Institute for Computational and Experimental Research in Mathematics

Annual Report
August 1, 2013 – July 31, 2014

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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

ICERM's scheduled programs and events from July 2013 through June 2014

TYPE	TITLE	DATE	# ATTENDED
Topical Workshop	Issues in Solving the Boltzmann Equation for Aerospace Applications	June 3 – 7, 2013	41
Summer Program	IdeaLab 2013: Weeklong Program for Early Career Researchers	July 15 - 19, 2013	34
Summer Program	Research Experiences for Undergraduate Faculty (REUF) (co-sponsored by ICERM and AIM)	July 22 - 26, 2013	28 (10 funded)
Semester Program	Low-dimensional Topology, Geometry, and Dynamics	September 9 - December 6, 2013	83
Program Workshop	Exotic Geometric Structures	September 15 - 20, 2013	113
Public Lecture	Simons Public Lecture: On Growth and Form: Mathematics, Physics and Biology	September 24, 2013	575
Special Event	Modern Math Workshop (preceding SACNAS), Keynote Speaker: Professor Federico Ardila and Mini-Course Speakers: Edray Goins and Araceli Bonifant	October 2 - 3, 2013 (in San Antonio, TX)	178
Special Event	Biological Sense and Mechanisms of Death, led by Andrei Gudkov	October 7, 2013	15
Program Workshop	Topology, Geometry, and Group Theory Informed by Experiment	October 21 - 25, 2013	114
Program Workshop	Geometric Structures in Low-Dimensional Dynamics	November 18 - 22, 2013	111
Public Lecture	Toy Models	November 21, 2013	75
Topical Workshop	From the Clinic to Partial Differential Equations and Back: Emerging challenges for Cardiovascular Mathematics	January 20 - 24, 2014	75

Semester Program	Network Science and Graph Algorithms	February 3 - May 9, 2014	79
Research Cluster	Geometric analysis methods for graph algorithms	February 3 -28, 2014	26
Program Workshop	Semidefinite Programming and Graph Algorithms	February 10 - 14, 2014	104
Research Cluster	Graphs with incomplete information	17 Feb-14 March 2014	5
Special Event	Interlacing Families and Kadison-Singer, Adam Marcus, Crisply LLC and Yale University	February 26, 2014	50
Topical Workshop	Mathematical Challenges in Cybersecurity	March 13-14, 2014	21
Program Workshop	Stochastic Graph Models	March 17 - 21, 2014	82
Special Event	Small Group Research meeting	March 26-30, 2014	8
Special Event	The Brown University Symposium for Undergraduates in the Mathematical Sciences (SUMS): Math and Visualization (co-sponsored by ICERM)	April 5, 2014	80
Program Workshop	Electrical Flows, Graph Laplacians, and Algorithms: Spectral Graph Theory and Beyond	April 7 - 11, 2014	90
Research Cluster	Towards Efficient Algorithms Exploiting Graph Structure	April 24 - May 2, 2014	23
Program Workshop	Eigenvectors in graph theory and related problems in numerical linear algebra	May 5-9, 2014	78
Topical Workshop	Robust Discretization and Fast Solvers for Computable Multi-Physics Models	May 12-16, 2014	62
Topical Workshop	Computational Nonlinear Algebra	June 6, 2014	42 (as of 5/29/14)

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.

During this reporting period, ICERM funded one plenary speaker at a VI-MSS workshop and 19 research visits to partner Indian Institutes. See the VI-MSS section later in this report for more details.

Participant Summaries by Program Type

For this reporting terms (May 1, 2013 to May 1, 2014) 801 unique participants were enrolled in two semester long programs and/or nine workshops, Summer@ICERM, IdeaLab, and REUF. Of the 801, 517 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 all organizers and is as of May 2, 2014. For example Summer@ICERM funded 10 students and 6 faculty leaders and TA's.

ICERM Funded Participants

	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
	Summer@ICERM 2013	16	4	7	0	0	1	0	6	6	8	0	1	0	0	0	1	0	0
	IdeaLab	25	8	23	1	0	5	1	21	2	8	9	3	0	0	2	1	0	0
	REUF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fall Semester '13	Semester Program	64	15	47	0	0	12	1	45	12	18	3	3	0	6	0	17	0	5
	Workshop 1	74	17	54	1	0	14	1	51	7	15	8	6	0	7	1	27	1	2
	Workshop 2	73	16	60	0	0	11	2	55	13	22	4	8	0	4	2	14	0	6
	Workshop 3	74	15	52	0	0	8	3	46	20	15	5	4	0	4	2	22	1	1
	Total	285	63	213	1	0	45	7	197	52	70	20	21	0	21	5	80	2	14
	% of # Reporting		30%		1%	0%	23%	4%		18%	25%	7%	7%	0%	7%	2%	28%	1%	5%
Spring Semester '14	Semester Program	57	8	33	0	0	5	1	28	3	16	2	15	0	4	0	16	1	0
	Workshop 1	80	11	48	0	0	8	0	46	4	32	4	19	0	4	0	16	1	0
	Workshop 2	57	8	31	0	1	7	0	30	2	15	3	11	0	5	3	16	2	0
	Workshop 3	50	5	21	1	0	6	0	20	4	14	3	13	0	5	1	9	1	0
	Workshop 4	44	4	18	0	0	2	0	18	7	21	5	6	0	3	0	1	1	0
	Research Cluster 1	26	5	21	0	0	2	1	20	1	6	1	13	0	0	0	5	0	0
	Research Cluster 2	5	1	2	0	0	1	0	2	0	0	0	2	0	0	0	3	0	0
	Research Cluster 3	17	0	5	0	0	2	0	5	1	4	5	1	0	2	0	4	0	0
	Total	336	42	179	1	1	33	2	169	22	108	23	80	0	23	4	70	6	0
	% of # Reporting		23%		1%	1%	20%	1%		7%	32%	7%	24%	0%	7%	1%	21%	2%	0%
	6/3/13 Workshop	31	7	26	0	0	10	1	24	7	5	7	2	0	2	1	7	0	0
	1/20/14 Workshop	47	3	14	0	0	2	1	11	3	19	15	1	0	0	0	8	1	0

All Participants (ICERM funded and Non-ICERM funded)

	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
				Gender and Ethnicity					Geographical Point of Origin	
Program Type										
Summer@ICERM 2013	22	4	8	0	0	2	0	7	21	1
IdeaLab	34	8	27	1	1	5	1	25	31	3
REUF	8	2	2	1	0	0	0	2	8	0
Fall Semester '13										
Semester Program	83	17	64	0	0	16	1	55	48	35
Workshop 1	113	24	91	1	0	23	2	79	59	54
Workshop 2	114	20	99	0	0	21	4	90	79	35
Workshop 3	111	22	87	0	0	13	3	73	66	45
Total	421	83	341	1	0	73	10	297	252	169
% of # Reporting		24%		0%	0%	25%	3%		60%	40%
Spring Semester '14										
Semester Program	79	9	42	0	0	6	1	37	56	23
Workshop 1	104	15	65	0	11	1	0	63	79	25
Workshop 2	82	10	51	0	1	10	0	48	48	34
Workshop 3	90	9	54	1	0	14	0	53	69	21
Workshop 4	78	6	43	1	1	7	0	42	72	6
Research Cluster 1	26	5	21	0	0	2	0	20	21	5
Research Cluster 2	5	1	2	0	0	1	0	2	2	3
Research Cluster 3	23	0	6	0	0	2	0	6	15	8
Total	487	55	284	2	13	43	1	271	362	125
% of # Reporting		19%		1%	5%	16%	0%		74%	26%
Topical										
6/3/13 Workshop	41	9	35	0	0	11	1	30	31	10
1/20/14 Workshop	75	11	42	0	0	12	2	37	52	23
3/17/14 Workshop	21	2	6	0	0	0	0	4	18	3
5/12/14 Workshop	62	6	39	0	0	20	3	38	47	15
Total	199	28	122	0	0	43	6	109	148	51
% of # Reporting		23%		0%	0%	39%	6%		74%	26%

ICERM Funded Speakers

Program Type	Total Participants	Gender and Ethnicity							Geographical Point of Origin									
		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
Summer@ICERM 2013	3	1	1	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0
IdeaLab	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
REUF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fall Semester '13																		
Semester Program	2	1	1	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0
Workshop 1	23	3	13	0	0	1	0	13	1	2	2	3	0	1	1	12	1	0
Workshop 2	20	3	14	0	0	2	0	17	6	6	2	2	0	0	0	2	0	2
Workshop 3	22	3	12	0	0	0	0	9	6	3	3	0	0	1	1	8	0	0
Total	67	10	40	0	0	4	0	40	13	12	8	5	0	2	2	22	1	2
% of # Reporting		25%		0%	0%	2%	0%		5%	4%	3%	2%	0%	1%	1%	8%	0%	1%
Spring Semester '14																		
Semester Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Workshop 1	24	0	9	0	0	3	0	9	0	10	1	6	0	2	0	5	0	0
Workshop 2	22	1	8	0	0	0	0	6	0	6	1	6	0	1	1	7	0	0
Workshop 3	21	1	2	0	0	1	0	1	2	5	2	8	0	2	0	1	1	0
Workshop 4	24	1	3	0	0	0	0	3	5	9	4	6	0	0	0	0	0	0
Research Cluster 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research Cluster 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research Cluster 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	91	3	22	0	0	4	0	19	7	30	8	26	0	5	1	13	1	0
% of # Reporting		14%		0%	0%	2%	0%		2%	9%	2%	8%	0%	1%	0%	4%	0%	0%
Topical																		
6/3/13 Workshop	23	5	20	0	0	8	0	19	6	4	5	0	0	2	1	5	0	0
1/20/14 Workshop	34	0	2	0	0	0	0	1	1	16	12	1	0	0	0	3	1	0
3/17/14 Workshop	15	1	3	0	0	0	0	2	0	4	2	6	0	0	0	2	0	1
5/12/14 Workshop	25	1	7	0	0	2	1	6	2	6	5	3	0	3	0	6	0	0
Total	57	5	22	0	0	8	0	20	7	20	17	1	0	2	1	8	1	0
% of # Reporting		23%		0%	0%	14%	0%		5%	15%	13%	1%	0%	1%	1%	6%	1%	0%

All Speakers (ICERM funded and Non-ICERM funded)

Program Type		Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
					Gender and Ethnicity					Geographical Point of Origin	
Summer@ICERM 2013		3	1	1	0	0	0	0	0	3	0
IdeaLab		5	0	2	0	0	0	0	3	5	0
REUF		0	0	0	0	0	0	0	0	0	0
Fall Semester '13	Semester Program	2	1	1	0	0	1	0	1	2	0
	Workshop 1	26	3	13	0	0	1	0	13	10	16
	Workshop 2	22	3	14	0	0	2	0	17	18	4
	Workshop 3	23	3	12	0	0	0	0	9	13	10
	Total	73	10	40	0	0	4	0	40	43	30
	% of # Reporting		25%		0%	0%	1%	0%		10%	7%
Spring Semester '14	Semester Program	7	0	1	0	0	1	0	1	7	0
	Workshop 1	24	0	9	0	0	3	0	9	17	7
	Workshop 2	25	1	10	0	0	0	0	8	13	12
	Workshop 3	21	1	2	0	0	1	0	1	17	4
	Workshop 4	24	1	3	0	0	0	0	3	24	0
	Research Cluster 1	0	0	0	0	0	0	0	0	0	0
	Research Cluster 2	0	0	0	0	0	0	0	0	0	0
	Research Cluster 3	0	0	0	0	0	0	0	0	0	0
	Total	101	3	25	0	0	5	0	22	78	23
	% of # Reporting		12%		0%	0%	2%	0%		16%	5%
Topical	6/3/13 Workshop	24	5	21	0	0	8	0	20	16	8
	1/20/14 Workshop	36	1	3	0	0	1	0	3	31	5
	3/17/14 Workshop	17	2	4	0	0	0	0	2	14	3
	5/12/14 Workshop	25	1	7	0	0	2	1	6	16	9
	Total	102	9	35	0	0	11	1	31	77	25
	% of # Reporting		26%		0%	0%	10%	1%		39%	13%

ICERM Funded Postdocs

	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
					Gender and Ethnicity					Geographical Point of Origin									
	Summer@ICERM 2013	2	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
	IdeaLab	14	2	14	0	0	3	0	12	0	5	4	2	0	0	2	1	0	0
	REUF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fall Semester '13	Semester Program	12	3	8	0	0	1	1	8	3	3	0	0	1	0	0	4	0	1
	Workshop 1	14	3	10	0	0	4	1	9	3	3	2	1	0	2	0	3	0	0
	Workshop 2	16	5	12	0	0	2	1	11	3	4	1	1	0	1	1	4	0	1
	Workshop 3	22	6	18	0	0	3	2	15	7	4	1	1	0	2	1	6	0	0
	Total	64	17	48	0	0	10	5	43	16	14	4	3	1	5	2	17	0	2
	% of # Reporting		35%		0%	0%	5%	3%		6%	5%	1%	1%	0%	2%	1%	6%	0%	1%
Spring Semester '14	Semester Program	9	2	7	0	0	0	0	7	1	2	0	5	0	1	0	0	0	0
	Workshop 1	13	2	11	0	0	1	0	11	1	7	0	4	0	1	0	0	0	0
	Workshop 2	6	2	4	0	0	0	0	4	0	2	1	1	0	1	1	0	0	0
	Workshop 3	7	1	5	0	0	1	0	5	1	3	0	0	0	1	0	1	0	0
	Workshop 4	6	1	3	0	0	1	0	3	1	3	1	0	0	1	0	0	0	0
	Research Cluster 1	5	1	2	0	0	0	0	5	0	0	0	5	0	0	0	0	0	0
	Research Cluster 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Research Cluster 3	2	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0
	Total	48	9	33	0	0	3	0	36	5	17	2	15	0	6	1	1	0	0
	% of # Reporting		27%		0%	0%	2%	0%		1%	5%	1%	4%	0%	2%	0%	0%	0%	0%
Topical	6/3/13 Workshop	4	0	4	0	0	0	0	3	3	0	1	0	0	0	0	0	0	0
	1/20/14 Workshop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3/17/14 Workshop	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	5/12/14 Workshop	2	0	2	0	0	2	0	2	0	1	1	0	0	0	0	0	0	0
	Total	7	0	6	0	0	2	0	5	3	2	2	0	0	0	0	0	0	0
	% of # Reporting		0%		0%	0%	4%	0%		2%	1%	1%	0%	0%	0%	0%	0%	0%	0%

All Postdocs (ICERM funded and Non-ICERM funded)

	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
					Gender and Ethnicity					Geographical Point of Origin	
	Summer@ICERM 2013	2	1	1	0	0	0	0	1	2	0
	IdeaLab	15	2	14	0	0	3	0	12	12	3
	REUF	0	0	0	0	0	0	0	0	0	0
Fall Semester '13	Semester Program	17	5	13	0	0	2	1	13	9	8
	Workshop 1	19	5	15	0	0	6	1	14	12	7
	Workshop 2	22	8	18	0	0	5	1	17	13	9
	Workshop 3	28	9	24	0	0	4	2	21	18	10
	Total	86	27	70	0	0	17	5	65	52	34
	% of # Reporting		39%		0%	0%	6%	2%		12%	8%
Spring Semester '14	Semester Program	9	2	7	0	0	0	0	7	8	1
	Workshop 1	13	2	11	0	0	1	0	11	12	1
	Workshop 2	8	2	6	0	0	0	0	5	5	3
	Workshop 3	12	3	10	0	0	2	0	10	9	3
	Workshop 4	10	1	7	0	0	3	0	7	9	1
	Research Cluster 1	5	1	2	0	0	0	0	5	5	0
	Research Cluster 2	0	0	0	0	0	0	0	0	0	0
	Research Cluster 3	3	0	1	0	0	0	0	1	2	1
	Total	60	11	44	0	0	6	0	46	50	10
	% of # Reporting		25%		0%	0%	2%	0%		10%	2%
Topical	6/3/13 Workshop	4	0	4	0	0	0	0	3	4	0
	1/20/14 Workshop	10	2	10	0	0	4	1	9	6	4
	3/17/14 Workshop	1	0	0	0	0	0	0	0	1	0
	5/12/14 Workshop	8	1	6	0	0	6	0	6	8	0
	Total	23	3	20	0	0	10	1	18	19	4
	% of # Reporting		15%		0%	0%	9%	1%		10%	2%

ICERM Funded Graduate Students

	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
					Gender and Ethnicity					Geographical Point of Origin									
	Summer@ICERM 2013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	IdeaLab	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0
	REUF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fall Semester '13	Semester Program	14	4	13	0	0	4	0	13	2	4	0	1	0	2	0	4	0	1
	Workshop 1	17	5	16	0	0	6	0	16	2	4	1	1	0	3	0	5	0	1
	Workshop 2	14	3	13	0	0	5	0	13	2	6	0	1	0	2	0	2	0	1
	Workshop 3	13	3	12	0	0	3	0	12	4	4	0	1	0	1	0	2	0	1
	Total	58	15	54	0	0	18	0	54	10	18	1	4	0	8	0	13	0	4
	% of # Reporting		28%		0%	0%	9%	0%		4%	6%	0%	1%	0%	3%	0%	5%	0%	1%
Spring Semester '14	Semester Program	14	3	13	0	0	2	1	12	0	7	2	3	0	0	0	2	0	0
	Workshop 1	17	5	16	0	0	4	1	13	0	9	2	4	0	0	0	2	0	0
	Workshop 2	10	3	10	0	0	2	0	9	1	3	0	2	0	1	3	0	0	0
	Workshop 3	8	3	8	1	0	2	0	8	1	2	0	1	0	0	0	4	0	0
	Workshop 4	4	0	4	0	0	0	0	3	0	3	0	0	0	0	0	1	0	0
	Research Cluster 1	7	2	7	0	0	1	1	6	0	3	1	3	0	0	0	0	0	0
	Research Cluster 2	2	1	2	0	0	1	0	2	0	0	0	0	0	0	0	2	0	0
	Research Cluster 3	4	0	3	0	0	1	0	3	0	2	2	0	0	0	0	0	0	0
	Total	66	17	63	1	0	13	3	56	2	29	7	13	0	1	3	11	0	0
	% of # Reporting		27%		1%	0%	8%	2%		1%	9%	2%	4%	0%	0%	1%	3%	0%	0%
Topical	6/3/13 Workshop	5	1	4	0	0	2	0	4	0	1	1	1	0	0	0	2	0	0
	1/20/14 Workshop	6	1	6	0	0	2	1	6	2	3	0	0	0	0	0	1	0	0
	3/17/14 Workshop	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5/12/14 Workshop	3	1	2	0	0	2	0	2	0	3	0	0	0	0	0	0	0	0
	Total	14	3	12	0	0	6	1	12	2	7	1	1	0	0	0	3	0	0
	% of # Reporting		25%		0%	0%	11%	2%		1%	5%	1%	1%	0%	0%	0%	2%	0%	0%

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

	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
					Gender and Ethnicity					**Geographical Point of Origin**	
	Summer@ICERM 2013	0	0	0	0	0	0	0	0	0	0
	IdeaLab	2	1	2	0	1	0	0	2	2	0
	REUF	0	0	0	0	0	0	0	0	0	0
Fall Semester '13	Semester Program	18	4	17	0	0	5	0	15	8	10
	Workshop 1	32	9	31	0	0	10	1	27	15	17
	Workshop 2	27	3	26	0	0	8	2	24	18	9
	Workshop 3	33	7	31	0	0	6	0	28	19	14
	Total	110	23	105	0	0	29	3	94	60	50
	% of # Reporting		22%		0%	0%	10%	1%		14%	12%
Spring Semester '14	Semester Program	20	4	18	0	0	2	1	17	17	3
	Workshop 1	30	9	27	0	0	6	1	23	26	4
	Workshop 2	20	4	17	0	0	3	0	15	15	5
	Workshop 3	25	4	22	1	0	7	0	21	20	5
	Workshop 4	11	0	10	0	0	0	0	9	10	1
	Research Cluster 1	7	2	7	0	0	1	1	6	7	0
	Research Cluster 2	2	1	2	0	0	1	0	2	0	2
	Research Cluster 3	6	0	4	0	0	1	0	4	6	0
	Total	121	24	107	1	0	21	3	97	101	20
	% of # Reporting		22%		0%	0%	8%	1%		21%	4%
Topical	6/3/13 Workshop	7	1	6	0	0	3	0	6	5	2
	1/20/14 Workshop	11	5	11	0	0	3	1	11	9	2
	3/17/14 Workshop	0	0	0	0	0	0	0	0	0	0
	5/12/14 Workshop	10	3	9	0	0	4	1	9	7	3
	Total	28	9	26	0	0	10	2	26	21	7
	% of # Reporting		35%		0%	0%	9%	2%		11%	4%

15

ICERM Funded VI-MSS Attendees - Data below indicates ICERM funded participants who traveled to India for research and workshops.

Program Type	Total Participants	Gender and Ethnicity							Geographical Point of Origin									
		Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	US - West	Africa	Asia	Canada	Europe	Latin & South America	Oceania
Fall Semester '13	20	2	12	0	0	2	1	8	0	9	2	5	0	4	0	0	0	0
% of # Reporting		17%		0%	0%	25%	13%	8	0%	45%	10%	25%	0%	20%	0%	0%	0%	0%
Spring Semester '14	5	0	2	0	0	2	0	2	1	3	0	0	0	1	0	0	0	0
% of # Reporting		0%		0%	0%	100%	0%		20%	60%	0%	0%	0%	20%	0%	0%	0%	0%

During this time, 3 graduate students were sent to ICERM from India's Department of Science and Technology to participate in the Fall Semester program 2013.

