombia
Bianca Viray	Spring 2012	Brown University
Xiaoguang Wang	Spring 2012	Tenure track at Zhejiang
		University
Daniel Cargill	Fall 2012	Northwestern University
Arnab Ganguly	Fall 2012	Tenure track at University of
		Louisville
Peng Hu	Fall 2012	Oxford-Man University
Hao Ni	Fall 2012	Brown University
Aaron Smith	Fall 2012 - Spring 2013	At ICERM through June 2013
Julio Andrade	Fall 2012 - <i>Spring 2013</i>	At ICERM through June 2013, IHÉS starting fall 2013
Kwangho Choiy	Spring 2013	To be determined
Zajj Daugherty	Spring 2013	Dartmouth University
Martina Lanini	Spring 2013	To be determined
Ben Salisbury	Spring 2013	tenure track at University of
		Michigan starting fall 2013

# **Graduate Students**

# **Support for Graduate Students**

The research semester program budget includes partial support for a cohort of graduate students. A housing allowance (\$750/month) and travel to the institute is provided to about 10-14 graduate students each of whom applies to be in residence for the entire semester. Applicants include graduate students working with visitors to the program, as well as students who intend to come without an advisor. Graduate students must arrange for a letter of recommendation from their advisor to be sent separately. The graduate student applications are rank-ordered by the semester program organizing committee, and subsequently reviewed by the Deputy Director overseeing the development of that particular program. Final decisions are made by the director(s). The ability to provide a mentor for each graduate student in residence is a factor in the decision.

# **Training and Mentoring Programs**

Before an ICERM semester program starts, all postdocs and graduate students are assigned a mentor. The institute provides all senior mentors with written guidelines that spell out their responsibilities and the responsibilities 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. Currently, Associate Director Bjorn Sandstede coordinates these efforts and works with the members of the Program Organizing Committee assigned to be responsible for mentorship.

In addition, at the beginning of each semester program, directors hold mentor/mentee introductory meetings. These meetings emphasize that mentors should help mentees start to build a research cohort, and help them create contacts and resources which will persist beyond the program.

The mentoring program for the Institute Postdoctoral Fellows necessarily includes a plan for the "off semester" when these postdocs are in residence at ICERM while there is no active research program in their area. So far, all such postdocs have been matched with mentors at Brown in Math, Applied Math, or Computer Science. However, we envision the possibility of different arrangements, including mentorship from faculty at local institutions or even arranging travel or extended visits to more distant locations.

Postdoc	Mentor	Program
Daniel Cargill	Paul Dupuis, Bjorn	Fall 2012 ICERM Postdoctoral
New Jersey Institute of	Sandstede	Fellow
Technology		
Annalisa Cerquetti	Kavita Ramanan	Fall 2012 Postdoc/Independent
Università di Roma "La		
Sapienza"		
Arnab Ganguly	Paul Dupuis	Fall 2012 ICERM Postdoctoral
Swiss Federal Institute of		Fellow
Technology	L DI L	
Peng Hu	Jose Blanchet	Fall 2012 ICERM Postdoctoral
Universite de Bordeaux I	Variation 1 Diam	Fellow
Kody Law	Youssel Marzouk, Bjorn	Fall 2012 Postdoc/Independent
	Sandstede Daria Razavaluu	Eall 2012 ICEDM Destdeateral
Hao NI University of Oxford	Bolls Rozovsky	Fall 2012 ICENIVI FOStdoctoral
Aaron Smith	Chin Lawrence Kavita	Fall 2012 ICERM Institute
Stanford University	Ramanan	Postdoc
Julio Andrade	Ieff Hoffstein	Spring 2013 ICERM Institute
University of Bristol	Jen nonstein	Postdoc
Chris Berg	Anne Schilling	Spring 2013
University of Ouebec		Postdoc/Independent
Kwangho Choiy	Solomon Friedberg	Spring 2013 ICERM
Oklahoma State University		Postdoctoral Fellow
Zajj Daugherty	Vyjayanthi Chari	Spring 2013 ICERM
Dartmouth College		Postdoctoral Fellow
Martina Lanini	Arun Ram	Spring 2013 ICERM
University of Melbourne		Postdoctoral Fellow
Min Lee	Jeffrey Hoffstein	Spring 2013
Brown University		Postdoc/Independent
Alejandro Henry Morales		Spring 2013
University of Quebec		Postdoc/Independent
Yoon Kyung Park	Gautam Chinta	Spring 2013

