



Institute for Computational and Experimental Research in Mathematics

Annual Report

May 1, 2016 – April 30, 2017

Brendan Hassett, Director
Mathew Borton, IT Director
Jeff Brock, Associate Director
Ruth Crane, Assistant Director
Jeffrey Hoffstein, Consulting Associate Director
Caroline Klivans, Associate Director
Jill Pipher, Consulting Associate Director
Sinai Robins, Deputy Director
Bjorn Sandstede, Associate Director
Homer Walker, Deputy Director
Ulrica Wilson, Associate Director for Diversity and Outreach

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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 May 1, 2016 through April 30, 2017

TYPE	TITLE	DATE	# ATTENDED
Topical Workshop	Effective and Algorithmic Methods in Hyperbolic Geometry and Free Groups	16-20 May 2016	66
Collaborate@ICERM	Compatible Discretizations for Efficient Uncertainty Quantification of Magneto-Hydro-Dynamic (MHD) Models	6-10 June 2016	3
Topical Workshop	Algorithmic Coding Theory	13-17 June 2016	35
Undergraduate Research	Summer@ICERM: Dynamics and Stochastics	20 June - August 12 2016	22
Topical Workshops	Illustrating Mathematics	27 June - 1 July 2016	74
Collaborate@ICERM	On The Structure of Orbit Decompositions of the Generalized Symmetric Spaces of $SL_n(k)$	11-15 July 2016	6
Collaborate@ICERM	Hilbert Series of Symplectic Torus Quotients	11-15 July 2016	3
Topical Workshop	Stochastic Numerical Algorithms, Multiscale Modelling and High-Dimensional Data Analytics	18-22 July 2016	56
Collaborate@ICERM	Computational Arithmetic Dynamics	25-29 July 2016	6
Topical Workshop	Cycles on Moduli Spaces, Geometric Invariant Theory, and Dynamics <i>(This workshop was partially supported by NSF CAREER award DMS-1350396.)</i>	1-5 August 2016	67
Collaborate@ICERM	Turbulent Flows	1-5 August 2016	5
Topical Workshop	Predictive Policing and Community Detection	8 - 12 August 2016	33
Outreach Program	GirlsGetMath@ICERM (outside funding)	15-19 August 2016	25

Semester Program	Topology in Motion	6 September - 9 December 2016	66
Semester Workshop	Unusual Configuration Spaces	12-16 September 2016	81
Semester Workshop	Stochastic Topology and Thermodynamic Limits	17-21 October 2016	89
Public Lecture	“Voting Insecurity: Why We Won’t be Able to Verify the Outcome of the 2016 Election” featuring Barbara Simons	20 October 2016	184
Semester Workshop	Topology and Geometry in a Discrete Setting	28 November - 2 December 2016	92
Public Lecture	“Visualizing the Future of Biomedicine” featuring Chris R. Johnson	1 December 2016	72
Topical Workshop <i>(co-hosted with Brown’s Division of Applied Math)</i>	Frontiers in Applied and Computational Mathematics <i>(ICERM provided space and recorded lectures; did not fund participants)</i>	4-6 January 2017	76
Collaborate@ICERM	Solving S-unit Equations in Sage	9 - 13 January 2017	6
Collaborate@ICERM	How to Compute Localized Entropy	23 - 27 January 2017	3
Topical Workshop	Current Developments in Mathematical Fluid Dynamics: Regularity, Instabilities and Turbulence	24 - 27 January 2017	68
Semester Program	Singularities And Waves In Incompressible Fluids	30 January - 5 May 2017	60
Semester Workshop	Dynamics of Small Scales in Fluids	13-17 February 2017	80
Undergraduate Program	Brown Math Department's Symposium for Undergraduates in the Mathematical Sciences (SUMS). ICERM co-sponsored	18 March 2017	66
Semester Workshop	Making a Splash - Droplets, Jets and Other Singularities	20-24 March 2017	82

Public Lecture	“Modeling Sea Ice in a Changing Climate” featuring Kenneth Golden	26 April 2017	148
Semester Workshop	Computational Aspects of Water Waves	21 April 2017	33
Semester Workshop	Water Waves	24-28 April 2017	89