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 not included.
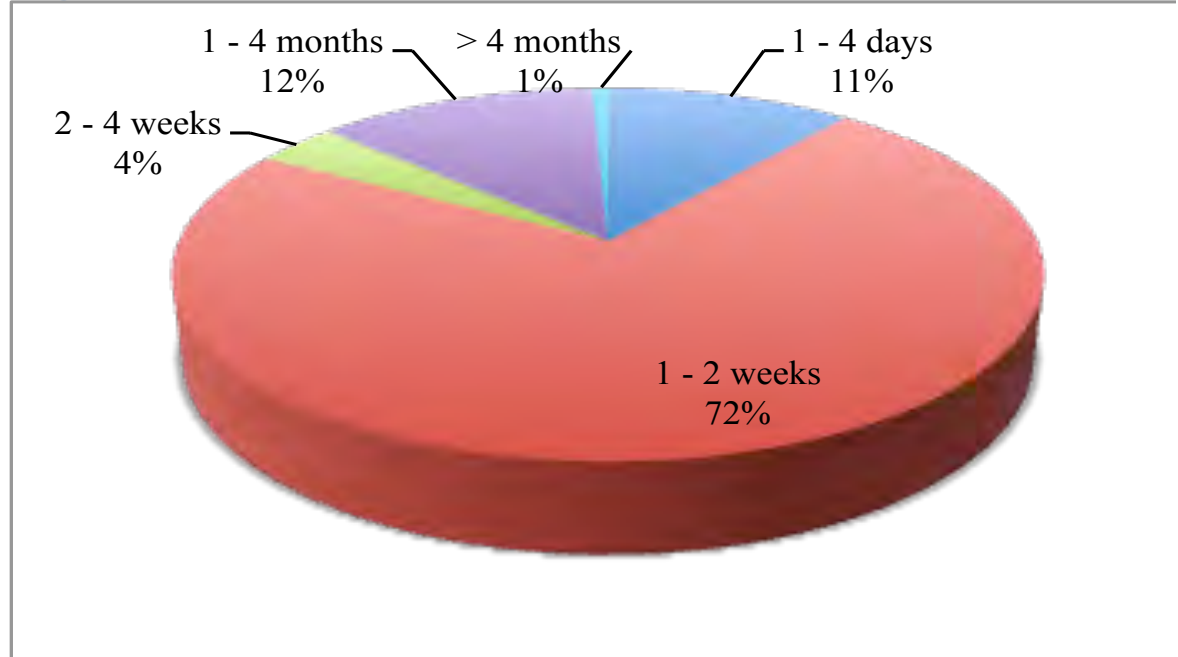
Length of Visits

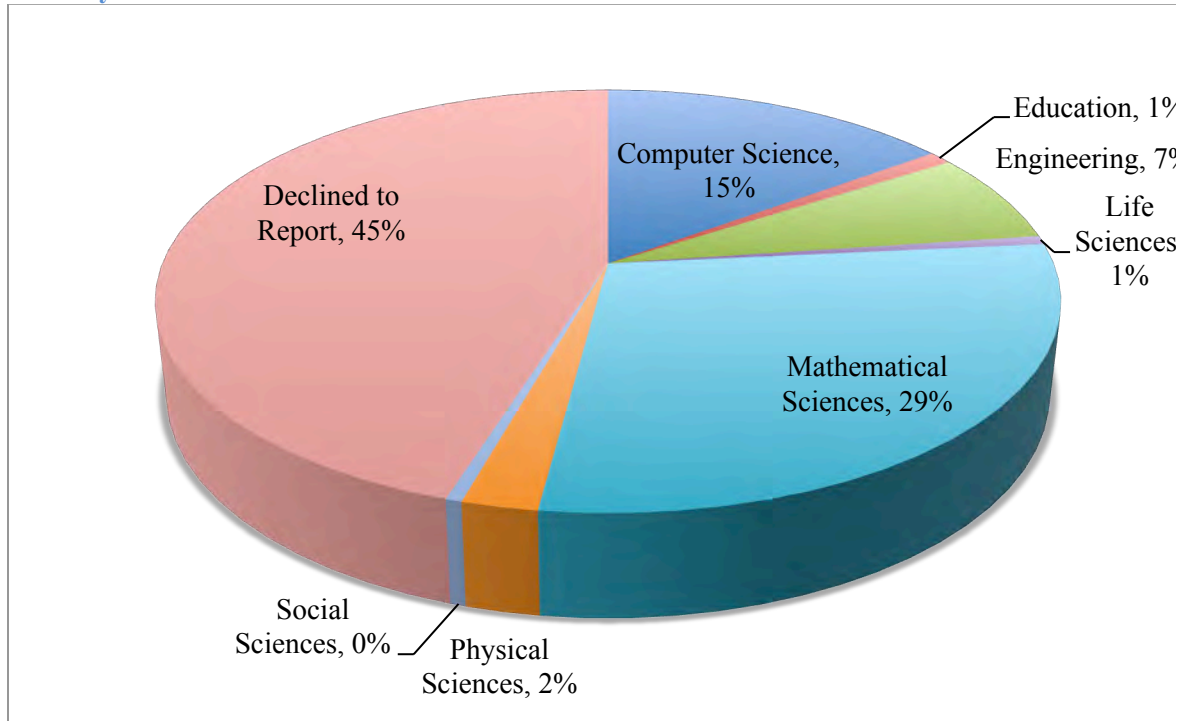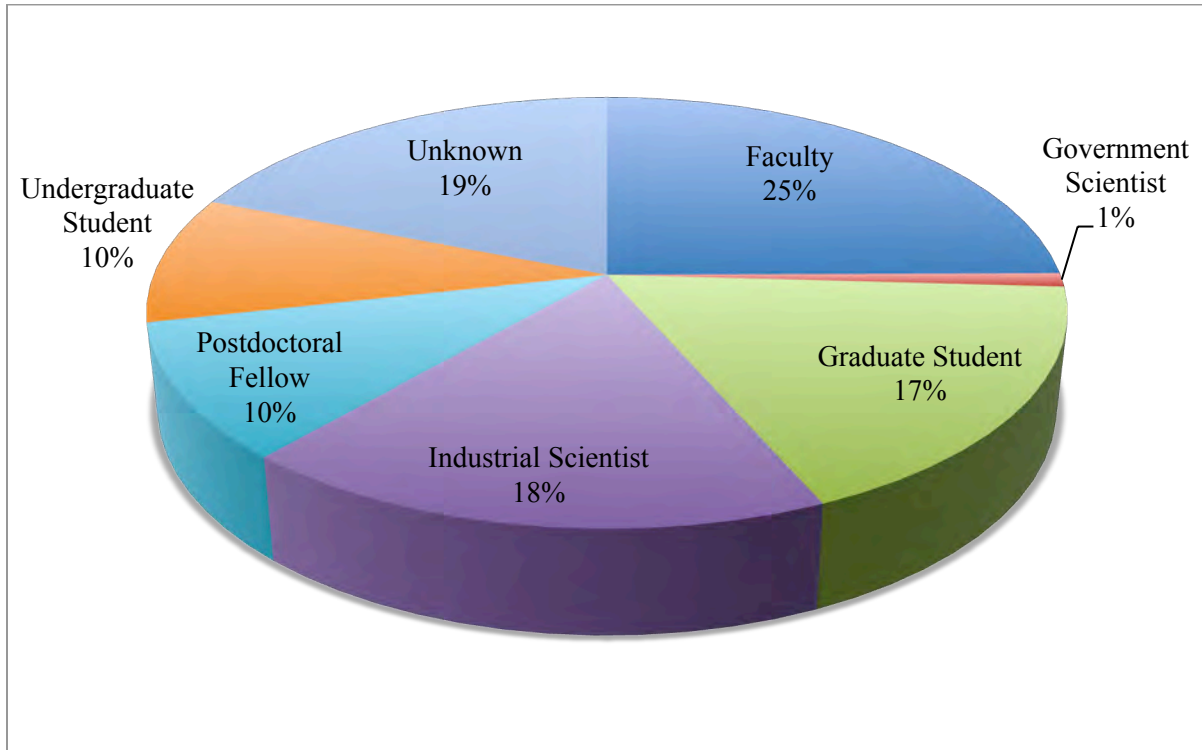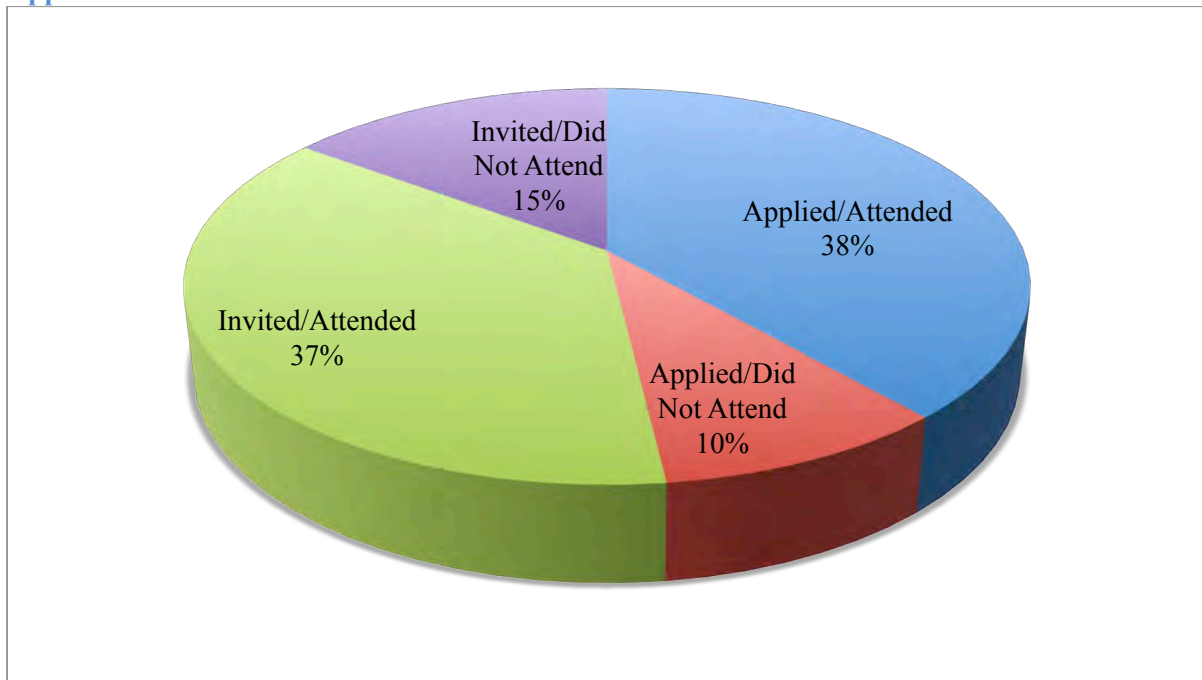
Figure 1

Primary Field of Interest

Figure 2

Academic Breakdown

Figure 3

Applied Attendees VS Invited Attendees

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

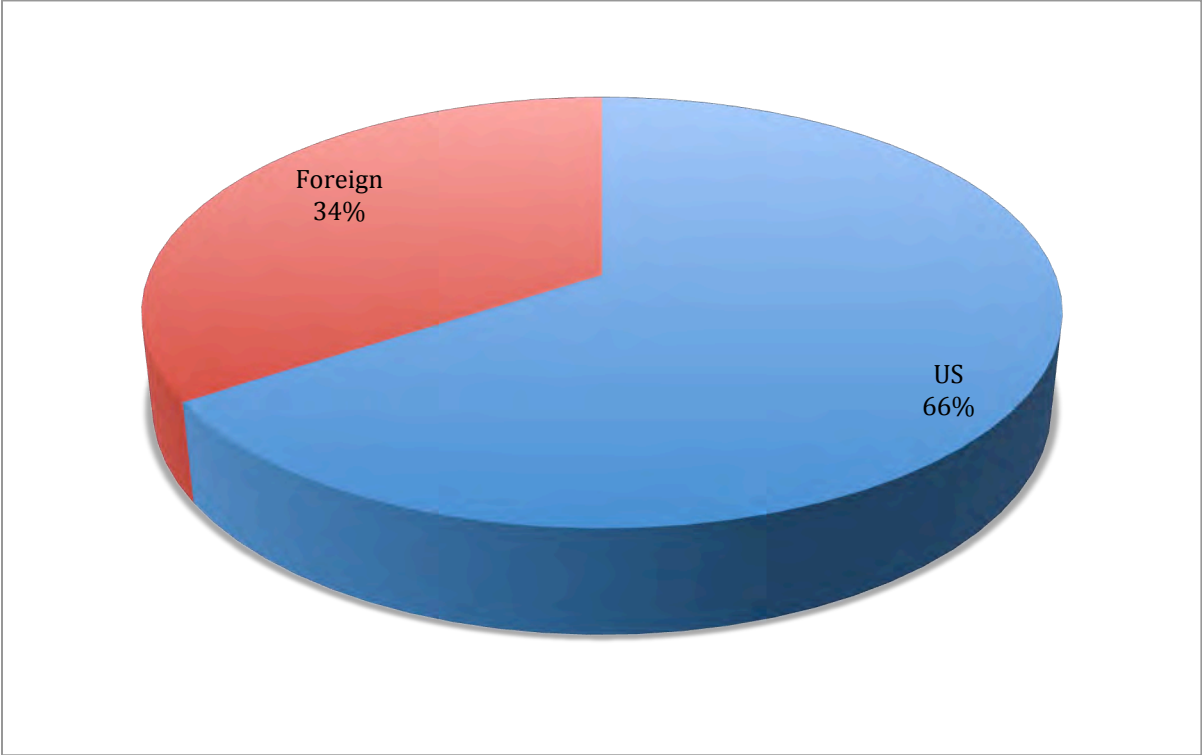**All Semester Attendees US Based VS Foreign Based**

Foreign
34%

US
66%

Figure 5

All Semester Program Workshop Attendees US Based VS Foreign Based
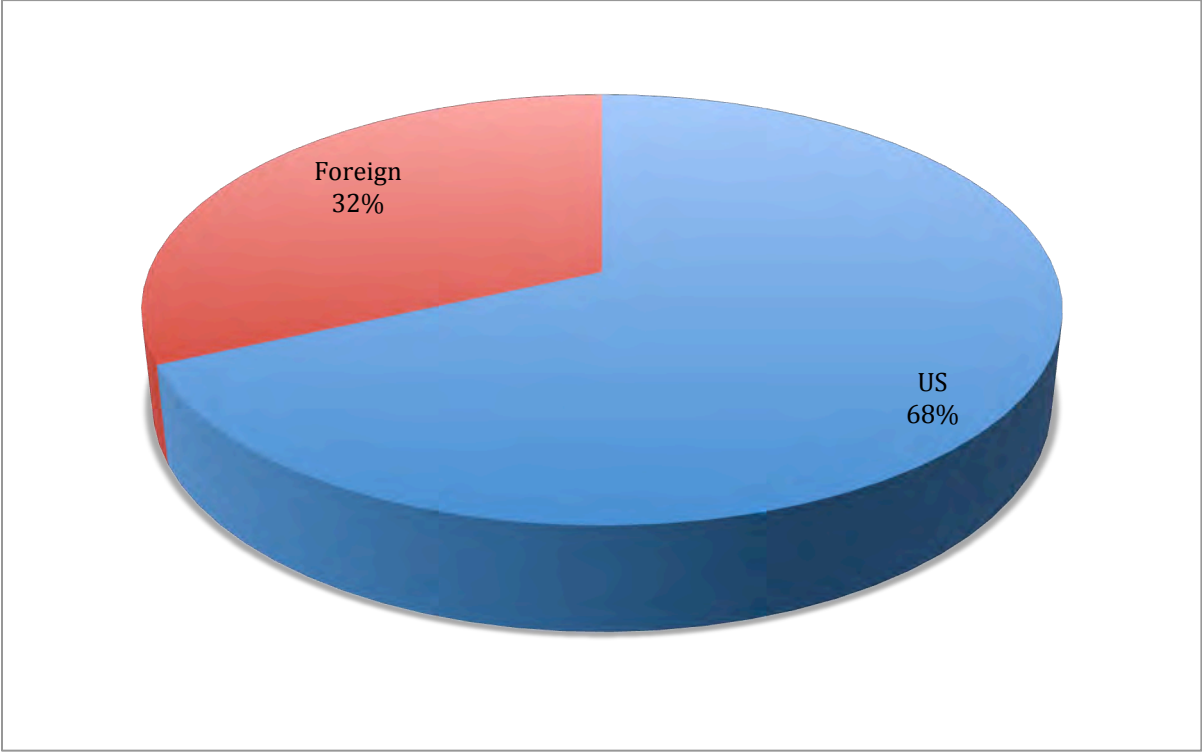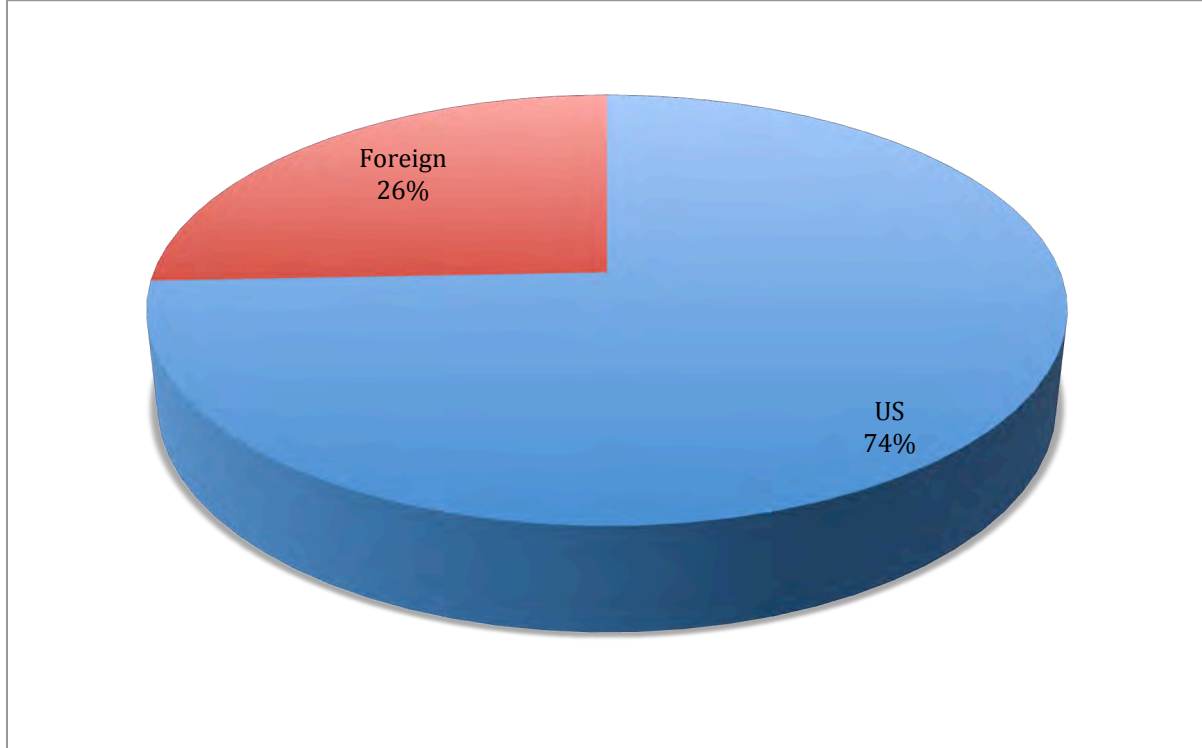
Foreign
32%

US
68%

Figure 6

All Topical Workshop Attendees US Based VS Foreign Based

Figure 7

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 2013 annual meeting and a subsequent conference call in June resulted in the selection of semester programs and topical workshops through Spring 2015. Gabor Szekely (NSF) was invited to the annual meeting, but was not able to attend.

The semester program selection process follows these steps:

1. Solicitation of Proposals
ICERM hosts two semester programs per year. Each has 5-10 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 Target Deadline

All pre-proposals should be submitted to the ICERM Director. Target deadlines are early September and mid-April. 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.

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 5-10), 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 should be submitted to the ICERM Director. Target deadlines are November 1st and May 15th. The ICERM directors and the Scientific Advisory Board (SAB) review all proposals. Proposers receive feedback within a few weeks of their submission.

2. Proposal Selection

The Science Advisory Board (SAB) approves the semester programs. The deadline for proposals is at least a week prior to the annual November SAB meeting (typically the end of the month). Proposals are usually 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 for applicants to the program.

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 Directors make the final decision on all invitations. `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 20-25 possible speakers and a list of 10 alternates. 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 the institute's Application database. The ICERM postdoctoral fellow applicants who were not hired 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 5 semester postdoctoral fellows and support for travel and shared housing for 12-15 graduate students per program. There is support for housing and travel for around 15-20 long-term visitors (including organizers) who stay for 4 months, and up to 60 additional shorter term visitors who stay for 1-4 weeks. In addition, there is support for workshop attendees. The institute has very limited funds for stipends and buyout of teaching for key participants. Some funds are reserved for support for applicants to the program. 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

Lasts about 1-2 days, beginning on first day of program and includes:
- 10-15 minute introductory presentations by the postdocs and grad students, designed to get everyone acquainted
- Opening reception on first day of program
- Talks related to upcoming workshops
- IT tutorial (led by ICERM's IT staff)

Weekly Seminar (non workshop weeks)
- The weekly seminar includes talks by visitors in residence at ICERM. Program organizers are provided with names and dates to facilitate scheduling.

Mini-Series (Optional)
- Mini-courses or other multi-session events are encouraged.

Research Clusters (Optional)

A Research Cluster takes place during a semester program and is an independently organized research group activity in a focused subfield of that semester program.

A typical Research Cluster lasts at least 10 days, and as long as 4-6 weeks, and focuses on immediate progress on a major problem or on several problems of significance in the field of the program. In addition to the invited participants, interested faculty, postdocs or graduate students in residence at ICERM may participate in the research cluster.

The activity period begins with a collection of tutorials or a short (possibly two day) workshop. The research activities, planned by the organizer(s), may consist of teamwork, daily/weekly seminars, and closing presentations. In collaboration with an ICERM director, Research Cluster organizer(s) develop a list of 6-15 key scientists to form the core cohort of the cluster.