# **ICERM Postdoctoral Participant and Mentor list by Semester Program**

Korea Institute for Advanced		Postdoc/Independent
Study (KIAS)		
Martin Raum	Solomon Friedberg	Spring 2013
ETH		Postdoc/Independent
Benjamin Salisbury	Anne Schilling	Spring 2013 ICERM
City College, CUNY		Postdoctoral Fellow
Meesue Yoo	Elizabeth Beazley	Spring 2013
Korea Institute for Advanced		Postdoc/Independent
Study (KIAS)		

\*Advisor also attended the program

# **Graduate Student Mentoring**

Graduate Student	Mentor	Program
Mohammadreza Aghajani*	Kavita Ramanan	Fall 2012
Brown University		
Xinyun Chen*	Jose Blanchet	Fall 2012
Columbia University		
Jing Dong*	Jose Blanchet	Fall 2012
Columbia University		
Zecheng Gan	Paul Dupuis	Fall 2012
Shanghai Jiaotong University		
Thorbjorn Gudmundsson*	Henrik Hult	Fall 2012
Royal Institute of Technology (KTH)		
Majid Janzamin	Kavita Ramanan	Fall 2012
University of California, Irvine		
Dane Johnson*	Paul Dupuis	Fall 2012
Brown University		
Ling Lin*	Eric Vanden-Eijnden	Fall 2012
New York University		
Yufei Liu*	Paul Dupuis	Fall 2012
Brown University		
Elizabeth Makrides*	Bjorn Sandstede	Fall 2012
Brown University		
Shorash Miro	George Karniadakis	Fall 2012
Ruhr-Universitat Bochum		
Karthyek Murthy	Jose Blanchet	Fall 2012
Tata Institute of Fundamental Research		
Pierre Nyquist*	Henrik Hult	Fall 2012
Royal Institute of Technology (KTH)		
Kamana Porwal	Govind Menon	Fall 2012
Indian Institute of Science		
Laura Slivinski*	Bjorn Sandstede	Fall 2012
Brown University		
Ivi Tsantili*	Gerassimos A. Athanassoulis	Fall 2012
National Technical University of Athens		
Kasia Wolny	Jose Blanchet	Fall 2012
University of Warwick		
Wei Wu*	Paul Dupuis	Fall 2012
Brown University		

Jie Zhong	Boris Rozovsky	Fall 2012
University of Southern California		
Tapas Chatterjee	Adrian Diaconu	Spring 2013
Institute of Mathematical Sciences		
Mario Anthony DeFranco*	Benjamin Brubaker	Spring 2013
Massachusetts Institute of Technology		
Gabriel Feinberg*	Kyu-Hwan Lee	Spring 2013
University of Connecticut		
Holley Ann Friedlander	Gautam Chinta	Spring 2013
University of Massachusetts		
Thomas Hulse*	Jeff Hoffstein	Spring 2013
Brown University		
Anh Huynh*	Sara Billey	Spring 2013
University of Washington		
Cihan Karabulut*	Gautam Chinta	Spring 2013
City University of New York (CUNY)		
Eren Kiral*	Jeff Hoffstein	Spring 2013
Brown University		
Chan Leong Kuan*	Jeff Hoffstein	Spring 2013
Brown University		~ -
Deniz Kus	Thomas Lam	Spring 2013
Universität zu Köln		
Li-Mei Lim*	Jeff Hoffstein	Spring 2013
Brown University		
David Lowry*	Jeff Hoffstein	Spring 2013
Brown University		
Dinakar Muthiah*	Alexander Braverman	Spring 2013
Brown University		
Anna Puskas*	Gautam Chinta, Dorian Goldfeld	Spring 2013
Columbia University		
Travis Cole Scrimshaw*	Anne Schilling	Spring 2013
University of California, Davis		
Xin Shen	Benjamin Brubaker	Spring 2013
University of Minnesota		
Ruoguang (Roger) Tian*	Anne Schilling	Spring 2013
University of California, Davis		
Aladin Virmaux*	Nicolas M. Thiery	Spring 2013
Universita de Paris XI (Paris-Sud)		
Jun Wen*	Gautam Chinta	Spring 2013
Stony Brook University		_
Ian Michael Whitehead	Joseph Hundley	Spring 2013
Columbia University		