Participant Summaries by Program Type
ICERM Funded Participants

	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 2016	22	8	21	0	0	3	0	11	4	10	1	6	0	0	0	1	0	0
	7 Collaboration Groups	32	13	30	1	0	3	1	27	6	8	8	5	0	0	2	2	1	0
Fall Semester '16	Semester Program	59	12	50	0	0	3	3	48	12	16	6	7	0	4	0	12	2	0
	Workshop 1	66	12	61	1	0	3	2	56	12	18	8	4	0	2	0	20	2	0
	Workshop 2	67	14	57	0	0	7	2	50	14	13	11	8	0	4	1	14	2	0
	Workshop 3	74	19	64	0	0	7	2	58	10	17	11	7	0	6	4	18	1	0
	Total	266	57	232	1	0	20	9	212	48	64	36	26	0	16	5	64	7	0
	% of # Reporting		25%		0%	0%	9%	4%		18%	24%	14%	10%	0%	6%	2%	24%	3%	0%
Spring Semester '17	Semester Program	51	9	46	0	0	10	3	39	6	12	4	12	0	2	0	11	4	0
	Workshop 1	63	15	56	0	0	23	4	49	10	18	12	8	0	5	2	5	3	0
	Workshop 2	63	15	54	0	0	13	5	51	7	20	6	9	0	4	0	13	4	0
	Workshop 3	36	8	33	0	0	8	4	28	4	9	3	7	0	2	0	8	3	0
	Workshop 4	72	15	65	0	0	20	5	58	11	17	7	15	1	2	1	14	4	0
	Total	285	62	254	0	0	74	21	225	38	76	32	51	1	15	3	51	18	0
% of # Reporting		24%		0%	0%	33%	9%		13%	27%	11%	18%	0%	5%	1%	18%	6%	0%	
Topical '16 - '17	Workshop A	50	15	48	1	0	10	1	42	6	15	11	8	0	1	4	5	0	0
	Workshop B	32	5	25	0	0	10	0	22	4	13	5	1	0	5	0	4	0	0
	Workshop C	43	13	35	0	0	2	0	29	3	16	9	6	0	0	2	7	0	0
	Workshop D	44	10	37	2	0	10	1	31	2	11	8	5	0	1	0	17	0	0
	Workshop E	57	7	50	0	0	10	0	43	10	21	4	3	0	0	0	18	1	0
	Workshop F	32	10	25	1	0	7	2	17	3	8	2	10	0	1	1	6	1	0
	Workshop G	43	11	34	1	0	10	1	31	5	14	15	7	0	1	0	0	1	0
	Total	301	71	254	5	0	59	5	215	33	98	54	40	0	9	7	57	3	0
% of # Reporting		28%		2%	0%	27%	2%		11%	33%	18%	13%	0%	3%	2%	19%	1%	0%	

Due to some participants reporting multiple ethnicities, some Total Reported Ethnicity columns may be higher than the corresponding Total Participants column.

All Participants (ICERM funded and Non-ICERM funded)

			Gender and Ethnicity							Geographical Point of Origin	
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
	Summer@ICERM 2016	36	17	34	0	0	6	0	19	35	1
	7 Collaboration Groups	32	13	30	1	0	3	1	27	27	5
Fall Semester '16	Semester Program	66	13	56	0	0	6	3	53	47	19
	Workshop 1	81	13	75	2	0	8	3	70	55	26
	Workshop 2	89	15	72	0	0	12	2	64	63	26
	Workshop 3	92	20	79	0	0	12	2	71	57	35
	Total	328	61	282	2	0	38	10	258	222	106
	% of # Reporting		22%		1%	0%	15%	4%		68%	32%
Spring Semester '17	Semester Program	60	10	54	0	0	14	3	46	42	18
	Workshop 1	80	16	67	0	0	29	4	59	63	17
	Workshop 2	82	17	67	0	0	18	5	62	60	22
	Workshop 3	44	9	40	0	0	12	4	34	30	14
	Workshop 4	89	17	77	0	0	24	5	69	62	27
	Total	355	69	305	0	0	97	21	270	257	98
	% of # Reporting		23%		0%	0%	36%	8%		72%	28%
Topical '16 - '17	Workshop A	66	19	63	1	0	11	2	53	55	11
	Workshop B	35	6	28	0	0	10	0	23	26	9
	Workshop C	74	20	63	0	0	6	3	55	63	11
	Workshop D	56	12	47	2	0	13	2	41	38	18
	Workshop E	67	8	59	0	0	13	0	50	47	20
	Workshop F	33	10	25	1	0	7	2	17	24	9
	Workshop G	68	15	50	1	0	15	3	47	65	3
	Total	399	90	335	5	0	75	12	286	318	81
	% of # Reporting		27%		2%	0%	26%	4%		80%	20%

Due to some participants reporting multiple ethnicities, some Total Reported Ethnicity columns may be higher than the corresponding Total Participants column.