Prior to each of semester workshops
- Full-day tutorials the Thursday and Friday the week before each workshop.
- Tutorials are given by long term visitors to the program

Note: Sample schedules 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

During the first week of the program a 1 to 3 day closing event is planned with input from the organizing committee. Some possible models include:
- 3 days of short talks from all long term visitors who are still in residence
- Special Colloquium to close out the event on the last day of the program
- Time set aside for takeaways
- Closing reception

2013-2014 Semester Programs

Fall Semester 2013: Low-dimensional Topology, Geometry, and Dynamics

September 9, 2013 - December 6, 2013

Organizing Committee

Marc Culler, University of Illinois, Chicago
Nathan Dunfield, University of Illinois, Urbana-Champaign
Walter Neumann, Barnard College, Columbia University
Richard Schwartz, Brown University
Caroline Series, University of Warwick
Dylan Thurston, Indiana University
Genevieve Walsh, Tufts University
Anton Zorich, IMJ, University of Paris-7

Program Description

The program focuses on the recent impact of computation and experiment on the study of the pure mathematics sides of topology, geometry, and dynamics. Specific areas include 3-dimensional topology, the study of locally symmetric spaces, low-dimensional dynamics, and geometric group theory. Included are areas where computation has not yet had an impact, but might do so in the near future.

Workshop 1: Exotic Geometric Structures

September 16-20, 2013
Number of Participants: 113

Organizing Committee

Richard Schwartz, Brown University
Bill Goldman, University of Maryland
John Parker, University of Durham
Caroline Series, Warwick University
Genevieve Walsh, Tufts University

Speakers

Thierry Barbot, Université d'Avignon
Yves Benoist, Université de Paris XI (Paris-Sud)
Martin Bridgeman, Boston College

Marc Burger, Swiss Federal Institute of Technology
Virginie Charette, University of Sherbrooke
Daryl Cooper, University of California, Santa Barbara
Jeffrey Danciger, University of Texas at Austin
Martin Deraux, Université de Grenoble I (Joseph Fourier)
David Dumas, University of Illinois
Olivier Guichard, Université de Strasbourg I (Louis Pasteur)
Alessandra Iozzi, ETH
Fanny Kassel, Université de Lille I (Sciences et Techniques de Lille Flandres Artois)
Ruth Kellerhals, Université de Fribourg
Steve Kerckhoff, Stanford University
Francois Labourie, Université de Paris XI (Paris-Sud)
Darren Long, University of California, Santa Barbara
Ludovic Marquis, Université de Rennes I
Curtis McMullen, Harvard University
Yair Minsky, Yale University
Frederic Palesi, Aix-Marseille University
Julien Paupert, Arizona State University
Jose Seade, National Autonomous University of Mexico (UNAM)
Ser Peow Tan, National University of Singapore
Pierre Will, Université de Grenoble I (Joseph Fourier)
Michael Wolf, Rice University
Maxime Wolff, Université de Paris VI (Pierre et Marie Curie)

Workshop Description
This workshop will focus on recent advances in the study of geometric structures and their associated group representations. As well as featuring hyperbolic structures, the workshop will also consider more exotic structures, such as projective structures, complex hyperbolic and spherical CR-structures and locally homogeneous space-times. A related focus includes aspects of coarse or non-positively curved geometry such as Gromov hyperbolic spaces and CAT(0) complexes. We will explore the interaction between experimental evidence and rigorous proof.

Some Workshop Organizer Comments for "Briefly describe workshop highlights":
"This was a very fruitful workshop. There were many people gathered from a variety of related fields. The talks were great, in the main. It helps to gain an overview of current research in a number of parallel areas with common underlying themes."

"I thought that the talks were generally excellent and the speakers and participants were of a very high caliber. The conference was sort of like a who's-who in geometric structures."

Some Workshop Participant Comments for "Briefly describe workshop highlights":
"There were a couple of especially nice talks and helpful discussions. The atmosphere has been very relaxed, and I haven't felt awkward about not knowing many people, which can often be a problem at conferences. Having a mentor is helpful in that regard also. The different groups seem to mix well."

"Meeting my colleagues from the US and Europe, all together. Very creative atmosphere. Intense scientific communication, new collaborators found."

"I got some very interesting new perspectives from this workshop. There were several talks which were highlights for me, among them definitely the relation between cubic differentials and hyperbolic convex sets of Yves Benoist. I further did not know much about spacetimes before and found the sequence of talks

very interesting, especially the relation to arc-complex. I thought it was a good and charming idea to have sequences of talks from coauthors, so that they could build up their topic over several talks."

"The ability and ease of casual math conversations. I talked to D. about projective geometry, I talked to S. about 3D printing, J. cleared up my confusion about the boundary of complex hyperbolic space, etc. The talks were good and indicated the direction the field was heading."

Workshop 2: Topology, Geometry and Group Theory, Informed by Experiment
October 21-25, 2013
Number of Participants: 114

Organizing Committee
Danny Calegari, Cambridge University
Marc Culler, University of Illinois, Chicago
David Gabai, Princeton University
Joel Hass, UC Davis
Robert Lipshitz, Columbia University
Karen Vogtmann, Cornell University
Genevieve Walsh, Tufts University

Speakers
Ian Agol, University of California, Berkeley
Joshua Batson, Massachusetts Institute of Technology
Benjamin Burton, University of Queensland
Danny Calegari, University of Chicago
Ruth Charney, Brandeis University
Nathan Dunfield, University of Illinois at Urbana-Champaign
Mark Feighn, Rutgers University
Matthias Gorner, University of Maryland
Daniel Groves, University of Illinois
Matthew Hedden, Michigan State University
Jennifer Hom, Columbia University
Jason Manning, University at Buffalo (SUNY)
Robert Meyerhoff, Boston College
Luisa Paoluzzi, Aix-Marseille University
Jessica Purcell, Brigham Young University
Alan Reid, University of Texas at Austin
Sucharit Sarkar, Princeton University
Saul Schleimer, University of Warwick
Dylan Thurston, Indiana University
Nathaniel Thurston, Google Inc.
Stephan Tillmann, University of Sydney
Alden Walker, University of Chicago

Workshop Description
The mathematical focus of this workshop will include all aspects of the topology and geometry of low-dimensional manifolds and geometric group theory. It has been understood for over a century that these subjects are tightly connected, but the connections have become even deeper as the subjects have matured. Recent advances have given dramatic evidence of this. The workshop aims to further extend the interplay between these subjects.

Algorithms have been an important and consistent feature of all of these mathematical areas from the beginning. This includes both questions about the existence of algorithms and the development of practical algorithms for computing natural invariants. More recently, computer experiments and rigorous computer-assisted proofs have had a significant impact. It is natural to expect experimental and computational methods to play an expanding role in the theory of low dimensional spaces. Additional goals of the workshop are to explore the development of new computational tools and implementations of new algorithms, and to provide opportunities for researchers to become more familiar with existing tools and how they can be applied in research.

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 for "Briefly describe workshop highlights":
"There were several [highlights]. One was the degree to which we were able to encourage communication between the three related, but relatively isolated areas of geometric group theory, 3-manifolds and Floer theory. Another was the live computer demonstration. A third highlight was that we were able to create an ambience in which computer experiment was accepted as a legitimate part of mathematical research. Those who don't do it gave some thought to how it might be beneficial. Those who do were allowed to discuss it in public as a legitimate component of their research. I think this represents a noticeable cultural shift."

"Many excellent discussions, including a great discussion over dinner about showing that knot genus is in co-NP. Many wonderful talks, for instance the presentation by Ben Burton"

Some Workshop Participant Comments for "Briefly describe workshop highlights":
"The highlight for me was how problems seemingly from a continuous setting can be effectively discretized, and then be solved via computers. There is a genuine overlap between pure mathematics and techniques from computer science."

"Very good talks. I particularly enjoyed the Wednesday afternoon session which people presented various computational computer packages. Some of these I'd heard of before, but most of them were completely new to me. I was overall VERY impressed by the capabilities of these programs and am now inspired to start using them to do computations and experiments."

"I am more a foliation geometer than 3-dimensional (experimental) geometer/topologist but I was very impressed by the scientific and technological level of aspect presented during the workshop. Now I am sure that the tiny bridge between these topics would (and should) be more wider."

"This workshop was somewhat outside my field, but the questions people asked me following my talk have already led me to some new ideas and a possible new collaboration. Bringing together a non-standard group of people along some common theme is a great idea. I very much appreciated that this conference was both focused on a specific topic, but at the same time very broad in its scope, which allowed me to see many different subjects viewed through a computational lens."

Workshop 3: Geometric Structures in Low-Dimensional Dynamics
November 18, 2013 - 22, 2013
Number of Participants: 111

Organizing Committee

Moon Duchin, Tufts University
Pascal Hubert, l'Université Paul Cézanne
Richard Schwartz, Brown University
Howard Masur, University of Chicago
Anton Zorich, IMJ, University Paris-7

Speakers
Matthew Bainbridge, Indiana University
Jon Chaika, University of Chicago
Diana Davis, Northwestern University
Vincent Delecroix, Université de Paris VII (Denis Diderot)
Alex Eskin, University of Chicago
Simion Filip, University of Chicago
Giovanni Forni, University of Maryland
Ursula Hamenstaedt, Rheinische Friedrich-Wilhelms-Universität Bonn
Sa'ar Hersonsky, University of Georgia
Patrick Hooper , City College, CUNY
Erwan Lanneau, Université de Grenoble I (Joseph Fourier)
John Lowenstein, New York University
Carlos Matheus Silva Santos, Université de Paris XIII (Paris-Nord)
Curtis McMullen, Harvard University
Martin Möller, Johann Wolfgang Goethe-Universität Frankfurt
Kasra Rafi, University of Toronto
Martin Schmoll, Clemson University
Richard Schwartz, Brown University
Giulio Tiozzo, Harvard University
Corinna Ulcigrai, University of Bristol
Franco Vivaldi, University of London
Barak Weiss, Tel Aviv University
Gabriella Weitze-Schmithuesen, Karlsruhe Institute of Technology
Alexander Wright, University of Chicago

Workshop Description
This workshop will present topics in low-dimensional dynamics such as billiards, flows on flat surfaces, dynamics on moduli spaces, and piecewise isometric maps. One theme in the workshop will be the appearance of geometric structures such as hyperbolic space and Teichmüller space in connection with dynamical systems which are basically defined in terms of the Euclidean plane. Computer experiments are common in these areas, and will be discussed, but the emphasis will be on the mathematics that comes out of the experiments.

Some Workshop Organizer Comments for "Briefly describe workshop highlights":
"I finally met people whose papers I had been reading for years, like H. Masur, A. Eskin and M. Möller. It was a great experience to be able to speak to them in person. I also got to know some of my younger colleagues and they made me aware that I have to finish certain calculations whose results would be very useful to them."

"1. Touching base with seldom seen colleagues 2. Extended conversations with young talent 3. Networking (for our postdoc positions, e.g.) 4. Several outstanding lectures. I love this place; 3rd time back..."

Some Workshop Participant Comments for "Briefly describe workshop highlights":

"I've had great opportunities to learn many different areas which I didn't know before I had come here. These experiences will influence my future research direction."

"Learnt about applications of algebraic geometry to dynamical systems; about computational methods in algebraic geometry; both are relevant to my research."

"Networking; several international collaborators were present, and I had the rare opportunity to be in the same physical location as them."

All Visitors to Fall 2013 Semester Program
Gray highlight represents anyone staying over 9 days

Name	Organization	Time Spent at ICERM (days)
Acosta, Miguel Camilo	Institut Mathématique de Jussieu	7
Adeboye, Ilesanmi	Wesleyan University	6
Agol, Ian	University of California, Berkeley	5
Artigiani, Mauro	University of Bristol	6
Askaripour, Nadya	University of Cincinnati	6
Athreya, Jayadev Sidditanta	University of Illinois at Urbana-Champaign	7
Atkinson, Christopher K	University of Minnesota	7
Aulicino, David	University of Chicago	6
Avni, Nir	Northwestern University	6
Baba, Shinpei	California Institute of Technology	6
Baik, Hyungryul	Cornell University	7
Bainbridge, Matthew	Indiana University	5
Ballas, Samuel Aaron	University of California, Santa Barbara	6
Barbot, Thierry	Université d'Avignon	6
Batson, Joshua	Massachusetts Institute of Technology	1
Bedaride, Nicolas	Aix-Marseille University	6
Bell, Mark Christopher	University of Warwick	64
Benedetti, Bruno	Freie Universität Berlin	62
Benoist, Yves	Université de Paris XI (Paris-Sud)	6
Benson, Brian Allen	University of Illinois at Urbana-Champaign	89
Boissy, Corentin	Aix-Marseille University	7
Bowman, Joshua Paul	Smith College	5
Bradlow, Steven	University of Illinois at Urbana-Champaign	8
Bray, Sarah	Tufts University	3
Bridgeman, Martin	Boston College	59
Brock, Jeffrey	Institute for Computational and Experimental Research in Mathematics (ICERM)	89
Burelle, Jean-Philippe	University of Maryland	7
Burger, Marc	Swiss Federal Institute of Technology	5
Burton, Benjamin	University of Queensland	46

Calegari, Danny	University of Chicago	5
Canary, Richard Douglas	University of Michigan	3
Capogna, Luca	Worcester Polytechnic Institute	5
Carr, Michael Patrick	Brandeis University	5
Cashen, Christopher H.	University of Vienna	15
Chaika, Jon	University of Chicago	5
Charette, Virginie	University of Sherbrooke	6
Charney, Ruth	Brandeis University	5
Choi, Suhyoung	Korea Advanced Institute of Science and Technology (KAIST)	6
Church, Thomas	Stanford University	10
Clark, Aaron	Southern Connecticut State University	5
Clavier, Lucien Pierre, Odilon	Cornell University	93
Cooper, Daryl	University of California, Santa Barbara	9
Crane, Daniel William	University of Queensland	69
Culler, Marc	University of Illinois	106
Czarnecki, Maciej Andrzej	University of Łódź	7
Danciger, Jeffrey	University of Texas at Austin	6
Davis, Diana	Northwestern University	5
Delecroix, Vincent	Université de Paris VII (Denis Diderot)	37
Deraux, Martin	Université de Grenoble I (Joseph Fourier)	82
Dimos, Joseph Jacob	Dislocated/Independent Research	7
Disarlo, Valentina	Indiana University	7
Dowdall, Spencer Dale	University of Illinois at Urbana-Champaign	20
Drumm, Todd	Howard University	5
Duchin, Moon	Tufts University	89
Dumas, David	University of Illinois	103
Dunbar, William Dart	Bard College at Simons Rock	89
Dunfield, Nathan	University of Illinois at Urbana-Champaign	114
Durham, Matthew Gentry	University of Illinois	7
Duryev, Eduard	Harvard University	11
Dye, Heather Ann	McKendree University	5
Emme, Jordan Hugo	Aix-Marseille University	7
Eskin, Alex	University of Chicago	5
Feighn, Mark	Rutgers University	5
Fickenscher, Jon	Princeton University	6
Filip, Simion	University of Chicago	7
Forni, Giovanni	University of Maryland	5
Fortier Bourque, Maxime F	City University of New York (CUNY)	4
Fougeron, Charles	École Normale Supérieure	13
Francoeur, Dominik	University of Sherbrooke	6
Fu, Ser-Wei	University of Illinois at Urbana-Champaign	6

Futer, David	Temple University	61
Gabai, David	Princeton University	5
Gadre, Vaibhav Suresh	University of Warwick	6
García Tec, Mauricio Benjamín	National Autonomous University of Mexico (UNAM)	7
Gekhtman, Ilya	University of Chicago	10
Ghosh, Sourav	Université de Paris XI (Paris-Sud)	8
Gilman, Jane Piore	Rutgers University	42
Goldman, William Mark	University of Maryland	16
Görner, Matthias Rolf Dietrich	University of Maryland	5
Goujard, Elise	Université de Rennes I	13
Granier, Jordane	Université de Fribourg	40
Greene, Ryan	Ohio State University	122
Groves, Daniel	University of Illinois	5
Gudkov, Andrei	Roswell Park Cancer Institute	1
Guichard, Olivier	Université de Strasbourg I (Louis Pasteur)	6
Guillot, Adolfo	National Autonomous University of Mexico (UNAM)	8
Gultepe, Funda	University of Illinois at Urbana-Champaign	5
Guzman, Rosemary Kay	University of Iowa	90
Hamenstaedt, Ursula	Rheinische Friedrich-Wilhelms-Universität Bonn	5
Han, Jiyoung	Seoul National University	8
Haraway, Robert Cyrus	Boston College	5
Harrison, Michael	Pennsylvania State University	98
Hass, Joel	University of California, Davis	13
Hedden, Matthew	Michigan State University	5
Hersonsky, Sa'ar	University of Georgia	5
Hironaka, Eriko	Florida State University	41
Ho, Son Lam	University of Maryland	6
Hodgson, Craig David	University of Melbourne	13
Hoffman, Neil Reardon	University of Melbourne	17
Hom, Jennifer	Columbia University	5
Hooper, Patrick	City College, CUNY	89
Hu, Hengnan	National University of Singapore	50
Huang, Zheng	City University of New York (CUNY)	4
Hubert, Pascal	University Paul Cézanne	5
Hulin, Dominique	Université de Paris XI (Paris-Sud)	8
Hurtado, Sebastian	University of California, Berkeley	6
Iozzi, Alessandra	ETH	6
Irmer, Ingrid	National University of Singapore	89
Ivrii, Oleg	Harvard University	5
Jacquemet, Matthieu	Université de Fribourg	15

Jeon, BoGwang	University of Illinois at Urbana-Champaign	122
Johnson, Charles Christopher	Clemson University	7
Judge, Christopher	Indiana University	7
Kabaya, Yuichi	Osaka University	13
Kassel, Fanny	Université de Lille I (Sciences et Techniques de Lille Flandres Artois)	6
Kellerhals, Ruth	Université de Fribourg	12
Kent, Richard Peabody	University of Wisconsin	9
Kerckhoff, Steve	Stanford University	27
Kim, Joonhyung	Kon-Kuk University	9
Kim, Sang-hyun	Korea Advanced Institute of Science and Technology (KAIST)	84
Kim, Sungwoon	Korea Institute for Advanced Study (KIAS)	8
Kim, Youngju	Korea Institute for Advanced Study (KIAS)	8
Kin, Eiko	Osaka University	7
Knapp, Adam C	American University	5
Ko, Kihyoung	Korea Advanced Institute of Science and Technology (KAIST)	10
Kolpakov, Alexander	Vanderbilt University	8
Kutluhan, Cagatay	University at Buffalo (SUNY)	2
Labourie, Francois	Université de Paris XI (Paris-Sud)	6
Lanneau, Erwan	Université de Grenoble I (Joseph Fourier)	5
Laun, Greg David	University of Maryland	6
Lecuire, Cyril	Université de Toulouse III (Paul Sabatier)	42
Lee, Gye-Seon	Université de Paris XI (Paris-Sud)	8
Leitner, Arielle Mira	University of California, Santa Barbara	93
Li, Qiongling	Rice University	8
Lindsey, Kathryn	Cornell University	89
Lipshitz, Robert	Columbia University	6
Long, Darren	University of California, Santa Barbara	6
Louwsma, Joel Ryan	University of Oklahoma	7
Lowenstein, John	New York University	5
Maloni, Sara	Brown University	89
Mangahas, Johanna	Brown University	79
Manning, Jason	University at Buffalo (SUNY)	5
Marchese, Luca	Université de Paris XIII (Paris-Nord)	8
Marquis, Ludovic	Université de Rennes I	6
Martin, Gaven	Massey University	55
Martinez Pedroza, Eduardo	Memorial University of Newfoundland	6
Masai, Hidetoshi	Tokyo Institute of Technology	72
Masur, Howard	University of Chicago	5
Matheus Silva Santos, Carlos	Université de Paris XIII (Paris-Nord)	5

McMullen, Curtis	Harvard University	11
Melnick, Karin H	University of Maryland	5
Méndez, Mayra	National Autonomous University of Mexico (UNAM)	8
Merenkov, Sergiy	University of Illinois at Urbana-Champaign	12
Meyerhoff, Robert	Boston College	5
Minervino, Milton	Montanuniversität	15
Minsky, Yair	Yale University	6
Mitra, Mahan	Ramakrishna Mission Vivekananda College	21
Möller, Martin	Johann Wolfgang Goethe-Universität Frankfurt	5
Mondello, Gabriele	Università di Roma "La Sapienza"	8
Monin, Leonid	University of Toronto	9
Mukamel, Ronen	University of Chicago	3
Neumann, Walter	Barnard College	4
Niemeyer, Robert Garrett	University of New Mexico	15
Norton, Chaya	Stony Brook University	4
Palesi, Frederic	Aix-Marseille University	6
Paoluzzi, Luisa	Aix-Marseille University	71
Parker, John	University of Durham	90
Parlier, Hugo	Université de Fribourg	6
Paupert, Julien	Arizona State University	12
Pfaff, Catherine	Université d'Aix-Marseille I (Université de Provence)	14
Pilgrim, Kevin	Indiana University	5
Pinsky, Tali	University of British Columbia	6
Pratoussevitch, Anna	University of Liverpool	10
Purcell, Jessica	Brigham Young University	6
Pushkar, Petr	Columbia University	5
Qing, Yulan	Tufts University	7
Quinn, Joseph Anthony	City University of New York (CUNY)	3
Racz, Bela Andras	Princeton University	5
Rafalski, Shawn	Fairfield University	5
Rafi, Kasra	University of Toronto	5
Ralston, David	College at Old Westbury, SUNY	5
Randecker, Anja Silke	Karlsruhe Institute of Technology (KIT)	88
Reeve-Black, Heather	Queen Mary, University of London	7
Reid, Alan	University of Texas at Austin	5
Rios-Zertuche, Rodolfo	Princeton University	122
Rivin, Igor	Temple University	255
Ruane, Kim	Tufts University	2
Sakuma, Makoto	Hiroshima University	20
Salem, Eliane	Université de Paris VI (Pierre et Marie Curie)	5

Sanki, Bidyut	Indian Institute of Science	92
Sapir, Jenya	Stanford University	7
Sarkar, Sucharit	Princeton University	5
Schleimer, Saul	University of Warwick	95
Schmidt, Thomas A	Oregon State University	5
Schmoll, Martin	Clemson University	5
Schwartz, Richard	Brown University	89
Seade, Jose	National Autonomous University of Mexico (UNAM)	6
Sengun, Mehmet Haluk	University of Warwick	43
Seppi, Andrea	Università di Pavia	8
Singh, Nitin	Indian Institute of Science	94
Smillie, John	Cornell University	89
Soloviev, Fedor L	Fields Institute	7
Stoltzfus, Neal	Louisiana State University	5
Stover, Matthew	Temple University	5
Strenner, Balazs	University of Wisconsin	5
Sun, Chunyi	University of Oklahoma	5
Suzuki, Masaaki	Meiji University	7
Tabachnikov, Sergei	Institute for Computational and Experimental Research in Mathematics (ICERM)	89
Tan, Ser Peow	National University of Singapore	30
Tang, Robert	University of Warwick	91
Tao, Jing	University of Oklahoma	5
Tholozan, Nicolas Olivier	University of Nice-Sophia Antipolis	9
Thompson, Abigail	UC Davis	6
Thomson, Scott Andrew	Université de Fribourg	23
Thurston, Dylan	Indiana University	5
Thurston, Nathaniel	Google Inc.	5
Tillmann, Stephan Dirk	University of Sydney	5
Tiozzo, Giulio	Harvard University	272
Toulisse, Jérémy	Université Paul Sabatier	6
Trevino, Rodrigo	Tel Aviv University	8
Tsvietkova, Anastasiia	Louisiana State University	101
Turaga, Venkata	Indian Institute of Science	93
Ulcigrai, Corinna	University of Bristol	5
Valdez Lorenzo, Jose Ferran	UNAM	9
Vivaldi, Franco	University of London	5
Vogtmann, Karen	Cornell University	89
Voight, John	University of Vermont	5
Volk, Denis	KTH	7
Walker, Alden	University of Chicago	5

Walsh, Genevieve	Tufts University	89
Wang, Biao	Wesleyan University	11
Watson, Liam	University of Glasgow	31
Weiss, Barak	Tel Aviv University	5
Weitze-Schmithuesen, Gabriella	Karlsruhe Institute of Technology	91
Will, Pierre	Université de Grenoble I (Joseph Fourier)	6
Wolf, Michael	Rice University	6
Wolff, Maxime	Université de Paris VI (Pierre et Marie Curie)	6
Work, Grace	University of Illinois at Urbana-Champaign	105
Wright, Alexander Murray	University of Chicago	5
Wu, Chenxi	Cornell University	89
Wu, Yunhui	Rice University	7
Xiu, Chris Yang	Princeton University	6
Yamashita, Yasushi	Nara Womens University	12
Yaroslavtsev, Grigory	Pennsylvania State University	272
Zhan, Bohua	Princeton University	7
Zorich, Anton	Institut Mathématique de Jussieu	75
Zufelt, Nicholas Troy	University of Texas at Austin	8

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

Some Semester Organizer Comments for "Briefly describe program highlights":
"I can hardly imagine it being better! It was great."