\*Advisor also attended program

**Note**: The 2013-2014 cohort of graduate students is still to be determined.

### **Roundtable Discussions**

To prepare graduate students and postdocs better for their future careers, the institute also organizes regular roundtable discussions with long-term visitors, Brown faculty, and directors, 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

### **Peer-to-Peer Discussions**

During semester programs, there are regularly scheduled postdoc-graduate student seminars, expressly limited to junior researchers. This gives participating postdocs and graduate students an opportunity to discuss research topics and any other issues openly, without senior people present. The format is completely flexible. For example, it could feature talks by postdocs or graduate students on their current research, or provide an opportunity to read and report on papers, or give an introduction to upcoming talks in other seminars. The group could even ask a senior participant to give a tutorial lecture and then follow up with a discussion session afterwards.

### Integration with Summer@ICERM undergraduate research program.

Ideally, our summer undergraduate research program has scientific connections to the themes of one of the surrounding semester program, and will attract applications from participating postdocs and graduate students to assist the summer faculty leaders.

### **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

The inaugural "Summer@ICERM" program "Geometry and Dynamics" ran from June 18, 2012 through August 10, 2012 with a cohort of 14 students. Ten students weree funded through the NSF, three via a Brown University Undergraduate Training and Research Award (UTRA), and another via a National University of Singapore research exchange program, co-funded by Brown, NUS, and Santander Bank.

#### Summer Undergraduate Research Program Process

The summer undergraduate research program selection process follows these steps:

# **1. Solicitation of Proposals**

ICERM has started to solicit and recruit proposals from faculty nationwide. Ideally, a successful summer program will run two consecutive years (as it has during this reporting cycle: "Geometry and Dynamics" during both the summer of 2012 and 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 are selected from proposals submitted to ICERM in an open competition. Successful programs typically have a significant computational component. Summer research programs which pair with the semester programs are especially encouraged, but not required. A subcommittee of the EAB and an Associate Director vet proposals. External evaluations of

proposals are solicited. Preliminary decisions on summer programs are made by the Directors and must be approved by the Scientific Advisory Board.

# **3. Application Process**

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

# 4. Applicant Selection

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

# **Financial Decisions for Program**

Each faculty member receives either salary or expenses, or some combination of the two. Both regular faculty members and senior postdoctoral researchers are 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 receives 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 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.

Summer@ICERM students receive a \$3,000 stipend, support for travel within the U.S., and room and board.

Name	Home Institute	Funding Source
Alevy, Ian (M)	University of Chicago	NSF Funded
Bozgan, Francisc (M)	UCLA	NSF Funded
Casto, Kevin (M)	Brown University	Outside Funding*
Chang, Hai Bin (M)	National University of Singapore	Outside Funding**
Engelman, Katherine (F)	Bryn Mawr College	NSF Funded
Gekhtman, Dmitri (M)	Harvard University	NSF Funded

# 2012 Summer@ICERM Cohort

Jeong, In-Jee (M)	Brown University	Outside Funding*
Kimball, Andrew (M)	Western Carolina University	NSF Funded
LaChance, Julienne (F)	Rensselaer	NSF Funded
Nesky, Amy (F)	Boston College	NSF Funded
Nikolov, Desislava (F)	University of the Free State, South	NSF Funded
	Africa	
Redwood, Clara (F)	Reed College	NSF Funded
Tsukerman, Emmanuel (M)	Stanford University	NSF Funded
Yang, Yilong (M)	Brown University	Outside Funding*

\*UTRA funded

\*\*SURE funded (Brown's summer international research exchange program with the National University of Singapore, funded by Santander

In addition to the 14 undergraduate researchers and 2 faculty organizers, 2 teaching assistants were key members of the Summer@ICERM program: Diana Davis, Brown University graduate student, and Tarik Aougab, Yale University graduate student.

Here follows a sample of the most substantive comments from our Summer@ICERM participants.