ICERM Funded Speakers

		Gender and Ethnicity								Geographical Point of Origin									
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	US - West	Africa	Asia	Canada	Europe	Latin & South America	Oceania
	Summer@ICERM 2016	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
	7 Collaboration Groups	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fall Semester '16	Semester Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Workshop 1	21	4	19	0	0	0	0	16	1	7	3	1	0	0	0	9	0	0
	Workshop 2	20	3	15	0	0	1	0	11	3	2	3	3	0	2	1	6	0	0
	Workshop 3	24	10	17	0	0	2	1	14	1	6	4	2	0	3	1	7	0	0
	Total	65	17	51	0	0	3	1	41	5	15	10	6	0	5	2	22	0	0
	% of # Reporting		33%		0%	0%	7%	2%		8%	23%	15%	9%	0%	8%	3%	34%	0%	0%
Spring Semester '17	Semester Program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Workshop 1	21	3	18	0	0	5	1	13	2	7	4	2	0	1	0	4	1	0
	Workshop 2	17	2	12	0	0	0	1	12	1	4	1	2	0	1	0	7	1	0
	Workshop 3	5	1	4	0	0	0	0	2	0	1	0	0	0	0	0	4	0	0
	Workshop 4	25	6	22	0	0	7	1	19	5	9	0	4	1	0	1	5	0	0
	Total	68	12	56	0	0	12	3	46	8	21	5	8	1	2	1	20	2	0
% of # Reporting		21%		0%	0%	26%	7%		12%	31%	7%	12%	1%	3%	1%	29%	3%	0%	
Topical '16 - '17	Workshop A	22	9	21	0	0	1	1	19	2	6	5	2	0	1	2	4	0	0
	Workshop B	18	3	11	0	0	1	0	10	1	7	2	1	0	4	0	3	0	0
	Workshop C	15	2	8	0	0	1	0	6	2	3	2	4	0	0	0	4	0	0
	Workshop D	24	2	18	1	0	4	1	14	2	5	2	4	0	0	0	11	0	0
	Workshop E	16	2	11	0	0	2	0	10	3	5	1	1	0	0	0	6	0	0
	Workshop F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Workshop G	18	5	11	0	0	1	0	9	4	4	4	5	0	0	0	0	1	0
	Total	113	23	80	1	0	10	2	68	14	30	16	17	0	5	2	28	1	0
% of # Reporting		29%		1%	0%	15%	3%		12%	27%	14%	15%	0%	4%	2%	25%	1%	0%	

Due to some participants reporting multiple ethnicities, some Total Reported Ethnicity columns may be higher than the corresponding Total Participants column.

All Speakers (ICERM funded and Non-ICERM funded)

			Gender and Ethnicity							Geographical Point of Origin	
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
Summer@ICERM 2016		1	0	1	0	0	0	0	1	1	0
7 Collaboration Groups		0	0	0	0	0	0	0	0	0	0
Fall Semester '16	Semester Program	0	0	0	0	0	0	0	0	0	0
	Workshop 1	21	4	19	0	0	0	0	16	12	9
	Workshop 2	22	4	17	0	0	1	0	12	13	9
	Workshop 3	25	10	17	0	0	2	1	14	14	11
	Total	68	18	53	0	0	3	1	42	39	29
	% of # Reporting		34%		0%	0%	7%	2%		57%	43%
Spring Semester '17	Semester Program	0	0	0	0	0	0	0	0	0	0
	Workshop 1	21	3	18	0	0	5	1	13	15	6
	Workshop 2	20	3	14	0	0	0	1	14	11	9
	Workshop 3	5	1	4	0	0	0	0	2	1	4
	Workshop 4	28	6	25	0	0	7	1	22	19	9
	Total	74	13	61	0	0	12	3	51	46	28
% of # Reporting		21%		0%	0%	24%	6%		62%	38%	
Topical '16 - '17	Workshop A	23	9	22	0	0	1	1	20	16	7
	Workshop B	18	3	11	0	0	1	0	10	11	7
	Workshop C	19	2	12	0	0	1	0	9	15	4
	Workshop D	27	2	20	1	0	4	1	16	16	11
	Workshop E	18	2	13	0	0	3	0	12	12	6
	Workshop F	0	0	0	0	0	0	0	0	0	0
	Workshop G	20	5	13	0	0	2	0	11	19	1
	Total	125	23	91	1	0	12	2	78	89	36
% of # Reporting		25%		1%	0%	15%	3%		71%	29%	