Some Semester Organizers Comments for "What, if any, specific projects or collaborations did you pursue during this program?":
"Joint projects with (separately) Marc Culler, Jeff Brock, and Rich Schwartz. Extensive discussions with Eko Hironaka, Heluk Sengun, Ben Burton, Saul Schleimer, Marc Bell and others."

"Nathan Dunfield and I started thinking about searching for non-arithmetic lattices in PU(2,1), starting with groups generated by two order-3 elliptic elements. Since Nathan was on sabbatical and I wasn't, Nathan put a lot more time into this. I've also been writing a paper on a projectively natural iteration on polygons which mimics heat flow in some sense. This is sort of a complex dynamics. I also have been polishing up 2 books for publication with the AMS, one a research monograph about polygon exchange transformations and another one a children's book about big numbers. I also spent some time thinking about the square peg conjecture, and about the layout problem for triangulated surfaces quasi-isometric to the hyperbolic plane."

"... 'Windtree models' with Vincent Delecroix. We plan to finish our paper around December 31."

Some Long-Term Participant Comments for "Briefly describe program highlights":
"It allowed me to get acquainted with topics that, in spite of being related to my field of research, I wouldn't have possibly explored otherwise. Discovering more computational approaches to address certain problems was also interesting. it also gave me the opportunity to interact with some of the participants to the program: these interactions will hopefully develop into future collaborations."

"The program met my expectations in the sense that there was a great mix of researchers that I already knew, and researchers whose work I knew but had never had the opportunity to interact with. The program was an ideal blend of material I find interesting with a collection of researchers that was just different enough from the usual crowd, so to speak. Again, peripheral to the question, I think it is worth mentioning that the ICERM staff were phenomenal before and during the program. This is an important component to a healthy research institute: I spent less time settling and more time working. It was a very productive time for me."

"I was pleased with the wide variety of math discussed and presented by the short- and long-term visitors. It was a great chance to find out what is happening in the field and to have experts around for consultation about specific questions. On the other hand, I was interested in doing some computational and experimental research while at ICERM, however the IT setup here is not conducive to that. The virtual machines are reset on a weekly basis (making nontrivial computational experiments impossible), and the persistent storage ICERM purchased on the CCV cluster is completely full."

"While I was at ICERM I worked quite closely with Luisa Paoluzzi. This was very productive, and I expect we will continue to work together, building on conversations that started at ICERM. Also, while this does not constitute collaboration in any sense, I had great conversations with other long term members. These were conversations that would not have occurred otherwise, that were directly facilitated by the program at ICERM, and that were well-timed with regards to problems that I have been meaning to pursue. While this comment does not fit the billing of 'collaboration' (i.e. the question asked!), I think that this is precisely the type of interaction that ICERM can view as a success vis-a-vis the program goals."

Some Long-term Visitor Comments for "What, if any, specific projects or collaborations did you pursue during this program?":
"I continued work on a joint project with Purcell and Schleimer to find effective estimates on the volume of fibered hyperbolic 3-manifolds. This work strengthens previous results of Brock, so conversations with him were also very helpful. I also continued work on a geometric group theory project that is joint with Wise. While he was not present at ICERM, conversations with ICERM visitors (Genevieve Walsh, Kim Ruane, Craig Hodgson) have informed our project."

"Johanna Mangahas -- Constructions of small dilatation mapping classes, Coxeter mapping classes Nathan Dunfiield -- Branched surfaces, combinatorial semiflows and the BNS invariant Kasra Rafi -- completed paper on McMullen cone and cycle polynomials for free-by-cyclic groups Giulio Tiozzo -- began discussions about zeros of Teichmueller polynomials"

I found that I spent most of my time gathering information that I might be able to use in future projects. For example, I developed in interest in complex hyperbolic geometry. I had originally planned to study the geometry (as opposed to the combinatorics) of hyperbolic 2-bridge link complements. At the start of the program, I worked on a programming project aimed at visualizing the diameter of an orbifold (starting with Euclidean 2-dimensional geometry), which I plan to continue work on next year (2014); I found a couple of people, during my stay at ICERM, to whom I can turn for help."

"(1) Joint project with Gaven Martin: This project aims to understand the space of 2-bridge knot groups and the Riley slice. (2) Joit project with Anastasiia Tsvietkova: We are trying to understand the relation between the polynomials constructed for 2-bridge links by Sakuma-Weeks and those constructed by Tsvietkova. (3) I am tryng to understand the model manifold theory established by Jeff Brock, Yair Minsky, Houssein Namazi, and Joan Souto, by talking with Jeff Brock and Yair Minsky, because it plays an essetial role in my joint work with Ken'ichi Ohshika."

Some Postdoc Comments for "Briefly describe program highlights":
"I was greatly looking forward to this opportunity to work at ICERM during my research leave. I had several projects I wanted to work on and ICERM provided an ideal environment, especially as one of my collaborators was also visiting at the same time. In addition, there were many interesting people visiting, some of whom I already knew and some who I met for the first time. The program of seminars, conferences and discussions provided a stimulating research environment. I had many conversations that may lead to research projects in the future."

"I was not sure what to expect regarding the experimental aspects of the program, but I very much enjoyed learning about the computational tools that are out there and what people are able to do with them."

"The conferences and workshops were great, better than I expected. The intellectual environment was also amazing. I was impressed by the number of prominent researchers ICERM was able to bring together for this program and the setting for collaboration and discussion the facility provides."

Some Postdoc Comments for "What, if any, specific projects or collaborations did you pursue during this program?":
"Hironaka's special constructions of mapping classes; following up with Mark Bell about mapping classes via triangulations; continuing on RAAGs and MCGs (with conversations with Sam Kim, Thomas Koberda, Sam Taylor, though not sure if latter two were affiliated with the program), project on Out(Fn) (with Pettet and Clay, not at the program, but useful related conversations with Catherine Pfaff and Funda Gultepe who did participate in the program), relevant conversations with Robert Tang about curve complex."

"(1) Joint project with Martin Deraux and Julien Paupert on construction of non-arithmetic lattices. Since Martin was also in ICERM for the semester and Julien made two visits, we were able to make significant progress on this project. We expect to submit a paper for publication by the end of 2013. (2) I have written a key section in a book project. I will have a first draft ready by January 2013. (3) I worked on a project with Pierre Will when he visited ICERM and by email afterwards."

"I may have found a way to incorporate my research team's new techniques into existing software (i.e. Ben Burton's Regina). This was directly facilitated because of the visit to ICERM and should lead an implementation in a more user friendly way than it is currently available."

Some Graduate Student Comments for "Briefly describe program highlights":
"I learned TONS of math, and I feel like I have a better feel for the different 'flavors' of things that are going on in this area. I also know who is who."

"I learned a lot on topics like projective structures and computational methods in 3-manifolds, and have a lot of opportunities to collaborate with other people in my field."

"There were more people than I expected and I found most of what they did to be quite interesting. The week long conferences brought together many of the influential people in my field and the talks were graded in difficulty."

Some Graduate Student Comments for "What, if any, specific projects or collaborations did you pursue during this program?":
"Continued my individual research projects. -Worked with two collaborators who visited during the 3rd week-long conference on two ongoing research paper projects -Worked with collaborator who visited during the 2nd week-look conference on another ongoing research paper project -Attended Rich

Schwartz's course "Topics in Geometric Structures" -Participated in informal seminar on "Translation Surfaces"''

"Collaborations with students of Smillie to write code to calculate saddle connections."

"Began collaboration with John Parker which seems to be moving in a great direction"

Note: for upcoming programs please see Appendix B.

Spring Semester 2014: Network Science and Graph Algorithms
February 3 - May 9, 2014

Organizing Committee
Andrea Bertozzi, University of California, Los Angeles
Jonathan Kelner, Massachusetts Institute of Technology
Philip Klein, Brown University
Claire Mathieu, CNRS, Ecole Normale Supérieure and Brown University
David Shmoys, Cornell University
Eli Upfal, Brown University

Program Description
The study of computational problems on graphs has long been a central area of research in computer science. However, recent years have seen qualitative changes in both the problems to be solved and the tools available to do so. Application areas such as computational biology, the web, social networks, and machine learning give rise to large graphs and complex statistical questions that demand new algorithmic ideas and computational models. A wide variety of techniques are emerging for addressing these challenges: from semidefinite programming and combinatorial preconditioners.

In addition to three international conferences, the program will support several research clusters, concentrated periods of activity organized around a specific and timely approach to graph algorithms.

Workshop 1: Semidefinite Programming and Graph Algorithms
February 10 - 14, 2014
Number of Participants: *104*

Organizing Committee
Monique Laurent, CWI and Tilburg University, Netherlands
David Phillips, United States Naval Academy
David Steurer, Cornell University
Kilian Weinberger, Washington University, St Louis

Speakers
Sanjeev Arora, Princeton University
Nikhil Bansal, Technische Universiteit Eindhoven
Boaz Barak, Microsoft Research
Jop Briët, New York University
Venkat Chandrasekeran, California Institute of Technology
Krzysztof Choromanski, Google Inc.
Daniel Dadush, New York University
Michel Goemans, Massachusetts Institute of Technology
Satyen Kale, Yahoo! Inc.

Jonathan Kelner, Massachusetts Institute of Technology
Jean Lasserre, Centre National de la Recherche Scientifique (CNRS)
Anthony Man-Cho So, Chinese University of Hong Kong
Claire Mathieu, École Normale Supérieure
Assaf Naor, New York University
Pablo Parrilo, Massachusetts Institute of Technology
Sebastian Pokutta, Georgia Institute of Technology
Prasad Raghavendra, University of California, Berkeley
Benjamin Recht, University of California, Berkeley
Amit Singer, Princeton University
Ali Sinop, Institute for Advanced Study
Renata Sotirov Tilburg University
Frank Vallentin, Universität zu Köln
Stephanie Wehner, National University of Singapore
Yuan Zhou, Carnegie Mellon University

Workshop Description
Semidefinite programming is playing an ever increasing role in many areas of computer science and mathematics, including complexity theory, approximation algorithms for hard graph problems, discrete geometry, machine learning, and extremal combinatorics. This workshop will bring together researchers from these different fields. The goal is to explore connections, learn and share techniques, and build bridges.

Some Workshop Organizer Comments for "Briefly describe workshop highlights":
"Most of the talks were first rate, and I learned several new very recent and exciting scientific developments."

"The talks were fantastic. Also, the administrative staff at ICERM were professional and efficient -- I was extremely impressed with them."

Some Workshop Participant Comments for "Briefly describe workshop highlights":
"Got exposure to a very broad class of problems. As my background is mainly in approximation algorithms typically restricted to LPs, it was rather illuminating to know the large avenues for research beyond linear programs and current advances in sdp."

"There were a few presentations by experts in the field whom I had never seen in real life. It was very inspiring to see them in person and hear what they were currently thinking about."

"... amazing breadth of applications of semidefinite programming discussed." "Linking different applications and techniques of semi-definite programming."

Workshop 2: Stochastic Graph Models
March 17-21, 2014
Number of Participants: 82

Organizing Committee
Susanne Albers, Humboldt-Universitat, Berlin
Ravi Kumar, Google
Michael Mitzenmacher, Harvard University
Eli Upfal, Brown University

Speakers
Suzanne Albers, Humboldt-Universität
Chen Avin, Ben Gurion University of the Negev
Flavio Chierichetti, Università di Roma "La Sapienza"
Artur Czumaj, University of Warwick
Robert Elsaesser, Universität Salzburg
Alessandro Epasto, Università di Roma "La Sapienza"
Alan Frieze, Carnegie Mellon University
Leslie Goldberg, University of Oxford
Michael Goodrich, University of California, Irvine
Valerie King, University of Victoria
Bobby Kleinberg, Cornell University
Ravi Kumar, Google Inc.
Silvio Lattanzi, Google Inc.
Stefano Leonardi, Università di Roma "La Sapienza"
Zvi Lotker, Ben Gurion University of the Negev
Mohammad Mahdian, Google Inc.
Vahab Mirrokni, Google Inc.
Michael Mitzenmacher, Harvard University
Gopal Pandurangan, Nanyang Technological University
Rajmohan Rajaraman, Northeastern University
Piotr Sankowski, University of Warsaw
Devavrat Shah, Massachusetts Institute of Technology
Alex Slivkins, Microsoft Research
Aravind Srinivasan, University of Maryland
Eli Upfal, Brown University

Workshop Description
Random graphs, stochastic processes on graphs and algorithms for computations on these structures continue to play a dominant role in algorithmic research and discrete mathematics, with recent applications ranging from web search and recommendation engines to social networks and system biology.

This workshop will be an opportunity for researchers from diverse fields to get together and share problems and techniques for handling and analyzing graphs structures. The connections---mathematical, computational, and practical---that arise between these seemingly-diverse problems and approaches will be emphasized.

Some Workshop Organizer Comments for "Briefly describe workshop highlights":
"I was busy collaborating with some of the workshop attendees, on some project already started before the workshop, so the workshop was the occasion for us to all meet in the same place at the same time so as to advance our project. As a result, I didn't pay much attention to the talks, even though they were good."

Some Workshop Participant Comments for "Briefly describe workshop highlights":
"The open problem session. This should become part of the regular schedule!"

"Mix of academic and industrial perspectives."

"Gained knowledge of some of the best ongoing research on network algorithms and stochastic graph models. Excellent talks on models for evolving networks, probabilistic models of event generation and detection, peeling algorithms, markov chain sampling"

"I'm a big fan of the space at ICERM that is well-suited for collaborations. I think ICERM makes a great effort to bring people together. The space makes it easy to either attend a talk, or not attend it and work in the offices or collaborative spaces, or to sit in the upstairs space and half-attend a talk on the screens. I think this helps people use their time as effectively as possible. This whole program has been a great boost for my productivity and career."

Workshop 3: Electrical Flows, Graph Laplacians, and Algorithms: Spectral Graph Theory and Beyond
April 7 - 11, 2014
Number of Participants: 90

Organizing Committee
Jonathan Kelner, Massachusetts Institute of Technology
Yiannis Koutis, University of Puerto Rico
Gary Miller, Carnegie Mellon University

Speakers
Anima Anandkumar, University of California, Irvine
Haim Avron, IBM Corporation
Erik Boman, Sandia National Laboratories
Christian Borgs, Microsoft Research
Christos Boutsidis, Yahoo! Inc.
Jennifer Chayes, Microsoft Research
David Gleich, Purdue University
Jonathan Kelner, Massachusetts Institute of Technology
Alexandra Kolla, University of Illinois at Urbana-Champaign
Yiannis Koutis, University of Puerto Rico
James Lee, University of Washington
Aleksander Madry, École Polytechnique Fédérale de Lausanne (EPFL)
Lorenzo Orecchia, Massachusetts Institute of Technology
Shayan Oveis-Gharan, Stanford University
Debmalya Panigrahi, Duke University
Richard Peng, Massachusetts Institute of Technology
Oliva Simpson, University of California, San Diego
Nikhil Srivastava, Microsoft Research India
Evimaria Terzi, Boston University
Nisheeth Vishnoi, Microsoft Research India
Van Vu, Yale University

Workshop Description
Spectral graph theory, which studies how the eigenvalues and eigenvectors of the graph Laplacian (and other related matrices) interact with the combinatorial structure of a graph, is a classical tool in both the theory and practice of algorithm design. The success of this approach has been rooted in the efficiency with which eigenvalues and eigenvectors can be computed, and in the surprisingly large number of ways that a graph's properties are connected to the Laplacian's spectrum---particularly to the value of its second smallest eigenvalue, $\lambda 2$.

However, while the eigenvalues and eigenvectors of the Laplacian capture a striking amount of the structure of the graph, they certainly do not capture all of it. Recent work in the field suggests that we have only scratched the surface of what can be done if we are willing to broaden our investigation to include more general linear-algebraic properties of the matrices we associate to graphs.

A particularly fruitful example of this has been the study of Laplacian linear systems, where the interplay between linear algebra and graph theory has led to progress in both fields. On the one hand, researchers have used the combinatorial structure of the corresponding graphs to facilitate the solution of these linear systems, resulting in solvers that run in nearly-linear time. On the other hand, one can use these linear systems to describe the behavior of electrical flows on a graph, which has provided a powerful new primitive for algorithmic graph theory. This interaction has already led to improved algorithmic results for many of the basic problems in algorithmic graph theory, including finding maximum flows and minimum cuts, solving traveling salesman problems, sampling random trees, sparsifying graphs, computing multicommodity flows, and approximately solving a wide range of general clustering and partitioning problems. In addition, researchers have recently shown how to exploit a wide range of other algebraic properties of matrices associated to graphs, such as the threshold rank, cut norm, sensitivity to perturbation, or hypercontractivity of the eigenspaces, to achieve impressive algorithmic results.

In this workshop, we will bring researchers together to study and advance this new emerging frontier in algorithmic graph theory.

Some Workshop Organizer Comments for "Briefly describe workshop highlights":
None submitted

Some Workshop Participant Comments for "Briefly describe workshop highlights":
"Discussions with speakers after the talks! Long breaks! The poster session was just right. About 8-10 posters and 20-30 people. Perfect!"

"I am now aware of techniques/algorithms that may help my current research, since I discovered different ways of approaching the problem that I might not have thought on my own."

"There were several talks that I thought were really good, and I felt that I got a lot of suggestions for how to improve my current research. More importantly (and the main reason I came to the conference), the conference provided a lot of good ideas for research."

"This was an efficient way to be exposed to some very important and exciting new developments in graph algorithms. The organizers brought in the absolute best people in the area and we all had opportunities to talk with them one on one."

Workshop 4: Eigenvectors in graph theory and related problems in numerical linear algebra
May 5 - 9, 2014
Number of Participants: 78

Organizing Committee
Anna Gilbert, University of Michigan
Peter Jones, Yale University
Gunnar Martinsson, University of Colorado at Boulder
Van Vu, Yale University

Speakers
Lawrence Carin, Duke University

Fan Chung, University of California, San Diego
Raphy Coifman, Yale University
Ioana Dumitriu, University of Washington
Rong Ge, Microsoft Research
Anna Gilbert, University of Michigan
Peter Jones, Yale University
James Lee, University of Washington
Gilad Lerman, University of Minnesota
Mauro Maggioni, Duke University
Michael Mahoney, Stanford University
Gunnar Martinsson, University of Colorado
Ankur Moitra, Massachusetts Institute of Technology
Elchanan Mossel, University of California, Berkeley
Joe Neeman, University of Texas at Austin
Sean O'Rourke, Yale University
Andrei Osipov, Yale University
Vladimir Rokhlin, Yale University
Mark Rudelson, University of Michigan
Amit Singer, Princeton University
Van Vu, Yale University
Ke Wang, University of Minnesota
Rachel Ward, University of Texas at Austin
Rebecca Willett, University of Wisconsin

Workshop Description

The analysis of problems modeled by large graphs is greatly hampered by a lack of efficient computational tools. The purpose of the workshop is to explore possibilities for designing appropriate computational methods that draw on recent advances in numerical methods and scientific computation. Specifically, the questions of how to form the matrices representing graph Laplacians, and how to compute the leading eigenvectors of such matrices will be addressed. It seems likely that these problems will be amenable to algorithms based on randomized projections that dramatically reduce the effective dimensionality of the underlying problems. Such techniques has recently proven highly effective for the related problems of how to find approximate lists of nearest neighbors for clouds of points in high dimensional spaces, and for constructing approximate low-rank factorizations of large matrices. In both cases, a key observation is that the problem of distortions of distances that is inherent to randomized projection techniques can be overcome by using the randomized projections only as pre-conditioners; they inform the algorithm of where to look, and then highly accurate deterministic techniques are used to compute the actual output. The resulting algorithms scale extra-ordinarily well on modern parallel and multicore architectures. To successfully address the enormous problems arising in the analysis of graphs, it is expected that additional machinery will be needed, such as the use of multi-resolution data structures, and more efficient scalable randomized projections.