# Summer@ICERM Organizer Comments

The quality of the scientific activity at Summer@ICERM was very high. I feel it was a great experience for the students, and the students worked at a very high level. I fully expect that a number of high quality undergraduate publications will arise from the program. Even the students who were not able to produce these kinds of results learned a lot of mathematics and gained first hand experience in research. This included an emphasis in computational approaches to research in mathematics.

The student groups met twice weekly with their primary advisors. In addition, there was a great deal of informal interactions between students, and between students and instructors. Topics studied by students were overlapping and this allowed for productive mathematical conversations outside groups lines. Furthermore, the large instructor and TA to student ratio meant that there was a lot of learning done at an informal level based primarily on the interests of the students.

Several of the students had written very interesting computer programs to aid their understanding of their projects. Most of these programs were written by students with little or no programming experience, representing a significant achievement. I believe that these students in particular benefited strongly from this aspect of the program. Furthermore, I believe that because other students were exposed to the early research opportunities made available by the experimental approach, students will return to their home institutions with greater interest in programming. Hopefully, many of these students will be motivated to take some programming courses.

Given the special nature of the program, involving undergraduate students, the level and quality of scientific activity was very high, and the frequency of interactions and collaborations extremely high.

Perhaps a way to facilitate greater success of the computer programing portion of the Summer@ICERM program would be to place greater priority on admitting students with prior programming experience...I also think the students should be asked to present less frequently and at more formal occasions.

#### Summer@ICERM Participant Comments

Perfectly organized research program, projects were very accessible and we had the chance to have real progress on our research. Professors were very helpful and the meetings were very useful. The lieu of all

the math activities, ICERM, looks wonderful and it is a great place to do research. I noticed that there were many empty offices on the 10th floor. It probably it would have been useful to give an office for each of the research groups.

*I think this program was incredibly well run and organized. The professors and TAs also made themselves available and approachable.* 

I loved the workspace on the 11th floor. It was particularly stimulating and exciting to work there. I also enjoyed the varied exposure to different topics by the different advisors and TA's, and the fact that they were easily approachable and willing to help at all times.

More in-depth mini courses with some exercises would be great.

# Summer@ICERM TA Comments

Being a TA at this program far exceeded my expectations. Primarily, I didn't expect that I would learn so much new mathematics as a result of working with the students on these problems. All of the students I advised (we divided the research groups amongst the four of us, so I was not directly involved in supervising all of the students) were motivated and talented.

While the students found the topics covered in the mini-courses to be interesting, some of them had trouble paying full attention because the lectures were aimed either too high or low at the audience. If we gave the instructors some advanced knowledge about the mathematical backgrounds of the students, we could avoid this problem.

The resources at ICERM are state of the art. The technology in the lecture rooms made it incredibly easy to give and listen to talks. I can't think of any software or hardware that ICERM lacks which would've improved our experience.

#### **Participant Selection Process**

The inaugural "Summer@ICERM" program ran from June 18, 2012 through August 10, 2012 with a cohort of 14 students. Ten students were funded through the NSF, three via a Brown University Undergraduate Training and Research Award (UTRA), and one via a National University of Singapore research exchange program, co-funded by Brown, NUS, and Santander Bank.

ICERM accepts applications for its Summer@ICERM program via *Mathprograms.org*, an online service provided by the American Mathematical Society. The total number of applicants in the pool for the 2012 Summer@ICERM program (186) included many who were not qualified in the sense that their research interests did not fit within the research parameters of the program, they did not complete the application properly, 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 2012 Geometry and Dynamics program. With consideration towards diversity, a rank-ordered list was generated.

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

	Male	Female
Black	0	0
Hispanic	0	1
American Indian/Alaskan Native	0	0
Asian/Pacific Islands	0	0
-----------------------	----------	--------------
White	5	4
Other (specify)	<u>0</u>	<u>0</u>
	5 +	5 = 10 Total

The 4 outside funded students were made up of 3 male Asian/Pacific Islanders, and 1 white male.

## Summer@ICERM Scientific Outcomes to Date

Like all ICERM programs, many of the scheduled scientific seminars for this program were announced and open to the Brown community. Throughout the Summer@ICERM program, 39 individuals (graduate students, undergraduate students, and Brown visitors) came to ICERM in order to participate in the Summer@ICERM mini-courses.