Due to some participants reporting multiple ethnicities, some Total Reported Ethnicity columns may be higher than the corresponding Total Participants column.

ICERM Funded Postdocs

		Gender and Ethnicity								Geographical Point of Origin									
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	US - West	Africa	Asia	Canada	Europe	Latin & South America	Oceania
	Summer@ICERM 2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7 Collaboration Groups	1	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Fall Semester '16	Semester Program	13	2	12	0	0	2	1	12	3	6	1	1	0	1	0	1	0	0
	Workshop 1	12	2	11	0	0	2	0	11	3	4	1	1	0	1	0	2	0	0
	Workshop 2	14	2	13	0	0	2	0	13	2	5	1	2	0	2	0	2	0	0
	Workshop 3	19	3	17	0	0	4	1	16	3	7	2	1	0	2	1	3	0	0
	Total	58	9	53	0	0	10	2	52	11	22	5	5	0	6	1	8	0	0
	% of # Reporting		17%		0%	0%	19%	4%		19%	38%	9%	9%	0%	10%	2%	14%	0%	0%
Spring Semester '17	Semester Program	11	3	9	0	0	3	1	10	3	4	1	1	0	1	0	1	0	0
	Workshop 1	18	4	16	0	0	10	1	16	6	5	3	1	0	2	0	1	0	0
	Workshop 2	13	4	10	0	0	4	2	12	3	5	1	0	0	1	0	3	0	0
	Workshop 3	15	3	13	0	0	5	3	15	2	6	2	1	0	1	0	2	1	0
	Workshop 4	8	2	6	0	0	2	2	8	2	3	1	0	0	1	0	1	0	0
	Total	65	16	54	0	0	24	9	61	16	23	8	3	0	6	0	8	1	0
	% of # Reporting		30%		0%	0%	39%	15%		25%	35%	12%	5%	0%	9%	0%	12%	2%	0%
Topical '16 - '17	Workshop A	12	3	11	0	0	3	0	9	1	2	2	3	0	0	2	2	0	0
	Workshop B	6	2	5	0	0	1	0	5	0	3	1	0	0	2	0	0	0	0
	Workshop C	3	1	3	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0
	Workshop D	7	0	7	0	0	5	1	7	0	1	3	1	0	0	0	2	0	0
	Workshop E	11	3	11	0	0	3	0	9	3	4	0	0	0	0	0	3	1	0
	Workshop F	4	1	3	0	0	1	0	2	0	0	0	2	0	0	0	2	0	0
	Workshop G	4	1	4	1	0	2	0	5	0	4	0	0	0	0	0	0	0	0
	Total	47	11	44	1	0	15	1	38	4	14	6	6	0	2	3	11	1	0
	% of # Reporting		25%		3%	0%	39%	3%		9%	30%	13%	13%	0%	4%	6%	23%	2%	0%

12 postdocs received a salary from ICERM during 2016-2017: 9 males, 3 Females. Due to some participants reporting multiple ethnicities, some Total Reported Ethnicity columns may be higher than the corresponding Total Participants column.

All Postdocs (ICERM funded and Non-ICERM funded)