Some Workshop Organizer Comments for "Briefly describe workshop highlights":
"Hearing the talk on several recent results in my field"

Some Workshop Participant Comments for "Briefly describe workshop highlights":
"Having my first exposure to a high level workshop with many well known academics associated with the field of graph theory, and to gain experience presenting a poster for the first time as well."

"There were several highlights: -Peter Jones talk on the heat kernel and its application to data analysis. -Rong Ge's talk on an Algorithm for Learning Incoherent and Overcomplete Dictionaries -Larry Carin's talk -Anuk Moitra's talk".

"Meeting people from very different areas of mathematics and its applications."

Research Cluster 1: Geometric analysis methods for graph algorithms
February 3 - 28, 2014
Number of Participants: 26

Organizing Committee
Andrea Bertozzi, University of California, Los Angeles
Thomas Laurent, Loyola Marymount University

Participants
Milan Bradonjic, Lucent Technologies Bell Laboratories
Xavier Bresson, Universita de Lausanne
Mihai Cucuringu, University of California, Los Angeles
Arjuna Flenner, Naval Air Warfare Center
Cristina Garcia, Claremont Graduate University
Nicolas Garcia, Carnegie Mellon University
Steven Heilman, Courant Institute of Mathematical Sciences
Huiyi Hu, University of California, Los Angeles
Blake Hunter, University of California, Los Angeles
Slav Assenov Kirov, Carnegie Mellon University
Gitta Kutyniok, TU Berlin
Thomas Laurent, Loyola Marymount University
Ekaterina Merkurjev, University of California, Los Angeles
Francois Meyer, University of Colorado
Braxton Osting, University of California, Los Angeles
Yuan Qi, Purdue University
Michaela Puck Rombach, University of California, Los Angeles
Dejan Slepcev, Carnegie Mellon University
Arthur David Szlam, City College, CUNY
Xue-Cheng Tai, University of Bergen
Yves van Gennip, University of Nottingham
James von Brecht, University of California, Los Angeles
Ulrike von Luxburg, Universitat Hamburg
Christopher Dale White, University of Texas at Austin
Joseph Thomas Woodworth, University of California, Los Angeles
Dominique Patrice Zosso, University of California, Los Angeles

Research Cluster Description
This working group will develop new mathematics at the interface between graph structures and high dimensional data and geometric analysis. In the last ten years we have seen an explosion of work in both (a) compressive sensing (sparsity, L1-based methods) and in (b) machine learning involve graphical structures for large scale and high dimensional data. The focus is on both analysis and algorithm development. In the case of new algorithms - codes will be tested against state of art machine learning algorithms. In the case of analytical results - we will draw on expertise in diverse areas of mathematics including differential geometry, nonlinear PDE, optimization, and spectral analysis of graphs. Application

areas represented include machine learning, social network data, modularity optimization, L1-compressive sensing methods, and image processing.

One area of focus is community detection in large networks. A current approach for community detection consists in minimizing the so-called modularity functional. Preliminary experiments using fast compress sensing algorithms shows very promising results for modularity optimization. A second area of focus is data retrieval, where L1 approaches could lead to significant advances. Thirdly, graph matching is another problem in which compressed sensing and total variation methods for graphs could have an impact.

Some Research Cluster Organizer Comments for "Briefly describe cluster highlights":
"Connections between researchers from the machine learning community and from the computational PDE community were established. Various collaborations were started. This was one of the main goals of this research cluster and I think it was successful."

"The collaboration started with Bresson, Hu, Szlam and von Brecht looks very promising."

Some Research Cluster Organizer Comments for "What, if any, specific projects did you initiate or continue while participating in this research cluster?"
"Continue a project on gamma convergence of balanced graph cuts toward toward balanced domain cuts (collaboration with Bresson, Garcia, Slepcev and von Brecht) 2) Started a project on fast clustering algorithms for large data sets. (collaboration with Bresson, Hu, Szlam and von Brecht)"

Some Research Cluster Participant Comments for "Briefly describe cluster highlights":
"The main highlight of this research cluster for me was professional networking; I met many new people and solidified old professional relationships. I expected to begin new projects while at ICERM, but was not successful."

"Finding the key idea for a proof of a conjecture I've been working on since a year. Meeting many new people with whom my research interests overlap significantly, but who come from a different community that I am. I learned a lot about their techniques. BTW, you should have a field in your survey with "open comments". Because I'd like to mention the following: This has been the nicest research stay I've had in a very long time. I think it is a great idea to collect 10-20 people for an extended period, so people actually can start working together. This is so much better than just a conference where everybody leaves with lots of ideas, but no time to pursue these ideas. I'd also like to mention that the staff at ICERM extremely helpful, also in the phase of planning travel, accommodation, etc."

Some Research Cluster Participant Comments for "What, if any, specific projects did you initiate or continue while participating in this research cluster?"
"Found a proof for a conjecture about density estimation in unweighted k nearest neighbor graphs. I've been looking for such a proof since a year, and here I found the most stimulating environment, so I got the key idea ;-) Also, with a couple of participants we are planning to organize a Banff workshop as a follow-up of this meeting."

"Continued work with existing collaborators and talked about new work with existing collaborators."

"Continued my project on eigenvalue optimization with Braxton Osting. I attempted initiating new projects but was not successful."
"Comparison of current graph-based data classification methods using the Ginzburg-Landau functional with alternative convex techniques."

Research Cluster 2: Graphs with incomplete information
February 17 – March 14, 2014
Number of Participants: 5

Organizing Committee
Claire Mathieu, École Normale Supérieure

Participants
Mihai Cucuringu, University of California, Los Angeles
Nathanael Francois, Universite de Paris VII
Howard Karloff, Yahoo! Inc.
Claire Mathieu, École Normale Supérieure
Hang Zhou, École Normale Supérieure

Research Cluster Description
How can we handle graph problems when the graph is only known imperfectly?

In one setting, the input is a noisy version of some unknown ground truth graph, to which random edges have been added, destroying the structure : planarity, clustering, distances for example. In another setting, the graph itself can only be accessed via queries such as shortest path queries, distance queries, or cut queries, and must be inferred from the result to well-chosen queries ; this comes up in internet tomography. In a third setting, the graph evolves dynamically over time and solutions must adapt to edge additions and removals.

The cluster will gather researchers around a bi-weekly working group drawing on the skills of the participants in random graphs and discrete probability, optimization and linear, semi-definite or convex programming methods, structural graph properties, and randomized dynamic data structures.

The research cluster organizer, Claire Matthieu, reported that this cluster was not very successful in part because she was the only cluster leader and the main research project turned out to be subsumed in the work of a previously published paper.

Research Cluster Participant Comment for "Briefly describe cluster highlights" and "What, if any, specific projects did you initiate or continue while participating in this research cluster?":
"Spectral analysis on correlation clustering."

Research Cluster 3: Towards Efficient Algorithms Exploiting Graph Structure
April 24 – May 2, 2014
Number of Participants: 23

Organizing Committee
Blair D. Sullivan, North Carolina State University
Erik D. Demaine, Massachusetts Institute of Technology
Daniel Marx, Hungarian Academy of Sciences

Participants
Aaron Adcock, Stanford University
Yixin Cao, Hungarian Academy of Sciences (MTA)
Rajesh Hemant Chitnis, University of Maryland
Erik Demaine, Massachusetts Institute of Technology
Hossein Esfandiari, University of Maryland

Fedor Fomin, University of Bergen
Kyle Jordan Fox, University of Illinois at Urbana-Champaign
MohammadTaghi Hajiaghayi, University of Maryland
Philip Klein, Brown University
Michael Langston, University of Tennessee
Vahid Liaghat, University of Maryland
Daniel Lokshtanov, University of Bergen
Daniel Marx, Hungarian Academy of Sciences (MTA)
Morteza Monemizadeh, University of Maryland
Shay Mozes, Interdisciplinary Center for Neural Computation at Hebrew University
Michael Patrick O'Brien, North Carolina State University
Felix Reidl, RWTH Aachen
Villaamil Fernando Sanchez, RWTH Aachen
Saket Saurabh, Institute of Mathematical Sciences
Aaron Schild, Princeton University
Blair Sullivan, North Carolina State University
Ali Vakilian, Massachusetts Institute of Technology

Research Cluster Description
This working group will develop new theoretically grounded approaches to practical problems on graphs and networks using the arsenal of graph structure theory and algorithms (treewidth, minors, fixed-parameter tractability, approximation algorithms, etc.).

Our approach is to combine the expertise of a mix of junior and senior researchers from three disciplines: mathematics (graph theory), computer science (fixed-parameter and approximation algorithms), and applied network analysis (social networks, power grid, bioinformatics, etc.). During this research cluster, we will identify specific practically motivated problems, and tackle the key associated mathematical challenges, with a goal of ultimately encouraging broader adoption of graph-structure-based tools in the computational community. This goal is particularly important given the emergence of vast quantities of relational data (a.k.a. networks) and increased need for analysis via scalable algorithms.

We face several challenges in making graph structure techniques applicable to real-world network analysis. First, many of the algorithms currently involve incredibly large constants (e.g., in their dependence on an excluded minor), so a natural goal is to improve or replace the relevant components with more reasonable dependencies. Second, we do not know which real-world networks fall into one or more of the mathematical graph classes where structural techniques are applicable. This problem can be tackled mathematically, through generative models, or experimentally, raising several questions about how to test whether specific graphs belong to parametrically defined classes. This problem becomes even more interesting when one considers that real-world networks are generally noisy, which means that the observed graph may have extra edges that place it outside the desired class, even if the intrinsic network satisfies the necessary conditions. For graphs that are "nearly" within a tractable graph class, can we detect which parts need modification to apply the efficient algorithms, and bound the effect of these modifications on the computed solution? We are excited by the new theoretical challenges raised by these practical questions, as well as the potential for significantly impacting the computability of many quantities of interest on real-world graphs.

Some Research Cluster Organizer Comments for "Briefly describe cluster highlights":
"Enjoyed working with diverse group of researchers on problems that were a bit outside what would likely get focus at any single institution. Good mix of experienced and junior participants."

Some Research Cluster Organizer Comments for "What, if any, specific projects did you initiate or continue while participating in this research cluster?"
"New projects on tournament bisection, a unique coverage graph domination-style problem, and algorithms for the Flow game were initiated and saw significant progress. Additional progress was made on ongoing work with random graph classes and bounded expansion. Several other open problems were discussed that may lead to future results."

"I think overall, the model we tried to employ was very effective - it looks like we'll end up with two or three new-start papers/collaborations coming out of it (and others that are just less well developed at this point; I'm counting those that we created mailing lists for and are discussing how to divvy up writing, etc). You'll be happy to hear there's a mix of discrete math and computer science represented (and we were even computational - one of the students wrote Python code to brute-force check a bunch of base cases in one of the reductions!)."

Some Research Cluster Participant Comments for "Briefly describe cluster highlights":
"The tutorials were excellent and brought me up to speed on a lot of topics I was aware of but not familiar with. The large group collaborations were a great way to make new connections make progress on many problems."

"Working with very talented people."

"Very instructive talks on the selected subjects. And a very friendly atmosphere during the research hours."

Some Research Cluster Participant Comments for "What, if any, specific projects did you initiate or continue while participating in this research cluster?"
"Two projects are initiated, a work on online dynamic Steiner connectivity, and a work on secretary prophet inequality."

"Several papers are planned as an outcome of the cluster. I was involved slightly with several and heavily with a problem geared towards solving a graph based game called flow."

"Studying the computational complexity of finding a single negative length clockwise cycle in a plane graph. Searching for a polynomial time approximation scheme for b-balanced cut in planar graphs. Studying the complexity of solving puzzles in the mobile game Flow."

All Visitors to Spring 2014 Semester Program
Gray highlight represents anyone staying over 9 days

Name	Organization	Time spent at ICERM (days)
Abebe, Rediet Tesfaye	University of Cambridge	5
Adcock, Aaron	Stanford University	9
Aghajani, Mohammadreza	Brown University	5
Ahmadi, Amir Ali	Massachusetts Institute of Technology	6
Albers, Suzanne	Humboldt-Universität	5
Alevy, Ian	Brown University	2
Alfuraidan, Monther Rashed	King Fahd University of Petroleum and Minerals	7

Allen-Zhu, Zeyuan	Massachusetts Institute of Technology	5
Anandkumar, Anima	University of California, Irvine	5
Arora, Sanjeev	Princeton University	15
Augustine, John	Indian Institute of Technology	91
Avin, Chen	Ben Gurion University of the Negev	96
Avron, Haim	IBM Corporation	5
Bansal, Nikhil	Technische Universiteit Eindhoven	5
Barak, Boaz	Microsoft Research	5
Bassu, Devasis	Applied Communication Sciences	5
Bauer, Frank	Harvard University	5
Beckage, Nicole Marie	University of Colorado	7
Ben-David, Emanuel	Columbia University	5
Bercea, Ioana Oriana	University of Maryland	7
Berenbrink, Petra	Simon Fraser University	13
Bhamre, Tejal	Princeton University	6
Bienstock, Daniel	Columbia University	33
Boman, Erik	Sandia National Laboratories	5
Borgs, Christian	Microsoft Research	5
Boutsidis, Christos	Yahoo! Inc.	5
Bradonjic, Milan	Lucent Technologies Bell Laboratories	16
Bresson, Xavier	Université de Lausanne	8
Briët, Jop	New York University	4
Cao, Yixin	Hungarian Academy of Sciences (MTA)	49
Carin, Lawrence	Duke University	5
Chambers, Erin	St. Louis University	5
Chandrasekeran, Venkat	California Institute of Technology	5
Chayes, Jennifer	Microsoft Research	5
Chierichetti, Flavio	Università di Roma "La Sapienza"	5
Chitnis, Rajesh Hemant	University of Maryland	9
Cho, Eungchun	Kentucky State University	5
Choromanski, Krzysztof Marcin	Google Inc.	5
Chung, Fan	University of California, San Diego	5
Coifman, Raphy	Yale University	5
Cucuringu, Mihai	University of California, Los Angeles	71
Czumaj, Artur	University of Warwick	5
Dadush, Daniel	New York University	5
Das, Kinkar Chandra	Sungkyunkwan University	6
De Stefani, Lorenzo	Università di Padova	55
Demaine, Erik	Massachusetts Institute of Technology	9
Dickerson, Thomas	Brown University	96
Dubhashi, Devdatt	Chalmers University of Technology	8

Dumitriu, Ioana	University of Washington	5
Egidi, Michela	Durham University	7
Elsaesser, Robert	Universität Salzburg	7
Epasto, Alessandro	Università di Roma "La Sapienza"	5
Esquerra-Ortells, Lledó	University of Colorado	8
Fawzi, Hamza	Massachusetts Institute of Technology	5
Flenner, Arjuna	Naval Air Warfare Center	22
Fomin, Fedor	University of Bergen	10
Fox-Epstein, Eli	Brown University	96
Fox, Kyle Jordan	University of Illinois at Urbana-Champaign	131
Fraigniaud, Pierre	Université de Paris VII (Denis Diderot)	13
François, Nathanaël	Université de Paris VII (Denis Diderot)	102
Frieze, Alan	Carnegie Mellon University	2
Garcia, Cristina	Claremont Graduate University	12
Garcia, Nicolas	Carnegie Mellon University	27
Ge, Rong	Microsoft Research	5
Giakkoupis, George	Institut National de Recherche en Informatique Automatique (INRIA)-Lorraine	5
Gilbert, Anna C.	University of Michigan	5
Gillman, David W.	New College of the University of South Florida	4
Gleich, David	Purdue University	5
Goemans, Michel	Massachusetts Institute of Technology	5
Goldberg, Leslie	University of Oxford	5
Goodrich, Michael	University of California, Irvine	5
Gopal, Venu	Brown University	5
Gruler, Sebastian	Universität Konstanz	7
Gupta, Anupam	Carnegie Mellon University	9
Hajiaghayi, MohammadTaghi	University of Maryland	9
Heilman, Steven	Courant Institute of Mathematical Sciences	57
Hendrickson, Bruce	Sandia National Laboratories	5
Hill, William Andrew	North Carolina State University	11
Hobbs, WIll	University of California, San Diego	4
Hogan, Emilie Ann	Pacific Northwest National Laboratory	7
Hu, Huiyi	University of California, Los Angeles	28
Hunter, Blake A	University of California, Los Angeles	27
Iyer, Sameer	Brown University	1
Janzamin, Majid	University of California, Irvine	7
Jones, Peter	Yale University	5
Kale, Satyen	Yahoo! Inc.	5
Karloff, Howard	Yahoo! Inc.	5
Kawarabayashi, Ken-ichi	National Institute of Informatics	9
Kelner, Jonathan	Massachusetts Institute of Technology	10

Kemper, Yvonne Suzanne	National Institute of Standards and Technology	5
Kenter, Franklin H. J.	Rice University	6
Kim, Chiheon	Massachusetts Institute of Technology	5
Kim, Steven	Brown University	2
Kim, Sungmin	Ohio State University	7
King, Valerie	University of Victoria	5
Kirov, Slav Assenov	Carnegie Mellon University	27
Klein, Daniel	Brown University	5
Klein, Philip N.	Brown University	96
Kleinberg, Bobby	Cornell University	5
Knyazev, Andrew	Mitsubishi Electric Research Laboratories	10
Kolla, Alexandra	University of Illinois at Urbana-Champaign	5
Koutis, Ionnis	University of Puerto Rico	99
Kumar, Ravi	Google Inc.	5
Kutyniok, Gitta	TU Berlin	16
Kyng, Rasmus	Yale University	5
Langston, Matthew Harper	Reservoir Inc	6
Langston, Michael	University of Tennessee	9
Lasserre, Jean	Centre National de la Recherche Scientifique (CNRS)	5
Lattanzi, Silvio	Google Inc.	5
Laurent, Monique	Center for Mathematics and Computer Science (CWI)	5
Laurent, Thomas	Loyola Marymount University	29
Lee, Christina Esther	Massachusetts Institute of Technology	5
Lee, James	University of Washington	10
Leonardi, Stefano	Università di Roma "La Sapienza"	5
Lerman, Gilad	University of Minnesota	5
Lezoray, Olivier	Université de Caen	7
Lippner, Gabor Peter	Harvard University	15
Liu, Shiping	University of Durham	7
Lokshtanov, Daniel	University of Bergen	9
Lotker, Zvi	Ben Gurion University of the Negev	7
Louidor, Oren	Technion-Israel Institute of Technology	7
Lyubchich, Viacheslav	University of Waterloo	7
Madry, Aleksander	École Polytechnique Fédérale de Lausanne (EPFL)	5
Maggioni, Mauro	Duke University	5
Mahabadi, Sepideh	Massachusetts Institute of Technology	4
Mahdian, Mohammad	Google Inc.	5
Mahmoody, Ahmad	Brown University	96
Mahoney, Michael	Stanford University	14

Man-Cho So, Anthony	Chinese University of Hong Kong	5
Martin, William Joseph	Worcester Polytechnic Institute	96
Martinsson, Gunnar	University of Colorado	5
Marx, Daniel	Hungarian Academy of Sciences (MTA)	8
Mastrolilli, Monaldo	IDSIA	7
Mathieu, Claire	École Normale Supérieure	64
McDonald, Patrick	New College of the University of South Florida	7
Meierfrankenfeld, David Anton	Brown University	96
Merkurjev, Ekaterina	University of California, Los Angeles	44
Meyer, Francois G	University of Colorado	26
Miller, Gary	Carnegie Mellon University	5
Mirrokni, Vahab	Google Inc.	5
Mitzenmacher, Michael	Harvard University	5
Moitra, Ankur	Massachusetts Institute of Technology	5
Morton, Jason Ryder	Pennsylvania State University	5
Mossel, Elchanan	University of California, Berkeley	5
Mozes, Shay	Interdisciplinary Center for Neural Computation at Hebrew University	9
Naderi Parizi, Sobhan	Brown University	5
Nanongkai, Danupon	Nanyang Technological University	111
Naor, Assaf	New York University	5
Neeman, Joe	University of Texas at Austin	5
Ness, Linda	Applied Communication Sciences	11
O'Brien, Michael Patrick	North Carolina State University	11
O'Rourke, Sean	Yale University	5
Orecchia, Lorenzo	Massachusetts Institute of Technology	5
Osipov, Andrei	Yale University	5
Osting, Braxton	University of California, Los Angeles	26
Oveis-Gharan, Shayan	Stanford University	5
Pachocki, Jakub Wojciech	Carnegie Mellon University	5
Pandurangan, Gopal	Nanyang Technological University	217
Panigrahi, Debmalya	Duke University	5
Parrilo, Pablo	Massachusetts Institute of Technology	5
Peleg, David	Weizmann Institute of Science	12
Peng, Richard	Massachusetts Institute of Technology	5
Perkins, Will	Georgia Institute of Technology	5
Pham, Lam	Yale University	5
Phillips, David	U.S. Naval Academy	13
Pietracaprina, Andrea	Università di Padova	32
Pignolet, Yvonne Anne	ABB Corporate Research	5
Pokutta, Sebastian	Georgia Institute of Technology	5
Porter, Mason	University of Oxford	31