# **Final Student Presentations**

Links to these final presentation PDFs can be found at: <u>http://icerm.brown.edu/summerug\_2012</u>

- "Bicycle Polygons, Solitons, and the Darboux Transform" by E. Tsukerman and I. Alevy
- "Billiards in Near Rectangle" by Y. Yilong and C. Hai Bin
- "Outer Billiards with Contraction" by I. Jeong, F. Bozgan, and J. LaChance
- "Converse Desargues' Theorem" by K. Casto and D. Nikolov
- "A Cute Little Rhombus" by Y. Yilong and C. Hai Bin
- "Negative Snell Propagation" by K. Engelman and A. Kimball
- "Bicycle 'Unicycle' Path" by A. Nesky and C. Redwood
- "Bugs" by D. Gekhtman

## **Completed Student Projects**

• A simple visualizer for outer billiards with contraction: Visualizer developed by Julienne LaChance, for use in her S@I research project with Francisc Bozgan and In-Jee Jeong.

Example and code can be found here: http://sourceforge.net/projects/outercontract/

- Geometry of bicycle curves and bicycle polygons: Two papers (both submitted for publication) resulted from the study of bicycle polygons and the related Darboux transformation:
  - S. Tabachnikov E. Tsukerman: On the discrete bicycle transformation http://front.math.ucdavis.edu/1211.2345
  - S. Tabachnikov E. Tsukerman: Circumcenter of Mass and generalized Euler Line <a href="http://front.math.ucdavis.edu/1301.0496">http://front.math.ucdavis.edu/1301.0496</a>
- Senior thesis by In-Jee Jeong, presented May 2013: "Outer Billiards With Contraction"
- At least one more paper, by I. Alevy and E. Tsukerman, based on their summer research, is in progress.

## Expanding Summer@ICERM

ICERM will continue to explore additional sources of funding for the undergraduate program. One such program, the Leadership Alliance (<u>http://www.theleadershipalliance.org</u>), supports minority participation in research projects at several dozen universities and colleges including Brown. For the past two years, attempts have been made to find qualified students through the Leadership Alliance, and in fact two students were identified and recruited (one for the 2012 program, and one for the upcoming 2013 program); however their research interests did not match either year's Geometry and Dynamics topic and

both declined to apply. ICERM will continue to network and create relationships with organizations that can help recruit minorities.

### **The Evaluation Process**

Kathleen Banchoff, Ph.D., Principal McCarthy Marx & Associates, was hired as ICERM's external evaluator staring in years one and two to review the internal evaluations process and assist with the design of the questionnaires and surveys. During year three, Banchoff has begun to advise on the construction of a results database and subsequent report and analysis design. 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. Starting 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.

In its first three years of program operation, ICERM developed and tested its

evaluation program, following a "rapid prototyping" model for devising and improving questionnaires with each iteration. The institute plans to use 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**

During its preliminary stage of survey development, the institute has been 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.

#### **Method of Analysis**

Kathleen Banchoff has begun to 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

Until now, 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?). The institute is creating 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 <u>Practical Assessment, Research & Evaluation</u>.)

## **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.

## **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 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.

An exit survey has also been developed for the Summer@ICERM undergraduate researchers.

# **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?

Note: A binder with examples of each type of ICERM survey as well as summary survey results from ALL ICERM programs will be made available in the Site Visit meeting room.

### **Follow-up Surveys**

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 also been advising the institute's evaluation component.

Professors Wong and Tyler have been discussing the development of a control versus treatment design for a longitudinal analysis of the effects of ICERM's work. This analytic framework has guided ICERM to gather follow up and/or longitudinal data for the program participants and the potential comparison groups.

Several follow-up surveys are distributed two years following the completion of each of the semester programs. 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 "impact" 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 can be attributed to their time at ICERM. ICERM has already requested a self-report on publications from participants in past programs.

Note: Appendix D provides samples of the institute's pre, exit, and organizer surveys.

## **Reported Scientific Outcomes and Collaborations**

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.

Note: a list of self-reported publications and collaborations formed to date is provided in Appendix E.

#### **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 in 2011.

The Corporate Sponsorship program has a \$5,000 annual membership fee. To date, ICERM has received \$22,500 in corporate sponsorship funds.