Preciado, Victor Manuel	University of Pennsylvania	7
Pucci, Geppino	Università di Padova	33
Purohit, Manish Deepak	University of Maryland	5
Qi, Yuan (Alan)	Purdue University	12
Quader, Saad	University of Connecticut	12
Raghavendra, Prasad	University of California, Berkeley	5
Raghu, Maithra	University of Cambridge	5
Rajaraman, Rajmohan	Northeastern University	5
Ramanan, Kavita	Brown University	5
Ramassamy, Sanjay	Brown University	5
Rao, Anup	Yale University	6
Raphael, Ben	Brown University	96
Ravi, R	Carnegie Mellon University	5
Recht, Benjamin	University of California, Berkeley	5
Redlich, Amanda Epping	Bowdoin College	120
Richerby, David	University of Oxford	7
Riondato, Matteo	Brown University	10
Rivin, Igor	Temple University	255
Roche, Scott Thomas	Northeastern University	96
Rokhlin, Vladimir	Yale University	5
Rombach, Michaela Puck	University of California, Los Angeles	48
Rudelson, Mark	University of Michigan	5
Sachdeva, Sushant	Yale University	5
Saligrama, Venkatesh	Boston University	5
Sankowski, Piotr	University of Warsaw	5
Sarpatwar, Kanthi Kiran	University of Maryland	5
Sauerwald, Thomas Michael	University of Cambridge	5
Saunderson, James	Massachusetts Institute of Technology	5
Saurabh, Saket	Institute of Mathematical Sciences	14
Schroeder, Bernd Siegfried Walter	Louisiana Tech University	5
Shah, Devavrat	Massachusetts Institute of Technology	5
Shmoys, David B.	Cornell University	15
Silas, Shashwat	Brown University	5
Simpson, Oliva	University of California, San Diego	3
Singer, Amit	Princeton University	10
Sinop, Ali Kemal	Institute for Advanced Study	10
Sjogren, Jon Arne	Towson State University	4
Slepčev, Dejan	Carnegie Mellon University	16
Slivkins, Alex	Microsoft Research	5
Snarski, Michael	Brown University	1
Sotirov, Renata	Tilburg University	5

Srinivasan, Aravind	University of Maryland	5
Srivastava, Nikhil	Microsoft Research India	5
Steurer, David	Cornell University	5
Stolz, Robert C	University of the Virgin Islands	7
Sudderth, Erik	Brown University	5
Sullivan, Blair D.	North Carolina State University	10
Sun, He	Max Planck Institute for Informatics	16
Szlam, Arthur David	City College, CUNY	28
Tai, Xue-Cheng	University of Bergen	27
Tamon, Christino	Clarkson University	7
Terzi, Evimaria	Boston University	5
Tiozzo, Giulio	Harvard University	272
Tonchev, Vladimir D	Michigan Technological University	6
Tsourakakis, Charalampos	Carnegie Mellon University	131
Turkel, Itzhak	Ben Gurion University of the Negev	7
Turner, Lara Ruth	University of Vienna	5
Unda, Francisco	Massachusetts Institute of Technology	5
Upfal, Eli	Brown University	96
Vakilian, Ali	MIT	15
Vallentin, Frank	Universität zu Köln	5
van Gennip, Yves	University of Nottingham	28
Vishnoi, Nisheeth	Microsoft Research India	5
Vladu, Adrian	MIT	5
von Brecht, James	UCLA	22
von Luxburg, Ulrike	Universität Hamburg	33
Voroninski, Vladislav	MIT	5
Vu, Van	Yale University	10
Wang, Ke	University of Minnesota	5
Ward, Rachel	University of Texas at Austin	5
Weaver, Chelsea Ann	University of California, Davis	6
Wehner, Stephanie	National University of Singapore	5
Weinberger, Kilian	Washington University	5
White, Christopher Dale	University of Texas at Austin	29
Willett, Rebecca	University of Wisconsin	5
Woodworth, Joseph Thomas	University of California, Los Angeles	27
Wulff-Nilsen, Christian	University of Copenhagen	6
Xu, Shen Chen	Carnegie Mellon University	5
Yaroslavtsev, Grigory	Pennsylvania State University	272
Young, Neal	University of California, Riverside	22
Yu, Gexin	College of William and Mary	7
Zanetti, Luca	Saarland University	8

Zhang, Teng	Princeton University	5
Zhang, Xiangxiong	MIT	5
Zhou, Hang	École Normale Supérieure	82
Zhou, Yuan	Carnegie Mellon University	2
Zhu, Yao	Purdue University	5
Zosso, Dominique Patrice	Universtiy of California, Los Angeles	7

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

Semester Organizer Comments for "Briefly describe program highlights":
None submitted

Some Semester Organizer Comments for "What, if any, specific projects or collaborations did you pursue during this program?":
"I continued working on algorithms for solving semidefinite programs and started some new projects applying these algorithms to different problems of interested."

"Several papers are in writing phase."

Some Long-Term Participant Comments for "Briefly describe program highlights":
"Meeting and listening to researchers from different communities working on a related set of problems."

Some Long-Term Participant Comments for "What, if any, specific projects or collaborations did you pursue during this program?":
"... the project with von Brecht, Bresson Laurent and Garcia Trillos was greatly accelerated and new directions have been identified."

Some Postdoc Comments for "Briefly describe program highlights":
"There were a number of interesting and enthralling talks."

Some Postdoc Comments for "What, if any, specific projects or collaborations did you pursue during this program?":
"We started a project for comparing non-convex minimization techniques for learning on graphs that I have been working on with other convex techniques used for image processing."

"I mostly continued work on a graph partitioning problem and also thought about sparsification of graphs."

Some Graduate Student Comments for "Briefly describe program highlights":
"There were two. The first was the stochastic graph workshop, which I really felt drew together some of the most important people in my field and provided a chance interact with them (open problem sessions, dinners, etc.) that I wouldn't have gotten at a large conference. The second was the ability to work with two of my collaborators who were also in residence at ICERM."

Some Graduate Student Comments for "What, if any, specific projects or collaborations did you pursue during this program?":
"I finished this project: http://arxiv.org/abs/1403.0885 . I also continued to work on Unique Games hardness for the noncommutative Grothendieck inequality. I worked a bit on a conjecture of Mendel and

Naor related to Gaussian Poincare inequalities and expander graphs. I also talked a little with Will Perkins about a problem of his in geometric probability."

"Started a project on developing distributed algorithms to heal a P2P networks. Continued a project on modeling information dissemination in networks through epidemic-type models."

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. The target deadlines for submissions are early September and mid-April. The ICERM directors and a subcommittee of the Scientific Advisory Board (SAB) will review all pre-proposals. Proposers will receive feedback within a few weeks of their submission.

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 3-6),
   • The main contact (chair) of the organizing committee,
   • A discussion of the experimental and computational aspects of the 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 deadlines for proposals is mid-October, prior to the annual November SAB meeting, and mi May, prior to an annual conference call. 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.

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 2013-2014

ICERM has hosted 5 topical workshops from June 2013 to June 2014. These workshops focus on topics of current interest in the mathematical sciences.

Topical Workshop 1: Issues in Solving the Boltzmann Equation for Aerospace Applications

June 3-7, 2013
Number of participants: 41
This workshop was externally funded by AFOSR with support from ICERM for accepted applicants

Organizing Committee
Alex Alekseenko, California State University, Northridge/AFRL at Wright-Patterson AFB
Jose Camberos, AFRL Wright-Patterson AFB
Irene Gamba, University of Texas at Austin
Sergey Gimelshein, University of Southern California
Prakash Vedula, University of Oklahoma, Norman
Ingrid Wysong, AFOSR

Speakers
Kazuo Aoki, Kyoto University
Iain D. Boyd, University of Michigan
Yingda Cheng, Michigan State University
Irene Martinez Gamba, University of Texas at Austin

Yaman Guclu, Michigan State University
Jeffrey Haack University of Texas at Austin
Nicolas Hadjiconstantinou, Massachusetts Institute of Technology
Eswar Josyula, US Air Force Research Laboratory
Vladimir I. Kolobov, CFD Research Corporation
Elena Kustova, St. Petersburg State University
Charles David Levermore, University of Maryland
Deborah Levin, Pennsylvania State University
Fengyan Li, Rensselaer Polytechnic Institute
Thierry Magin, Von Karman Institute for Fluid Dynamics
Luc Mieussens, Universita de Bordeaux I
Taku Ohwada, Kyoto University
Lorenzo Pareschi, Universita di Ferrara
Leonid Pekker, Victor Technologies
Gabriella Puppo, Universita dell'Insubria
David C. Seal, Michigan State University
Jie Shen, Purdue University
Henning Struchtrup, University of Victoria
Philip Leslie Varghese, University of Texas at Austin
Prakash Vedula, University of Oklahoma
Aihua Wood, Air Force Institute of Technology

Workshop Description
Being central to gas dynamics, the Boltzmann equation describes gas flows at the microscopic level in regimes from free molecular to continuum. Its descriptive power makes it indispensable for predicting non-continuum phenomena in gases when experimental data is limited or not available. The Boltzmann equation is used in a wide range of applications, from external aerodynamics and thruster plume flows to vacuum facilities and microscale devices. Accurate solution of the Boltzmann equation for modeling gas flows arising in aerospace applications continues to be a challenge. Existing numerical capabilities fall short of capturing the complexities of engineering design. Reasons for this range from the absence of mathematical models that capture the physics properly to higher dimensionality of kinetic models and the resulting high cost of computations to the failure of mathematical theories to handle complex geometries of real life applications.

The goal of this workshop is to facilitate the development of high-fidelity computational capabilities for the solution of the Boltzmann equation in application to simulation of non-continuum flows. This will be accomplished by addressing the gaps in communication between mathematicians, engineers and researchers in various fields of research.

Topics of the workshop include but are not be limited to: different forms of the Boltzmann equation; reduced order models for the Boltzmann equation; mesh adaptation in velocity space; fast evaluation of the Boltzmann collision integral; simulations that account for real gas effects and chemical and electromagnetic interaction of particles; complex geometry simulations; coupling of continuum and non-continuum models; and quantification of numerical error and uncertainty of simulations.

To address the goal of the workshop, the presenters were asked to incorporate in their lectures at least one of the following three common topics:
- Communication of issues related to high computational costs of simulations;
- Communication of issues related to accuracy of models that is the accuracy in approximating the solutions to the Boltzmann equation and the accuracy in approximating physics of gas flows;

- Communication of progress in the analysis of numerical errors.

Participants (Issues in Solving the Boltzmann Equation for Aerospace Applications Workshop)

Name	Organization
Alekseenko, Alexander	California State University Northridge
Aoki, Kazuo	Kyoto University
Bernard, Florian	Politecnico di Torino
Boyd, Iain D.	University of Michigan
Causley, Matthew	Michigan State University
Cheng, Yingda	Michigan State University
Clarke, Peter	University of Texas at Austin
Fahroo, Fariba	US Air Force Office of Scientific Research
Gamba, Irene Martinez	University of Texas at Austin
Gorikhovsky, Igor	Institute for Computational and Experimental Research in Mathematics (ICERM)
Guclu, Yaman	Michigan State University
Guo, Yan	Brown University
Gutierrez-Miravete, Ernesto	Rensselaer Polytechnic Institute
Haack, Jeffrey	University of Texas at Austin
Hadjiconstantinou, Nicolas	Massachusetts Institute of Technology
Hoffman, Jack Stewart	Orange Coast College
Josyula, Eswar	US Air Force Research Laboratory
Kallman, Elizabeth Marie	Harvard University
Kolobov, Vladimir I.	CFD Research Corporation
Kustova, Elena	St. Petersburg State University
Le, Hai	University of California, Los Angeles
Levermore, Charles David	University of Maryland
Levin, Deborah	Pennsylvania State University
Li, Fengyan	Rensselaer Polytechnic Institute
Lu, Chunting	University of Maryland
Magin, Thierry	Von Karman Institute for Fluid Dynamics
Mieussens, Luc	Universita de Bordeaux I
Munafo, Alessandro	Von Karman Institute for Fluid Dynamics
Ohwada, Taku	Kyoto University
Pareschi, Lorenzo	Universita di Ferrara
Pekker, Leonid	Victor Technologies
Puppo, Gabriella	Universita dell'Insubria
Seal, David C	Michigan State University
Shen, Jie	Purdue University

Strauss, Walter	Brown University
Struchtrup, Henning	University of Victoria
Varghese, Philip Leslie	University of Texas at Austin
Vedula, Prakash	University of Oklahoma
Wood, Aihua	Air Force Institute of Technology
Yang, He	Rensselaer Polytechnic Institute
Yue, Yubei	College of Staten Island, CUNY

Topical Workshop 2: From the Clinic to Partial Differential Equations and Back: Emerging challenges for Cardiovascular Mathematics
January 20-24, 2014
Number of participants: 75

Organizing Committee
Leopold Grinberg, Brown University and IBM T. J. Watson Research Center
Anne Marie Robertson, University of Pittsburgh
Pablo Javier Blanco, National Laboratory for Scientific Computing and INCT in Medicine Assisted by
    Scientific Computing, Brazil
Alessandro Veneziani, Emory University
John N Oshinski, Emory University, School of Medicine
W. Robert Taylor, Emory University, School of Medicine

Speakers:
Pablo Javier Blanco, National Laboratory for Scientific Computing
Daniela Calvetti, Case Western Reserve University
Suncica Canic, University of Houston
Juan Raul Cebral, George Mason University
Luis Dorfmann, Tufts University
Sam Dudley, Brown University
Flavio Fenton, Georgia Institute of Technology
Carlos Alberto Figueroa, King's College
Leopold Grinberg, IBM
Viatcheslav Gurev, IBM
Jay Humphrey, Yale University
Alain Karma, Northeastern University
George Karniadakis, Brown University
Gideon Koren, Brown University
Dexter Liu, University of Georgia
Torbjorn Lundh, Chalmers University of Technology
Alison Marsden, University of California, San Diego
Lucas Omar Muller, Università di Trento
Mette Sofie Olufsen, North Carolina State University
John Oshinski, Emory University
Paris Perdikaris, Brown University
Julie Phillippi, University of Pittsburgh
Alfio Quarteroni, École Polytechnique Fédérale de Lausanne (EPFL)

Erzsebet Regan, Harvard University
John Jeremy Rice, IBM
Anne Marie, Robertson, University of Pittsburgh
Cody Rutledge, Brown University
Habib Samady, Emory University
W. Robert Taylor, Emory University
Frank Tong, Emory University
Arturo Valentin, University of Pittsburgh
Alessandro Veneziani, Emory University
Paul Watton, University of Oxford
Raimond Winslow, Johns Hopkins University
Ghomglei Xiong, Cornell University
Yue Yu, Brown University
Paolo Zunino, University of Pittsburgh

Workshop Description
Mathematical models have been giving remarkable contributions in advancing knowledge and supporting decisions in several branches of medicine. Some progress in applying predictive mathematical tools has been made, for example: surgical planning of the Total Cavopulmonary Connection in cardiac pediatrics is, in some hospitals, based on extensive numerical simulation. However, despite the significance, the impact of predictive modeling in the routine medical treatment falls behind.

The ultimate goal of this workshop is to foster collaboration between mathematicians and medical doctors on modeling cardiovascular system. The workshop is organized into two lines that reflect the special format of the workshop: (a) "Core topics" are up-to-date research areas in mathematics and scientific computing that still present several open exciting challenges, which can require developing new numerical models, computational approaches and validation techniques; (b) "New challenges" are a set of cardiovascular (in broad sense) problems and diseases that have not been attacked extensively with numerical tools.

The "core topics" will include fluid-structure interaction, multi-scale dynamics, data assimilation, while the "new challenges" will focus on the liver circulation, cardiac re-synchronization therapy, chronic venous insufficiency and coiling of intracranial aneurysms. The workshop will be based on round-table discussions in smaller groups and lectures.

Participants (From the Clinic to Partial Differential Equations and Back… Workshop)

Name	Organization
Alevy, Ian	Brown University
Blanco, Pablo Javier	National Laboratory for Scientific Computing
Bukac, Martina	University of Pittsburgh
Calvetti, Daniela	Case Western Reserve University
Canic, Suncica	University of Houston
Cebral, Juan Raul	George Mason University
Chung, Bong Jae	George Mason University
Davidovic, Andjela	INRIA
Di Achille, Paolo	Yale University
Dorfmann, Luis	Tufts University
Duan, Xinjie	University of Pittsburgh

Dudley, Sam	Brown University
Dzinbek, Andrea	SUNY
Ellwein, Laura	Virginia Commonwealth University
Falke, Carrie Virginia	Louisiana Tech University
Farina, Angiolo	Università di Firenze
Fenton, Flavio	Georgia Institute of Technology
Figueroa, Carlos Alberto	King's College
Forti, Davide	École Polytechnique Fédérale de Lausanne (EPFL)
Fusi, Lorenzo	Università di Firenze
Gatto, Paolo	Brown University
Gerardo Giorda, Luca	Basque Center for Applied Mathematics
Golbert, Daniel Reis	Brown University
Gopal, Venu	University of Delhi
Greenwald, Stephen Edward	Queen Mary and Westfield College
Gremaud, Pierre Alain	North Carolina State University
Grinberg, Leopold	IBM
Gurev, Viatcheslav	IBM
Humphrey, Jay	Yale University
Iffrig, Elizabeth Marie	Georgia Institute of Technology
Kandel, Sunil Mani	Oakland University
Karma, Alain	Northeastern University
Karniadakis, George	Brown University
Kim, Tae Yun	Brown University
Koren, Gideon	Brown University
Lau, Kevin Daniel	University of London
Li, Xuejin	Brown University
Li, Zhen	Brown University
Liu, Dexter	University of Georgia
Lundh, Torbjörn	Chalmers University of Technology
Marsden, Alison L.	University of California, San Diego
Muller, Lucas Omar	Università di Trento
Olufsen, Mette Sofie	North Carolina State University
Orizaga, Saulo I	Iowa State University
Oshinski, John N.	Emory University
Peng, Zhangli	Massachusetts Institute of Technology
Perdikaris, Paris	Brown University
Perla Menzala, Gustavo	Laboratorio Nacional de Computacao Cientifica
Phillippi, Julie	University of Pittsburgh
Quarteroni, Alfio	École Polytechnique Fédérale de Lausanne (EPFL)
Rangarajan, Ramsharan	Brown University

Regan, Erzsebet	Harvard University
Rice, John Jeremy	IBM
Robertson, Anne Marie	University of Pittsburgh
Rossmann, Jenn Stroud	Lafayette College
Rutledge, Cody	Brown University
Samady, Habib	Emory University
Shaw, Simon	Brunel University
Somersalo, Erkki	Case Western Reserve University
Spiteri, Raymond	University of Saskatchewan
Sun, Yi	University of South Carolina
Szopos, Marcela	Université de Strasbourg I (Louis Pasteur)
Taylor, W. Robert	Emory University
Tong, Frank	Emory University
Valentin, Arturo	University of Pittsburgh
Veneziani, Alessandro	Emory University
Venturi, Daniele	Brown University
Watanabe, Mario Sansuke Maranhao	Laboratorio Nacional de Computacao Cientifica
Watton, Paul	University of Oxford
Winslow, Raimond L.	Johns Hopkins University
Witthoft, Alexandra Elisabeth	Brown University
Xiong, Ghomglei	Cornell University
Yazdani, Alireza	Brown University
Yu, Yue	Brown University
Zunino, Paolo	University of Pittsburgh

Some Workshop Organizer Comments for "Describe the highlight of this workshop":
"The possibility of bringing together mathematicians, engineers, computer scientists and physicians has been unique. The atmosphere of the workshop was great, the size of the workshop allowed people to get in real contact with senior and young researchers. The presentations were all of high quality and the discussions promoted at the end of each day were very exciting."

"The interdisciplinarity was excellent and stimulating. We need to prepare more carefully the scheduling to keep people more engaged and give more opportunity for discussions and networking."

"Collaborations were triggered. Research of our group was exposed with great reception. Atmosphere of the workshop was great for promoting exciting discussions. ICERM infrastructure was excellent."

Some Workshop Participant Comments for "Describe the highlight of this workshop":
"The multidisciplinary background of the participants was certainly one of the most impressive highlights of the workshop. In general, we attend meetings where participants have similar backgrounds. This workshop was definitely different and much more informative. Actually, it probably was one of the very best events I ever attended. Being able to listen to presentations given by medical doctors where they ask for answers to specific problems is very refreshing."

"The most important aspect, as mathematician, has been the contact from medical people."

"I reconnected with several researchers I had not seen recently, including those from the math community who do not usually attend the biomedical / fluids meetings. The reception / poster session provided a nice opportunity for mixing. I enjoyed the discussion sessions at the end of each day."

"The multidisciplinary background of the participants was certainly one of the most impressive highlights of the workshop. In general, we attend meetings where participants have similar backgrounds. This workshop was definitely different and much more informative. Actually, it probably was one of the very best events I ever attended. Being able to listen to presentations given by medical doctors where they ask for answers to specific problems is very refreshing."

Topical Workshop 3: Mathematical Challenges in Cybersecurity
March 13-14, 2014
Number of participants: 21
This workshop was externally funded by SaTC

Organizing Committee
Henry Cohn, Microsoft Research
John Harer, Duke University
John Johnson, Pacific Northwest National Laboratory
Jill Pipher, ICERM

Workshop Description
A two-day NSF-funded strategic workshop aimed at convening a diverse group of mathematicians, computer scientists and cybersecurity experts to discuss "mathematical challenges in cybersecurity". The organizers of this workshop planned some short lectures, panel discussions and working group discussions. The goal was to generate strategies for engaging the larger mathematical community in cybersecurity, to identify the areas of mathematics most likely to lead to contributions in this area, and to plan subsequent theme-oriented workshops to accelerate these contributions.

Participants (Mathematical Challenges in Cybersecurity)

Name	Organization
Aucsmith, David	Microsoft Research
Benaloh, Josh	Microsoft Research
Carvalho, Marco	Florida Institute of Technology
Chin, Peter	Boston University
Cohn, Henry	Microsoft Research
Harer, John	Duke University
Heninger, Nadia	University of Pennsylvania
Hoffstein, Jeffrey	Brown University
Johnson, John R.	Pacific Northwest National Laboratory
Moran, Bill	University of Melbourne
Naccache, David	École Normale Supérieure
Ness, Linda	Applied Communication Sciences
Pavlovic, Dusko	University of Hawaii at Manoa
Pinch, Richard	Government Communications Headquarters

Pipher, Jill Catherine	ICERM
Pollington, Andrew	National Science Foundation
Saltman, David	Center for Communications Research
Silverman, Joseph	Brown University
Sommers, Eric	National Science Foundation
Wachter, Ralph	National Science Foundation
Walker, Homer	ICERM

Because of the unique format of this workshop, no exit surveys were collected for this program.

Topical Workshop 4: Robust Discretization and Fast Solvers for Computable Multi-Physics Models
May 12-May 16, 2014
Number of participants: 62

Organizing Committee
Franco Brezzi, University of Pavia
Jan Hesthaven, Ecole Polytechnique Fédérale de Lausanne
Michael Holst, University of California, San Diego
Jinchao Xu, Pennsylvania State University

Speakers:
Douglas Arnold, University of Minnesota
Yuri Bazilevs, University of California, San Diego
Daniele Boffi, Università di Pavia
Zhiming Chen, Chinese Academy of Sciences
Leszek Demkowicz, University of Texas at Austin
Roland Glowinski, University of Houston
Jay Gopalakrishnan, Portland State University
Leopold Grinberg, IBM
Johnny Guzman, Brown University
Ralf Hiptmair, ETH
Jun Hu, Beijing (Peking) University
George Karniadakis, Brown University
Youngju Lee, Texas State University-San Marcos
Mitchell Luskin, University of Minnesota
Yvon Maday, Brown University
Donatella Marini, Università di Pavia
Ricardo Nochetto, University of Maryland
Joachim Schöberl, Technische Universität Wien
Chi-Wang Shu, Brown University
Mary Wheeler, University of Texas at Austin
Ragnar Winther, University of Oslo
Carol Woodward, Lawrence Livermore National Laboratory
Pingwen Zhang, Beijing (Peking) University
Ludmil Zikatanov, Pennsylvania State University

Workshop Description
Most systems targeted by mathematical modeling in modern science and engineering are fundamentally multi-physical and multi-scale in nature. As such, they involve solving complex coupled, generally

nonlinear, systems of partial differential equations (PDEs) built from subsystems of PDEs that mathematically model very different physical processes, often at very different scales.

Recent advances in high-performance computer hardware and advanced numerical algorithms have made it feasible to construct realistic mathematical models and to build corresponding numerical simulation software for these types of complex multi-physics/multi-scale problems. However, developing robust, efficient, and practical numerical algorithms for such simulation software that are capable of tackling these complex mathematical models is still extremely challenging in a number of fundamental ways. For example, we do not yet have robust methods that can handle strong coupling between different physics and/or scales, and we still do not have optimal linear solvers that can reliably and efficiently treat the discretized linearized systems.

This workshop will gather together experts in the core related fields in applied and computational mathematics to exchange ideas regarding the development of robust and efficient numerical schemes that preserve the key physics of these models, and to study the development of fast and efficient linear and nonlinear solvers that are scalable and optimal. This workshop will also target young researchers and members of under-represented groups to help launch their research in this area.

Participants (Robust Discretization and Fast Solvers for Computable Multi-Physics Models)

Name	Organization
Afkhami, Shahriar	New Jersey Institute of Technology
Alexandersen, Joe	Technical University of Denmark
Antil, Harbir	George Mason University
Arnold, Douglas	University of Minnesota
Bacuta, Constantin	University of Delaware
Bazilevs, Yuri	University of California, San Diego
Boffi, Daniele	Università di Pavia
Borodachov, Sergiy	Towson State University
Brannick, James	Pennsylvania State University
Brezzi, Franco	Consiglio Nazionale delle Ricerche (CNR)
Cantin, Pierre	Électricité de France
Chen, Feng	Brown University
Chen, Long	University of California, Irvine
Chen, Yanlai	UMass Dartmouth
Chen, Zhiming	Chinese Academy of Sciences
Christiansen, Rasmus Ellebæk	Technical University of Denmark
Demkowicz, Leszek	University of Texas at Austin
Erdelyi, Bela	Northern Illinois University
Falk, Richard	Rutgers University
Gillette, Andrew Kruse	University of Arizona
Glowinski, Roland	University of Houston
Gopal, Venu	Brown University
Gopalakrishnan, Jay	Portland State University
Grinberg, Leopold	IBM

Guzman, Johnny	Brown University
Hesthaven, Jan	Ecole Polytechnique Federal de Lausanne
Hiptmair, Ralf	ETH
Hirani, Anil N.	University of Illinois at Urbana-Champaign
Holst, Michael	University of California, San Diego
Hu, Jun	Beijing (Peking) University
Hu, Xiaozhe	Pennsylvania State University
Karniadakis, George	Brown University
Lee, Youngju	Texas State University-San Marcos
Leykekhman, Dmitriy	University of Connecticut
Luskin, Mitchell	University of Minnesota
Maday, Yvon	Brown University
Mahadevan, Vijay S	Argonne National Laboratory
Marini, Donatella	Università di Pavia
Neilan, Michael Joseph	University of Pittsburgh
Nochetto, Ricardo	University of Maryland
Sarkis, Marcus	Worcester Polytechnic Institute
Schöberl, Joachim	Technische Universität Wien
Shi, Ke	Texas A & M University
Shu, Chi-Wang	Brown University
Sun, Pengtao	University of Nevada
Walker, Shawn Wesley	Louisiana State University
Wheeler, Mary	University of Texas at Austin
Winther, Ragnar	University of Oslo
Woodward, Carol	Lawrence Livermore National Laboratory
Xing, Xiaoqing	South China Normal University
Xu, Jinchao	Pennsylvania State University
Yang, Kai	Penn State University
Zhang, Pingwen	Beijing (Peking) University
Zhong, Liuqiang	South China Normal University
Zikatanov, Ludmil	Pennsylvania State University

Some Workshop Organizer Comments for "Describe the highlight of this workshop":
"Several talks on unpublished very recent work."

Some Workshop Participant Comments for "Describe the highlight of this workshop":
"This was an extremely useful opportunity for me. I was able to get to see the cutting edge research of highly successful scientists in the field and learn more about new ideas in the direction of fast and robust numerical and computational solvers. The workshop provided the opportunity for me to get to learn about recent advances in the field of finite elements and numerical analysis. The exposure to high impact research will be most beneficial to my future research direction and I look forward to using my experience here at the workshop in my research."

"The talks presented in the workshop have widely touched the area of the numerical methods of the partial differential equations occurring in different physical situations. In numerical methods, certainly the discretizations and the solvers play the most important role. So, in my opinion, the workshop is one of the successful attempt to gather some of the leading numerical analyst to present the recent development in the area of the numerical methods for PDEs occurring in the physical models."

"It is fantastic that a number of leading mathematicians in this area gathered in this conference, and there is time for free discussion. There are some interesting talks attracting the audience."

Topical Workshop 5: Computational Nonlinear Algebra
June 2-6, 2014
Number of participants: 42 (as of 5/29/14)

Organizing Committee
Greg Blekherman, Georgia Institute of Technology
Lek-Heng Lim, University of Chicago
Pablo Parrilo, MIT
Andrew Sommese, University of Notre Dame
Rekha Thomas, University of Washington

Speakers:
Henry Cohn, Microsoft Research
Harm Derksen, University of Michigan
Sandra Rocco Di , Royal Institute of Technology (KTH)
Jean-Charles Faugère, INRIA
Shmuel Friedland, University of Illinois
João Gouveia, University of Coimbra
Wenrui Hao, University of Notre Dame
Aram Harrow, Massachusetts Institute of Technology
Jonathan Hauenstein, North Carolina State University
Christopher Hillar, Mathematical Sciences Research Institute
Zuzana Kúkelová, (Czech) Technical University of Prague (ČVUT)
Abhinav Kumar, Massachusetts Institute of Technology
Joseph Landsberg, Texas A & M University
Anton Leykin, Georgia Institute of Technology
Susan Margulies, U.S. Naval Academy
Bernard Mourrain, Institut National de Recherche en Informatique Automatique (INRIA)
Giorgio Ottaviani, Universite di Firenze
James Renegar, Cornell University
J. Maurice Rojas, Texas A & M University
Agnes Szanto, North Carolina State University
Russ Tedrake, Massachusetts Institute of Technology
Frank Vallentin, Universität zu Köln
Cynthia Vinzant, University of Michigan

Workshop Description
Over the last two decades, algebraic and numerical techniques for nonlinear problems have begun a steady and relentless transition from mostly academic constructions, to widely used tools across the mathematical sciences, engineering and industrial applications. The workshop will bring together participants from many diverse fields including computer vision, cryptography, optimization and control,

partial differential equations, robotics, and quantum computation, with the common interest in nonlinear algebraic computations. The main goal is to assess the state of the art, to stimulate further progress, and to accelerate developments by bringing together these diverse communities and have them share computational challenges and successes.

Participants to date (Computational Nonlinear Algebra)

Name	Organization
Cheruvu, Vani	University of Toledo
Cifuentes, Diego Fernando	Massachusetts Institute of Technology
Cohn, Henry	Microsoft Research
Derksen, Harm	University of Michigan
Di Rocco, Sandra	Royal Institute of Technology (KTH)
Faugère, Jean-Charles	INRIA
Fawzi, Hamza	Massachusetts Institute of Technology
Friedland, Shmuel	University of Illinois
Gopal, Venu	Brown University
Gouveia, João	University of Coimbra
Hao, Wenrui	University of Notre Dame
Harrow, Aram	Massachusetts Institute of Technology
Hauenstein, Jonathan	North Carolina State University
Hillar, Christopher	Mathematical Sciences Research Institute
Kileel, Joseph David	University of California, Berkeley
Krone, Robert	Georgia Institute of Technology
Kúkelová, Zuzana	(Czech) Technical University of Prague (ČVUT)
Landsberg, Joseph	Texas A & M University
Lasserre, Jean	Centre National de la Recherche Scientifique (CNRS)
Lee, Hon Leung	University of Washington
Leykin, Anton	Georgia Institute of Technology
Liddell, Alan Claude	North Carolina State University
Lim, Lek-Heng	University of Chicago
Majumdar, Anirudha	Massachusetts Institute of Technology
Margulies, Susan	U.S. Naval Academy
Mata, Cristina	Massachusetts Institute of Technology
Mourrain, Bernard	Institut National de Recherche en Informatique Automatique (INRIA)
Ottaviani, Giorgio	Universita di Firenze
Parrilo, Pablo	Massachusetts Institute of Technology
Permenter, Frank	Massachusetts Institute of Technology
Renegar, James	Cornell University
Rojas, J. Maurice	Texas A & M University
Saunderson, James	Massachusetts Institute of Technology

Skau, Erik West	North Carolina State University
Sommese, Andrew	University of Notre Dame
Stojanac, Zeljka	Rheinische Friedrich-Wilhelms-Universitat Bonn
Szanto, Agnes	North Carolina State University
Tedrake, Russ	Massachusetts Institute of Technology
Tetali, Prasad	Georgia Institute of Technology
Thomas, Rekha	University of Washington
Vallentin, Frank	Universität zu Köln
Vinzant, Cynthia	University of Michigan

This workshop had not yet been held at the time of this report; no participant comments available this time.

Note: for upcoming programs please see Appendix B.

VI-MSS Workshops
During this reporting period, ICERM funded one plenary speaker at a VI-MSS workshop (Elias) and 19 research visits to partner Indian Institutes.

VI-MSS Lecture Series: Soergel bimodules and Kazhdan-Lusztig theory
January 20 – February 3, 2014 – IMSc, Chennai, India

Organizing Committee
Upendra Kulkarni, Chennai Mathematical Institute, Chennai
K N Raghavan, The Institute of Mathematical Sciences, Chennai

Featured Lecturer:
Benjamin Elias, Massachusetts Institute of Technology, Boston

Description
Recently, Geordie Williamson and I proved Soergel's conjecture, which is the generalization to arbitrary Coxeter systems of the Kazhdan-Lusztig conjecture, thus realizing a long-standing program of Soergel. Our proof was an algebraic adaptation of de Cataldo and Migliorini's Hodge-theoretic proof of the Decomposition Theorem in geometry. Our goal in this lecture series is to provide a thorough introduction to Hecke algebras, Soergel bimodules, and the Hodge-theoretic techniques which went into the proof of the Soergel conjecture. We will also introduce the diagrammatic tools which are used to study Soergel bimodules.

VI-MSS Research Visits to India 2013-2014
Name	Home Organization	Traveled To	Travel Dates
Blanchet, Jose	Columbia University	School of Technology and Computer Science, TIFR, Mumbai	September 1 - 30, 2013
Chari, Vyjayanthi	University of California, Riverside	IMSc, Chennai	August 1 - 31, 2013
Elias, Ben	Massachusetts Institute of Technology	IMSc, Chennai	January 1 - February 28,

			2014
Flicker, Yuval	Ohio State University	School of Mathematics, TIFR, Mumbai	January 1 - February 9, 2014
Fouque, Jean Pierre	University of California, Santa Barbara	School of Technology and Computer Science, TIFR, Mumbai	September 3 - 12, 2013
Goldberg, David Alan	Georgia Institute of Technology	School of Mathematics, TIFR, Mumbai	December 1, 2013 - January 31, 2014
Goldfeld, Dorian	Columbia University	School of Mathematics, TIFR, Mumbai	December 1, 2013 - January 31, 2014
Guzman, Johnny	Brown University	IISc, Bangalore	July 1 - July 31, 2013
Lorig, Matt	Princeton University	School of Technology and Computer Science, TIFR, Mumbai	December 31, 2013 - January 14, 2014
Lucia, Marcello	College of Staten Island, CUNY	IISc, Bangalore and Tata Institute of Fundamental Research Centre (TIRF), Bangalore	December 17-30, 2013
Lunde, Mathew A	University of California, Riverside	IMSc, Chennai	August 1 - 31, 2013
Ramanan, Kavita	Brown University	ISI, Bangalore	May 1 - June 30, 2013
Renardy, Michael	Virginia Polytechnic Institute and State University	IISc, Bangalore and Tata Institute of Fundamental Research Centre (TIRF), Bangalore	May 19 - June 26, 2013
Scrimshaw, Travis Cole	University of California, Davis	IMSc, Chennai	June 1 - July 31, 2013
Shereen, Peri	University of California, Riverside	IMSc, Chennai	July 22 - August 15, 2013
Sircar, Ronnie	Princeton University	School of Technology and Computer Science, TIFR, Mumbai	September 1 - 30, 2013
Tirupathi, Seshu	Brown University	IISc, Bangalore	October 4 - 21, 2013
Vinroot, Christopher Ryan	College of William and Mary	IMSc, Chennai	June 9 - 23, 2014
Wang, Liyao	Yale University	IISc, Bangalore	January 1, 2014 - February 25, 2014

Note: for upcoming programs 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 made up of former and future 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 4,000 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.

During this reporting cycle, 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 2013 (Washington, DC)
- MAA MathFest, Summer 2013 (Hartford, CT)
- Mathematical Field of Dreams Conference, Fall 2013 (Tempe, AZ)
- Modern Math Workshop at SACNAS, Fall 2013 (San Antonio, TZ)
- JMM, Winter 2014 (Baltimore, MD)
- SIAM Summer 2014 (Chicago, IL)

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.

ICERM Board of Trustees

Name	Institution
Barbara Keyfitz (Chair)	Ohio State University
Sir John Ball	University of Oxford

Jennifer Chayes	Microsoft Research
Peter Jones	Yale University
David Keyes	Columbia University/KAUST
Yvon Maday	Université Pierre et Marie Curie
Srinivasa Varadhan	New York University
Bin Yu	University of California at Berkeley

Note: See Appendix C for the minutes of the May 17, 2013 annual Board of Trustees meeting and subsequent December 13, 2013 conference call.

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.

ICERM Scientific Advisory Board

Name	Institution
Andrea Bertozzi (Chair)	University of California at Los Angeles
Henry Cohn	Microsoft Research
Charles Epstein (new member in 2014)	University of Pennsylvania
Anna Gilbert (new member in 2014)	University of Michigan
Sally Goldman (new member in 2014)	Google
Jun Liu	Harvard University
Robert Pego	Carnegie Mellon University
George Papanicolaou	Stanford University
Cynthia Phillips	Sandia
Guillermo Sapiro (new member in 2014)	Duke University
Richard Schwartz	Brown University
Robert S. Sutor (new member in 2014	IBM
Yuri Tschinkel	University of California at Berkeley
Peter Winkler	Dartmouth University

Charles Epstein, Anna Gilbert, Sally Goldman, Guillermo Sapiro and Robert S. Sutor joined the SAB in 2014, replacing and adding to those rotating off: Tom Dean, Juan Meza, and Andrew Odlyzko. Michael Brenner rotated off due to scheduling conflicts.

Note: see Appendix D for the minutes of the November 22-23, 2013 annual Scientific Advisory Board meeting and subsequent conference call on May 1, 2014.

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.

ICERM Education Advisory Board

Name	Institution
Thomas Banchoff (Chair)	Brown University
Karen Haberstroh	Brown University
Irina Mitrea	Institute for Mathematics and its Applications
Frank Morgan	Williams College
Allison Pacelli (new member in 2014)	Williams College
Lynn Rakatansky (new member in 2013)	RI Mathematics Teachers Association Executive Board
Kenneth Wong	Brown University

Allison Pacelli, Lynn Rakatansky joined the EAB, replacing those rotating off: David Mumford, Mary Ann Sinder, and Philip Uri Treisman

Note: see Appendix E or the minutes of the September 20, 2013 annual Education Advisory Board meeting.

Mathematics Institute Directors Meeting (MIDs)
See Appendix F for the May 2, 2014 MIDs meeting minutes.

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 IdeaLab for early career researchers. 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.

2013-2014 ICERM Postdoctoral Cohort
ICERM Postdoctoral Fellows (4 months; funds for travel to and from institute)

Name	Previous Institution	Semester
BoGwang Jeon	University of Illinois, Urbana-Champaign	Fall 2013 TGD
Rodolfo Rios-Zertuche	Princeton University (Lecturer)	Fall 2013 TGD
Ryan Greene	The Ohio State University	Fall 2013 TGD
Anastasiia Tsvietkova	Louisiana State University (VIGRE Postdoc)	Fall 2013 TGD
Danupon Nanongkai	Nanyang Technological University (Research Fellow)	Spring 2014 NGA
Amanda Redlich	Rutgers University	Spring 2014 NGA
Kyle Fox	University of Illinois at Urbana-Champaign	Spring 2014 NGA
Charalampos Tsourakakis	Carnegie Mellon University	Spring 2014 NGA

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

Name	Previous Institution	Semester
Giulio Tiozzo	Harvard University	2013-14: focus Fall TGD
Grigory Yaroslavtsev	Pennsylvania State University	2013-14: focus Spring NGA

Based on available information, the ICERM-funded postdocs for 2013-2014 break down as follows:

	Male	**Female**	
Black	0	0	
Hispanic	0	0	
American Indian/Alaskan Native	0	0	
Asian/Pacific Islands	2	0	
White	6	2	
Other (specify)	0 +	0	
	8	2	= 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	Tenure track University of HI
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 – *Spring 2012*	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	Oxford-Man University
Aaron Smith	*Fall 2012* - Spring 2013	University of Waterloo
Julio Andrade	Fall 2012 - *Spring 2013*	IHES through '14, then Univ. of Rochester

Kwangho Choiy	Spring 2013	Oklahoma State University
Zajj Daugherty	Spring 2013	Dartmouth University
Martina Lanini	Spring 2013	University of Melbourne
Ben Salisbury	Spring 2013	Tenure track at University of Michigan
BoGwang Jeon	Fall 2013	Columbia University
Rodolfo Rios-Zertuche	Fall 2013	Max Planck Institute
Ryan Greene	Fall 2013	Lecturer at Ohio State
Giulio Tiozzo	*Fall 2013* – Spring 2014	Tenure track at Yale University
Anastasiia Tsvietkova	Fall 2013	Tenure track at UC-Davis
Danupon Nanongkai	Spring 2014	To be determined
Amanda Redlich	Spring 2014	Tenure track at Bowdoin College
Kyle Fox	Spring 2014	Duke University
Charalampos Tsourakakis	Spring 2014	At time of report: offers at Google, Yahoo Research, Harvard or Imperial College
Grigory Yaroslavtsev	Fall 2013 - *Spring 2014*	University of Pennsylvania

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.