Corporate sponsors include:

- Simulia
- Mircrosoft Research
- Google

The Academic Sponsorship has an annual membership fee of \$3,000 for domestic membership, and \$5,000 for international membership. To date, ICERM has received \$21,750 in academic sponsorship funds

Academic sponsors include:

- Cornell University, Department of Mathematics
- Georgia Tech, School of Mathematics
- Iowa State University, Department of Mathematics
- Korea University, Department of Mathematics
- Michigan State University, Department of Mathematics
- Michigan Tech, Department of Mathematical Sciences
- UMASS Amherst, Department of Mathematics and Statistics

### **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.

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Additional Grants	<u>Amount</u>
Mathematical Sciences Research Institute	\$38,500.00
Sloan Foundation	\$30,000.00
Sub-total	\$68,500.00
University Funding Support	
VP of Research Support (Seed Fund)	\$30,000.00
Supplemental Administrative Costs	\$12,866.25
Brown UTRA Program for Summer@ICERM	\$12,000.00
Sub-total	\$54,866.25
Sponsor Support	
Academic Sponsors	\$13,000.00
Corporate Sponsors	\$ 7,500.00
Sub-total	\$20,500.00
Gifts	
Phoebe Snow Foundation	\$30,000.00
Sub-total	\$30,000.00
TOTAL	\$173,866.25

## **Other Funding Support 2012-2013**

## Additional Workshops Held At ICERM

Performance Analysis of Monte Carlo Methods

Sub-total	\$30,000.00
TOTAL	\$30,000.00

## **Outreach/Diversity**

ICERM strongly supports the National Science Foundation's goals of expanding the numbers and diversity of individuals engaged in mathematical sciences through increased participation. ICERM is a member of the Math Institutes Diversity Committee. We actively seek participation of women and under-represented minorities in ICERM's governing bodies and in all scientific programs, workshops and events. Specifically, ICERM policy includes the following:

ICERM's Board of Trustees and Science Advisory Board work to ensure participation of women and under-represented minorities on all ICERM boards and in all scientific programs, respectively. The Director, Deputy, and Associate Directors are proactive in seeking representation of women and minorities in its undergraduate, graduate and postdoctoral programs and on organizing committees of programs and workshops, and work to liaise closely with organizing committees to increase diversity among funded participants. All past and future activities that support these goals and achievements in this area are documented on this page.

ICERM hosts or co-sponsors special events or conferences that serve women and under-represented minorities in the mathematical sciences, including diversity workshops, Blackwell-Tapia conferences, Society for Advancement of Chicanos and Native Americans in Science (SACNAS) conferences, Association for Women in Mathematics (AWM) workshops and events, and is building relationships with academic institutions that serve large minority populations.

ICERM states its commitment to diversity on all informational and promotional materials, and broadly advertises its activities and opportunities for funding.

ICERM sends diversity guides to all semester program and workshop organizers. They are available for review later in this tab section.

## **Diversity Events in 2012-2013**

- 2012 Modern Math Workshop at SACNAS
   October 9-10, 2012 in Seattle, WA
   ICERM sponsored guest speaker Jessica Purcell, Brigham Young University
   *"Low-dimensional Topology, Geometry, and Dynamics"* http://nimbios.org/education/modern\_math\_ws.html
- Mathematical Field of Dreams Conference
   November 2-4, 2012 in Tempe, AZ
   ICERM sponsored ICERM Institute Postdoc Julio Andrade as a guest speaker
   *"Number Theory, Polynomials and Random Matrices"* <u>http://mcmsc.asu.edu/conferences/FoD2012</u>
- Biennial Blackwell-Tapia Conference 2012 (organized and hosted) November 9-10, 2012, ICERM, Providence, RI This event was supported in part by a grant from the Alfred P. Sloan Foundation. <u>http://icerm.brown.edu/blackwell-tapia-2012</u>

## **Other Activities**

- Shared funds among NSF Mathematics Institutes available for rotating programs like Modern Math Workshop and Blackwell-Tapia
- ICERM is a member of the NSF Institute-wide diversity committee
- ICERM co-supporter the AWM mentor network
- Planning to hire an Associate Director of Diversity Enhancement

## **EPSCoR**

ICERM supports the National Science Foundation's EPSCoR mission: "to assist the NSF in its statutory function "to strengthen research and education in science and engineering throughout the United States and to avoid undue concentration of such research and education." EPSCoR goals are:

- 1. to provide strategic programs and opportunities for EPSCoR participants that stimulate sustainable improvements in their R&D capacity and competitiveness;
- 2. to advance science and engineering capabilities in EPSCoR jurisdictions for discovery, innovation and overall knowledge-based prosperity.