ICERM Postdoctoral Participant and Mentor list by Semester Program

Postdoc	Mentor	Program
Bruno Benedetti	Futer and Dunfield	Fall 2013 Postdoc/Independent
Ryan Greene	David Dumas	Fall 2013 ICERM Postdoctoral Fellow
Rosemary Guzman	Luisa Paoluzzi	Fall 2013 Postdoc/Independent
Neil Hoffman	Genevieve Walsh	Fall 2013 Postdoc/Independent
Ingrid Irmer	Saul Schleimer	Fall 2013 Postdoc/Independent
BoGwang Jeon	Nathan Dunfield	Fall 2013 ICERM Postdoctoral Fellow
Sara Maloni*	Jeff Brock	Fall 2013 Postdoc/Independent
Johanna Mangahas*	Jeff Brock	Fall 2013 Postdoc/Independent
Rodolfo Rios-Zertuche	Anton Zorich	Fall 2013 ICERM Postdoctoral Fellow
Mehmet Sengun*	Nathan Dunfield	Fall 2013 Postdoc/Independent
Scott Thomson	N/A (only 30 days)	Fall 2013 Postdoc/Independent
Giulio Tiozzo	Rich Schwartz	Fall 2013 ICERM Institute Postdoc
Anastasiia Tsvietkova	Marc Culler	Fall 2013 ICERM Postdoctoral Fellow
Kyle Fox	Philip Klein	Spring 2014 ICERM Postdoctoral Fellow
Blake Hunter*	Andrea Bertozzi	Spring 2014 Postdoc/Independent
Danupon Nanongkai	Gopal Pandurangan	Spring 2014 ICERM Postdoctoral Fellow
Braxton Osting*	Andrea Bertozzi	Spring 2014 Postdoc/Independent
Amanda Redlich	Eli Upfal	Spring 2014 ICERM Postdoctoral Fellow
Michaela Rombach	Andrea Bertozzi	Spring 2014 Postdoc/Independent
Charalampos Tsourakakis	Eli Upfal	Spring 2014 ICERM Postdoctoral Fellow
James von Brecht*	Andrea Bertozzi	Spring 2014 Postdoc/Independent
Grigory Yaroslavtsev	Philip Klein	Spring 2014 ICERM Institute Postdoc

*Advisor also attended the program

Graduate Student Mentoring

Graduate Student	Mentor	Program
Mark Bell*	Saul Schleimer	Fall 2013
Brian Benson*	Nathan Dunfield	Fall 2013
Lucien Clavier*	John Smillie	Fall 2013
Yongfei Ci	Nathan Dunfield	Fall 2013
Daniel Crane	Benjamen Burton	Fall 2013
Jordon Granier	Ruth Kellerhals	Fall 2013
Michael Harrison*	Sergei Tabachnikov	Fall 2013
Hengnan Hu	Igor Rivin	Fall 2013
Arielle Leitner	David Dumas	Fall 2013
Kathryn Lindsey*	John Smillie	Fall 2013
Hidetoshi Masai	Marc Culler	Fall 2013
Turaga Prathamesh	Igor Rivin	Fall 2013
Anja Randecker*	Gabriella Weitz-Schmithuesen	Fall 2013
Bidyut Sanki	Jeff Brock	Fall 2013
Nitin Singh	David Futer and Igor Rivin	Fall 2013
Robert Tang	Saul Schleimer and John Smillie	Fall 2013
Grace Work	John Smillie and David Dumas	Fall 2013

Chenxi Wu*	John Smillie	Fall 2013
Rajesh Chitnis	Philip Klein	Spring 2014
Lorenzo De Stafani	Eli Upfal	Spring 2014
Thomas Dickerson*	Paul Valiant	Spring 2014
Eli Fox-Epstein*	Philip Klein	Spring 2014
Nathanael Francois	Claire Mathieu	Spring 2014
Nicolas Garcia*	Denan Slepcev	Spring 2014
Steven Heilman*	Assaf Naor	Spring 2014
Huiyi Hu*	Andrea Bertozzi	Spring 2014
Slav Kirov*	Andrea Bertozzi	Spring 2014
Ahmad Mahmoody*	Eli Upfal	Spring 2014
Ekaterina Merkujev*	Andrea Bertozzi	Spring 2014
Scott Roche*	Rajmohan Rajaraman and Gopal Pandurangan	Spring 2014
Christopher White*	Rachel Ward	Spring 2014
Joseph Woodworth*	Andrea Bertozzi	Spring 2014
Hang Zhou*	Claire Mathieu	Spring 2014

*Advisor also attended program/acted as mentor

Note: The 2014-2015 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 2013: Summer@ICERM – Geometry and Dynamics

June 17 – August 9, 2013

Organizing Committee

Chaim Goodman-Strauss, University of Arkansas
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.

2013 Summer@ICERM Cohort

Name	Home Institute	Funding Source
Eric Chen (M)	Princeton University	NSF
Matthew Cole (M)	University of Notre Dame	NSF
Benjamin DeMeo (M)	Williams College	NSF
Kelsey DiPietro (F)	University of Illinois	NSF
Emily Fischer (F)	Harvey Mudd College	NSF
Stephanie Ger (F)	Boston College	NSF
Nicholas Lourie (M)	Brown University	Outside Funding
Nakul Luthra (M)	Brown University	Outside Funding*
Christian Munteanu (M)	Jacobs University	NSF
Jenny Rustad (F)	Luther College	NSF
Alex St. Laurent (M)	Brown University	Outside Funding*
Xidian Sun (M)	Wabash College	Outside Funding
Ananya Uppal (F)	University of IL/Urbana-Champaign	NSF
Kamron Vachiraprasith (M)	Brown University	Outside Funding*
Yuwen Wang (F)	Swarthmore College	NSF
Zijian Yao (M)	Brown University	Outside Funding*

*UTRA funded

In addition to the 16 undergraduate researchers and 2 faculty organizers, 3 teaching assistants were key members of the Summer@ICERM program: Ryan Greene, an incoming ICERM semester posdoc, 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 Participant Comments for "Describe the highlight of this program":
"Sarah Koch's mini-course on Complex Dynamics was very intriguing and inspiring."

"The fact that I am able to have my name on a published paper is the most important thing for me and also the fact that I could make so many new peers."

"I liked the opportunities I had in the colloquia to get a better feel for the different fields of mathematics."

"The highlight of this program for me was working in my research group with the other members as well as the professor and TA."

"The other young mathematicians with whom I became acquainted."

Summer@ICERM TA Comments for "Describe the highlight of this program":
"The students becoming personally invested in the problems and working hard to figure them out."

"For me, the highlight was watching write-ups of new results emerging, particularly in the last two weeks."

Participant Selection Process

The "Summer@ICERM" program ran from June 17, 2013 through August 9, 2013 with a cohort of 16 students. Ten students were funded through the NSF, and four via a Brown University Undergraduate Training and Research Award (UTRA), and one via outside funding.

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 2013 Summer@ICERM program (310) 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 102 applicants were fully qualified for the 2013 Geometry and Dynamics program. With consideration towards diversity, a rank-ordered list was generated.

Based on available information, the 2013 Summer@ICERM *ICERM funded* cohort broke down as follows:

	Male	Female
Black	0	0
Hispanic	0	0
American Indian/Alaskan Native	0	0
Asian/Pacific Islands	1	1
White	3	5
Other (specify)	0	0
	4 +	6 = 10 Total

The 6 outside funded students were made up of 2 male Asian/Pacific Islanders, and 4 white males.

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, approximately 32 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: http://icerm.brown.edu/summerug_2013.
- "A Computer Model of Paper Models of Negative Curvature" by M. Cole and B. DeMeo.
- "Gutkin's Problem in Constant Curvature Geometries and Discrete Version" by X. Sun and Y. Wang

- "Negative Snell's Law" by K. DiPietro, J. Rustad, and A. St Laurent
- "Outer Billiard on Piecewise Circular Curves and Piecewise Hyperbola Curves" by K. Vachiraprasith and Z. Yao
- "Tripod Configurations" by E. Chen, N. Lourie, and N. Luthra

Completed Student Projects

Links to these completed student project PDFs can be found at: http://icerm.brown.edu/summerug_2013.
- A paper resulted from the study of curves and polygons:
  - T. Aougab, X. Sun, S. Tabachnikov, Y. Wang "On Curves and Polygons with the Equiangular Chord Property"
- A paper resulted from the study of the periodicity of outer billiards in the hyperbolic plane:
  - E. Fischer and C. M. Munteanu "Outer Billiards and Tilings of the Hyperbolic Plane"
- A paper resulted from the study outer billiards:
  - Z. Yao "Devil's Staircase - Rotation Number of Outer Billiard with Polygonal Invariant Curves"

Expanding Summer@ICERM

ICERM will continue to explore additional sources of funding for the undergraduate program. One such program, the Leadership Alliance (http://www.theleadershipalliance.org), supports minority participation in research projects at several dozen universities and colleges including Brown. For the past three years, attempts have been made to find qualified students through the Leadership Alliance; however, the Leadership Alliance summer program cycle does not easily align with the timing of Summer@ICERM, nor has the program found Leadership Alliance students whose research interests match the offered Summer@ICERM topics. ICERM will continue to network and create relationships with organizations that can help recruit minorities.

Two to four Brown-funded students and one to two self-funded students participate each summer in the program.

The Evaluation Process: Measure to Evaluate Progress

ICERM is an institute that has a number of different programs, all with the aim of promoting and facilitating research at the intersection of mathematics and computation/experimentation. ICERM has been collecting pre and exit survey data to assess the immediate impact of its programs and determine the level of satisfaction of its participants. This type of evaluative effort is extremely important as participant satisfaction is the first step in measuring short term outputs, particularly in the area of maintaining, training, and expanding the number of researchers in the field. ICERM is currently working to further understand the impact of its programming on different subgroups and to begin measuring program outcomes in both the intermediate- and long-term.

It is important to note that not only is the conceptualization of these outcomes (e.g., advancement in computational and experimental methods in mathematics) difficult, but also the development of reliable and valid indicators (e.g., quality and impact of publications, promotion of research, collaborations and networking) presents challenges in identifying the impact of workshops and other programming on facilitating research and expanding the field. Programs can impact participants in numerous ways. Participants can benefit from training in the use of new tools, programs, and methodologies. Additionally, participants can be influenced through learning about other research in the field or by networking and developing collaborations. Consequently, measuring these types of longer-term outputs presents challenges. Yet, it is important to understand the program's impact, and thus, ICERM has fine-tuned its evaluation methods to learn from previous efforts and to refine its methods as it proceeds to develop the most useful measures.

ICERM has made several advances in the evaluation procedures used to appraise programs and events over the last few years, which will be briefly described. Additionally, ICERM has proposed two primary goals for future program evaluation: 1) identifying the differential impact of programming on various subgroups of participants and 2) specifically measuring intermediate and long-term outcomes of early career participants. These goals will be described and outlined as planned below.

Current Program Evaluation
In 2014, ICERM augmented the efforts of its internal evaluation consultant (Kathleen Banchoff) by hiring an external evaluation company: SRG. As a result, ICERM developed a more customized survey in order to have the ability to link multiple surveys (e.g., pre, post, follow-up) to each participant, including organizers, in order to track participant satisfaction and program impact over time. These are first steps in facilitating future larger-scale evaluation goals.

ICERM recently started using, and will continue to use, Qualtrics as a survey tool. Qualtrics provides myriad functions for customization and has the ability to create more complex logic patterns within the survey items. Through these functions, ICERM is able to develop surveys whereby participants are responding to items that are applicable to their experience in the program.

Additionally, Qualtrics provides an in-survey data analysis tool that will be used in the future to create preliminary reports of survey data, including participant subgroups analyses.

Unique identifiers
Due to the ability to incorporate unique identification numbers, each participant's evaluation of program components can be tracked across multiple surveys, as well as be linked with other information collected by the participant's program application (e.g., participants demographic characteristics). By tracking particular variables of interest across participants and over time, ICERM can more easily recognize the program's strengths in certain areas and may be able to tailor aspects of their programs to successfully equip individuals for a thriving and influential research career. It is important to note here that ICERM maintains the strictest standard of confidentiality with all information provided its participants. Responses are not shared or reported in any way outside of ICERM that is personally identifiable and all results are reported at the aggregate level.

Primary Goals for Future Evaluation
The two primary goals for future ICERM program evaluation focus on analyzing differential impacts on subgroups of participants and tracking immediate and long-term influences of ICERM programming on participant research and collaborations.

These evaluation efforts will provide ICERM with more in-depth analyses on how certain subgroups of program participants (e.g., minorities, women, early career researchers) are impacted by their experiences while attending ICERM programming. Additionally, the immediate (i.e., program exit surveys) and long-term (i.e., two- and five-year surveys) outcome evaluations will track whether current research and scholarly successes of individuals can be traced back to ideas generated, collaborations formed, or computational techniques learned while at ICERM.

The following section elaborates on these two goals and how they will be facilitated.

Impact on Subgroups
The first goal of future ICERM program evaluation is to understand how the institutes programming impacts different subgroups of researchers in both the immediate- (i.e., program exit surveys) and long-term (i.e., two- and five-years after program participation). For instance, does the current programming

meet the needs of unique types of participants? How can the programming address the different needs of individuals involved (e.g., different levels of education, experience, or background characteristics)?

Within the evaluation surveys given to program participants, ICERM will create an on-going analytic scheme to evaluate ICERM subgroups of interest (e.g., men vs. women, first year participants vs. multi-year participants, faculty vs. graduate students) to accomplish this goal. T-tests will best provide significance analysis of subgroups of respondents. In this way, one can determine significant differences between subgroups of respondents on key variables (e.g., program satisfaction, number of collaborations/connections made, knowledge gained).

Through the use of Qualtrics as a survey software tool, ICERM is positioned to conduct appropriate analysis for comparisons among and across subgroups such as cross-tabulation analysis of categorical data (i.e., Chi-square analysis) and t-tests within the survey website. Qualtrics also provides the opportunity to analyze longitudinal data, which will be helpful in the analysis of certain programs or seminars over time.

Intermediate and Long-Term Outcomes

The second evaluation goal is to conduct follow-up evaluations to track early career researchers in their research and scholarly successes and attribute some of those successes to ICERM attendance and collaboration. The institute believes that the definition of success, particularly among early career researchers and ICERM-funded postdocs could be best operationalized in two parts: 1) scientific connections made and scientific ideas generated from program participation (short-term) and 2) individual success (e.g., published papers, invited talks, research advancement) in a given field (long-term; two- and five-year follow-up surveys).

Measuring success in the short-term will stem from aspects of ICERM program or workshop participation and will continue to be measured in ICERM's pre and exit surveys. In these surveys, ICERM asks questions like: How are early career researchers and ICERM-funded postdocs benefitting from program participation? Are connections and/or collaborations being made? Are new ideas being generated? Success in the short-term is best conceptualized as whether ICERM participation is creating opportunities or situations where research can be advanced.

Measuring success in the long-term will be analyzed in the longitudinal surveys (i.e., two- and five year follow-up). Beginning late spring/early summer of 2014, ICERM will survey former participants to determine individual measures of success, such as published papers, invited talks, and general research advancement. Additionally, the institute will try to measure whether or not these successes can be attributed to ICERM program or workshop participation. Using websites such as Google Scholar, library databases, and ISI Web of Knowledge, as well as updated participant CVs, ICERM student interns have begun to track the most recent publications of participants and the impact of those publications (e.g., journal impact, number of citations). Once a participants publication list is created, SRG will assist with inputting the list into the web survey so that the participant can directly attribute ICERM participation to specific work. A module will be inserted into the second- and fifth-year follow-up survey that specifically targets early career researchers. The early career module will list the respondent's recent publications and ask a series of questions regarding if and how that particular publication or work is connected to ICERM. This section will be merged into the two- and five-year follow-up surveys; by doing so, the institute can also evaluate responses to more general questions that ask about the impact of networking and collaborations, ideas formed, grant applications, and so on. Through this follow-up survey, ICERM hopes to collect information that will help ICERM uncover the far-reaching impact of their program on participants, especially within the first few years of their research career.

Note: Appendix G provides samples of the institute's pre and exit surveys, as well as its inaugural 2-year

follow-up survey.

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 H.

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 $36,375 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
- Tufts University, Department of Mathematics
- UMASS Amherst, Department of Mathematics and Statistics
- Worcester Polytechnic Institute, Mathematical Sciences Department

External Support

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

In addition to the funding provided by the NSF, ICERM receives substantial in-kind financial support from Brown University. The Director is released from teaching, and two Deputy Directors are released from half of their teaching responsibilities. In addition, ICERM is not charged for the use of its building

or for custodial care which Brown values at $670,500. Brown also provides an annual seed fund from the office of Vice President of Research through the institute's first 5 years.

Other Funding Support received in 2013-2014

Additional Grants	**Amount**
MSRI Institute Diversity Grant from NSF	$16,500.00
NSF SaTC	$80,000.00
Mathematical Association of America (for GirlsGetMath@ICERM)	$ 5,000.00
Sub-total	$101,500.00

University Funding Support	
VP of Research Support (Seed Fund)	$30,000.00
Supplemental Administrative Costs	$19,457.57
Brown UTRA Program for Summer@ICERM	$15,000.00
Sub-total	$64,457.57

Sponsor Support	
Academic Sponsors	$16,375.00
Corporate Sponsors	$ 0.00
Sub-total	$16,375.00

TOTAL	$182,322.57

Outreach/Diversity

Ulrica Wilson, an Associate Professor of Mathematics at Morehouse College, was hired as ICERM's first Associate Director of Diversity and Outreach in July 2013. In this role, Ulrica provides leadership in meeting institutional diversity goals: ensuring diversity throughout ICERM's programs, assisting in the development of policies and procedures, participating in national meetings and conferences, and helping to identify and obtain funding for programs and activities.

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 Event in 2013-2014

- **2013 Modern Mathematics Workshop at SACNAS**
  October 2-3, 2013
  ICERM hosted this event in San Antonio, TX
  http://icerm.brown.edu/mmw2013/

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.

Accepted ICERM participants by EPSCoR States (to date)

EPSCoR State	# of ICERM Participants
Alabama	4
Alaska	0
Arkansas	1
Delaware	4
Guam	0
Hawaii	10
Idaho	2
Iowa	21
Kansas	5
Kentucky	3
Louisiana	15
Maine	4
Mississippi	0

Missouri	5
Montana	0
Nebraska	1
Nevada	1
New Hampshire	4
New Mexico	14
North Dakota	0
Oklahoma	9
Puerto Rico	26
Rhode Island	185
South Carolina	11
South Dakota	0
Tennessee	21
US Virgin Islands	0
Utah	7
Vermont	2
West Virgina	0
Wyoming	1
Total	**356**

Administration and Staff

ICERM Directors funded by the grant are: Jeffrey Brock, Govind Menon, Jill Pipher, and Bjorn Sandstede. Jeff Brock and Bjorn Sandstede have committed one summer month of effort to the institute as Associate Directors, Jill Pipher commits 100% time, Govind Menon received one month of salary support from the grant as Associate Director of VI-MSS. Jeff Hoffstein (the fourth PI on the grant) receives no financial support from the grant and volunteers his time for special projects at ICERM. Sergei Tabachnikov (Penn State) and Homer Walker (WPI) serve as Deputy Directors, each at 50% time, starting July 2013.

ICERM Staff

Mathew Borton, Director of IT (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.

Isani Cayetano, Technical Support Coordinator (hired in July 2011): reports to the Director of IT. 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.

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.

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.

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.

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.

Danielle Izzi, Administrative Assistant (hired May 2014): reports to both the Program and Financial Managers. Acts as receptionist/concierge and assists with basic event set-up and financial support, including processing reimbursement requests..

Brian Lavall, Events Support Technician, (part-time, hired April 2014): reports to the Director of IT. Provides A/V support for the institute's workshops and events, including teleconferences. Monitors and actively controls the Echo 360 lecture capture system and provides first level support for technical issues such as wireless connectivity and printing.

Bernadette McHugh, Web Content Editor (part-time, hired in September 2012): reports to the Senior 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.

Jenna Sousa, Program Manager (hired May 2014): 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, Senior Application Developer (hired in March 2011): reports to the Director of IT. 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.

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.
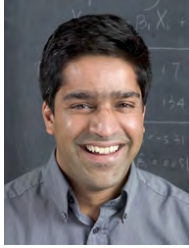

Jeffrey Brock is Professor and Chair of mathematics at Brown University. Brock's research focuses on low-dimensional geometry and topology, particularly on spaces with hyperbolic geometry. He received his undergraduate degree in mathematics at Yale University and his Ph.D. in mathematics from U.C. Berkeley, 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.

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.

Homer Walker began his term as an ICERM Deputy Director (replacing Jan Hesthaven) in July 2013. He has been a professor of mathematics at Worcester Polytechnic Institute since 1997 and previously held faculty appointments at Utah State University, the University of Houston, and Texas Tech University. He has also held visiting appointments at a number of institutions, including Cornell, Yale, and Rice Universities and Lawrence Livermore and Sandia National Laboratories. His previous administrative experience includes service as department head at WPI (1997-2002) and as program manager for the US Department of Energy Office of Science Applied Mathematics Program (2007-2008). Walker's research interests are in numerical analysis and computational mathematics, especially iterative methods for large-scale linear and nonlinear systems, implementations for high-performance computing, and applications. He recently completed a twelve-year term as an associate editor of SIAM Journal on Numerical Analysis and has served as a guest editor for ten special sections in SIAM Journal on Scientific Computing. He has also served on program committees for a number of

national and international conferences and workshops, notably the biennial Copper Mountain Conferences on Iterative Methods (since 1992), as well as on many review panels and site-visit teams for funding agencies in the US and abroad.

Ulrica Wilson is an Associate Professor of Mathematics at Morehouse College. Director of Diversity and Outreach she provides leadership in meeting institutional diversity goals: ensuring diversity throughout ICERM's programs, assisting in the development of policies and procedures, participating in national meetings and conferences, and helping to identify and obtain funding for programs and activities. Ulrica's primary research has been in noncommutative ring theory and combinatorial matrix theory. Throughout her career, she has integrated opportunities to address diversity issues in the mathematical workforce. A decade of experience includes directing the Enhancing Diversity in Graduate Education (EDGE) Program and organizing the Research Experience for Undergraduate Faculty (REUF) workshops at the American Institute of Mathematics (AIM).

Facilities

ICERM is located on the 10th and 11th floors of 121 S. Main Street, in a Brown owned building in ICERM is located on the 10th and 11th 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 Spring 2015 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.

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 model at ICERM.

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, fourteen researchers from various programs have taken 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 Schedule
Appendix B: Upcoming Programs and Events
Appendix C: Minutes from Board of Trustees Meetings
Appendix D: Minutes from Scientific Advisory Board Meetings
Appendix E: Minutes from Education Advisory Board Meeting
Appendix F: MIDs Meeting Minutes
Appendix G: Sample ICERM Surveys
Appendix H: Reported Scientific Outcomes

NSF Required Materials Available in the Appendix
Appendix I: ICERM Participant List and Summary Table
Appendix J: ICERM Financial Support List
Appendix K: ICERM Income and Expenditure Report
Appendix L: VI-MSS Income and Expenditure Report