	# of ICERM
EPSCoR State	Participants
Alabama	3
Alaska	0
Arkansas	1
Delaware	2
Guam	0
Hawaii	3
Idaho	0
Iowa	7
Kansas	1
Kentucky	1
Louisiana	7
Maine	1
Mississippi	0
Missouri	1
Montana	0
Nebraska	0
Nevada	0
New Hampshire	2
New Mexico	11
North Dakota	0
Oklahoma	4
Puerto Rico	6
Rhode Island	138
South Carolina	5

#### Accepted ICERM participants by EPSCoR States (to date)

South Dakota	0
Tennessee	10
U.S. Virgin Islands	0
Utah	4
Vermont	1
West Virginia	0
Wyoming	0
Total	208

## **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 have committed 50% time to the institute as Deputy Directors, Jill Pipher commits 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 became the Chair of the Mathematics Department in January 2013. Sergei Tabachnikov (University of Pennsylvania) has been hired to take his place as Deputy Director (at 50% time), starting June 2013.

## **ICERM Staff**

**Ruth Crane, Assistant Director (hired in November 2010):** reports to the Director. Responsibilities include overseeing the 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):** reports to the Director. 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, (hired in August 2011):** reports to the Assistant Director. Provides high-level administrative support and financial management; 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; Prepares 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): reports to the Assistant Director. Responsible for the implementation of the entire portfolio of ICERM's scientific research programs; manages a program timeline and program guide for each program, adhering to all programmatic deadlines and budgets. Major responsibilities include coordinating the housing, coordinating all communications regarding the 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; hiring and training student employees as needed to assist with event prep and administrative support.

**Shaun Wallace, Web Application Developer (hired in March 2011):** reports to the IT Manager. The Web Application Developer designs, implements and maintains websites, web based applications, and ICERM's proprietary databases 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):** reports to 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. Hires student employees as needed to assist with lecture capture and editing.

**Nicole Henrichs, Program Coordinator (hired in September 2011):** reports to the Program Manager. Is the first point of contact for program participants, including scholars, students and visitors. Major responsibilities include front desk coverage, program evaluation distribution, event/visitor and administrative support.

**Bernadette McHugh, Web Content Editor (hired in September 2012):** reports to the Web Application Developer. Updates and maintain website content and web-based applications used to support and promote ICERM and its activities, including semester programs, workshops, and special events. Assists with quality assurance testing of web content and data systems and routine maintenance and support as needed.

**Katie Droney, Financial Coordinator (hired in February 2013):** reports to the Financial Manager. Serves as primary point of contact for ICERM staff, program organizers, visitors, postdocs, students, vendors, and sponsor agencies for all financial transactions and related issues; reconciles the day-to-day financial activity for expenses supported by sponsored projects and University appropriated budgets.

## **ICERM PI and 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 is currently supported by the NSF and by the Australia Research Council, 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 for a term of two years. She is a PI or co-PI on four grants awarded in 2011 from DOE, NSA, NSF, and ONR for AWM activities and events. Pipher is a Fellow of the American Mathematical Society.

**Jeffrey Brock** is Professor and Chair of mathematics at Brown University. 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. Brock has stepped down as Deputy Director beginning January 2013, when he became chair of the Mathematics Department at Brown.

**Jan Hesthaven** is a Professor of applied mathematics at Brown University, and an ICERM Deputy Director. 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 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 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. He serves on the editorial board of 6 journals, including Journal of Computational Physics and SIAM Journal on Scientific Computing. Hesthaven will step down as ICERM Deputy Director at the end of June 2013.

**Jeffrey Hoffstein** is a Professor at Brown University, and an ICERM Associate Director. 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, Hoffstein 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 sixty 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 an Associate Professor in the Division of Applied Mathematics at Brown University. His work is primarily in differential equations and mathematical physics, but he also collaborates with several labs on the design of devices in nanotechnology. His initial training in mechanical engineering at IIT, Kharagpur and Cornell University was followed by a Ph.D in applied mathematics at Brown. He spent a postdoctoral year at the Max-Planck Institute for Mathematics in the Sciences and three years as a Van Vleck Asssistant Professor at the University of Wisconsin before returning to the faculty at Brown in 2004. His work has been continuously supported by the NSF since 2004 and he received an NSF career award in 2008. Since 2009, Menon has been an adjunct professor at the Tata Institute for Fundamantal Research's Center for Applicable Mathematics in Bangalore, India. Menon serves as ICERM's Associate Director of special projects, coordinating the VIMSS program with ICERM's partner institutions in India.

**Bjorn Sandstede** is Professor and Chair of applied mathematics at Brown University, and an ICERM Associate Director. 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. Sandstede 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 editor-in-chief of the SIAM Journal on Applied Dynamical Systems. Sandstede is a Fellow of the Society for Industrial and Applied Mathematics.

**Sergei Tabachnikov** is a professor of mathematics at Penn State University, and will begin his term as an ICERM Deputy Director (replacing Jeff Brock) in June 2013. He works in geometry, topology, and dynamics. He combines theoretical research with computer experiments. He (co)authored several books including "Mathematical Omnibus," a collection of 30 lectures on classic mathematics. Tabachnikov is the Director of the NSF-funded semester-long MASS (Mathematics Advanced Study Semesters) Program at Penn State. He is the Notes Editor of the American Mathematical Monthly, a column editor of the Mathematical Intelligencer, and the Editor-in-Chief of Experimental Mathematics. He has held visiting positions at mathematical institutes worldwide: IHES, ETH Zurich, I. Newton Institute Cambridge, MSRI, Max-Planck-Institut, Hausdorff Institute Bonn, Fields Institute. Tabachnikov is a Fellow of American Mathematical Society.

### 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.

#### **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 is 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 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 is 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 are distributed as needed. Application needs differ from program to program and researcher to researcher. Individuals have administrative control over their own thin client desktops. Each user is provided with a thin client terminal. Researchers are also 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. All previous talks and papers generated in the course of semester programs are archived and available for download and review via the website. In Fall 2013 we will add a participant forum to allow for social interaction for past, current, and future participants.

#### **Multimedia Resources**

ICERM has state of the art audio/visual capabilities. The 120-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 10th 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.

#### **Live Streaming**

ICERM provides live, real-time video streaming of all Workshop talks, special events, and tutorial sessions given in the lecture hall.

#### **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. We helped draft the proposal for a (funded) Cyberinfrastructure grant that is administered by MSRI, to create a searchable user-friendly archive of all video lectures and associated materials at every NSF mathematics institute.

#### **Data Collection and Reporting**

Currently ICERM uses Discovery, a database originally created by IMA to collect and report on participant data. ICERM has modified the database somewhat to more closely meet the business processes of the institute. ICERM uses a separate database to collect applications. Coming in Fall 2013, ICERM will roll out a new, customized system that will fully integrate application and data reporting process in a user-friendly web-based system.

#### **Brown Computing Resources**

ICERM participants are encouraged to use other IT resources available at Brown. Chief among these is the high-performance computing cluster (HPC) hosted by the Center for Computation and Visualization (CCV). ICERM provides premium access accounts upon request to all long-term participants and to workshop participants on an as needed basis with approval from the Director. To date, we have had ten researchers from various programs take advantage of this resource.

Participants are also welcome to use the Digital Scholarship Lab at the Rockefeller Library. This room incorporates a high-definition video wall for large-scale visualization and collaboration.

## APPENDIX

Appendix A: Sample Semester Program Tutorial Schedule Appendix B: Upcoming Programs and Events Appendix C: Minutes from 11/30-12/1/12 Scientific Advisory Board Meeting Appendix D: Survey Samples Appendix E: Self-Reported Scientific Outcomes to Date

## NSF Required Materials Available in the Appendix\*

Appendix F: ICERM Participant List and Summary Table Appendix G: ICERM Financial Support List Appendix H: ICERM Income and Expenditure Report Appendix I: VI-MSS Income and Expenditure Report

\*At the time of this report, the minutes from the May 3-4, 2013 MIDS meeting were not completed, and are therefore not included in this report.