			Gender and Ethnicity							Geographical Point of Origin	
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
	Summer@ICERM 2016	0	0	0	0	0	0	0	0	0	0
	7 Collaboration Groups	1	1	1	0	0	0	0	1	1	0
Fall Semester '16	Semester Program	14	2	13	0	0	3	1	13	11	3
	Workshop 1	14	2	13	0	0	3	0	13	10	4
	Workshop 2	17	2	16	0	0	3	0	16	11	6
	Workshop 3	22	3	20	0	0	6	1	19	14	8
	Total	67	9	62	0	0	15	2	61	46	21
	% of # Reporting		15%		0%	0%	25%	3%		69%	31%
Spring Semester '17	Semester Program	12	3	10	0	0	3	1	11	10	2
	Workshop 1	20	4	18	0	0	11	1	18	16	4
	Workshop 2	16	4	12	0	0	4	2	14	12	4
	Workshop 3	9	2	7	0	0	2	2	9	7	2
	Workshop 4	17	4	15	0	0	5	3	17	12	5
	Total	74	17	62	0	0	25	9	69	57	17
	% of # Reporting		27%		0%	0%	36%	13%		77%	23%
Topical '16 - '17	Workshop A	13	4	12	0	0	3	0	10	9	4
	Workshop B	6	2	5	0	0	1	0	5	4	2
	Workshop C	4	1	4	0	0	0	1	2	0	4
	Workshop D	9	0	9	0	0	6	1	9	7	2
	Workshop E	11	3	11	0	0	3	0	9	7	4
	Workshop F	4	1	3	0	0	1	0	2	2	2
	Workshop G	8	2	8	1	0	2	1	9	8	0
	Total	55	13	52	1	0	16	3	46	37	18
	% of # Reporting		25%		2%	0%	35%	7%		67%	33%

Due to some participants reporting multiple ethnicities, some Total Reported Ethnicity columns may be higher than the corresponding Total Participants column.

ICERM Funded Graduate Students

		Gender and Ethnicity								Geographical Point of Origin									
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US - Midwest	US - Northeast	US - South	US - West	Africa	Asia	Canada	Europe	Latin & South America	Oceania
	Summer@ICERM 2016	4	1	4	0	0	1	0	2	1	3	0	0	0	0	0	0	0	0
	7 Collaboration Groups	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Fall Semester '16	Semester Program	14	5	14	0	0	1	2	15	7	1	1	1	0	0	0	2	2	0
	Workshop 1	16	5	16	1	0	1	2	17	7	2	3	0	0	0	0	2	2	0
	Workshop 2	18	6	18	0	0	3	2	17	7	3	1	3	0	0	0	2	2	0
	Workshop 3	18	5	18	0	0	2	1	17	5	2	1	2	0	1	1	5	1	0
	Total	66	21	66	1	0	7	7	66	26	8	6	6	0	1	1	11	7	0
	% of # Reporting		32%		2%	0%	11%	11%		39%	12%	9%	9%	0%	2%	2%	17%	11%	0%
Spring Semester '17	Semester Program	6	1	6	0	0	4	0	7	0	3	0	2	0	1	0	0	0	0
	Workshop 1	8	3	8	0	0	6	0	9	0	4	1	1	0	1	1	0	0	0
	Workshop 2	11	3	11	0	0	7	1	13	1	5	1	2	0	1	0	1	0	0
	Workshop 3	15	3	15	0	0	8	0	16	4	3	1	4	0	1	0	2	0	0
	Workshop 4	5	1	5	0	0	4	0	6	0	3	0	1	0	1	0	0	0	0
	Total	45	11	45	0	0	29	1	51	5	18	3	10	0	5	1	3	0	0
	% of # Reporting		24%		0%	0%	57%	2%		11%	40%	7%	22%	0%	11%	2%	7%	0%	0%
Topical '16 - '17	Workshop A	9	1	9	0	0	3	0	9	2	3	2	2	0	0	0	0	0	0
	Workshop B	9	2	9	0	0	6	0	9	3	2	2	0	0	1	0	1	0	0
	Workshop C	6	4	6	0	0	1	0	6	1	3	1	0	0	0	1	0	0	0
	Workshop D	8	3	8	1	0	1	0	8	0	1	1	1	0	0	0	5	0	0
	Workshop E	23	2	23	0	0	7	0	22	5	9	1	2	0	0	0	6	0	0
	Workshop F	10	4	9	0	0	5	0	6	0	6	1	2	0	1	0	0	0	0
	Workshop G	16	4	16	0	0	7	1	16	0	4	9	2	0	1	0	0	0	0
	Total	81	20	80	1	0	30	1	76	11	28	17	9	0	3	1	12	0	0
	% of # Reporting		25%		1%	0%	39%	1%		14%	35%	21%	11%	0%	4%	1%	15%	0%	0%

Due to some participants reporting multiple ethnicities, some Total Reported Ethnicity columns may be higher than the corresponding Total Participants column.

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

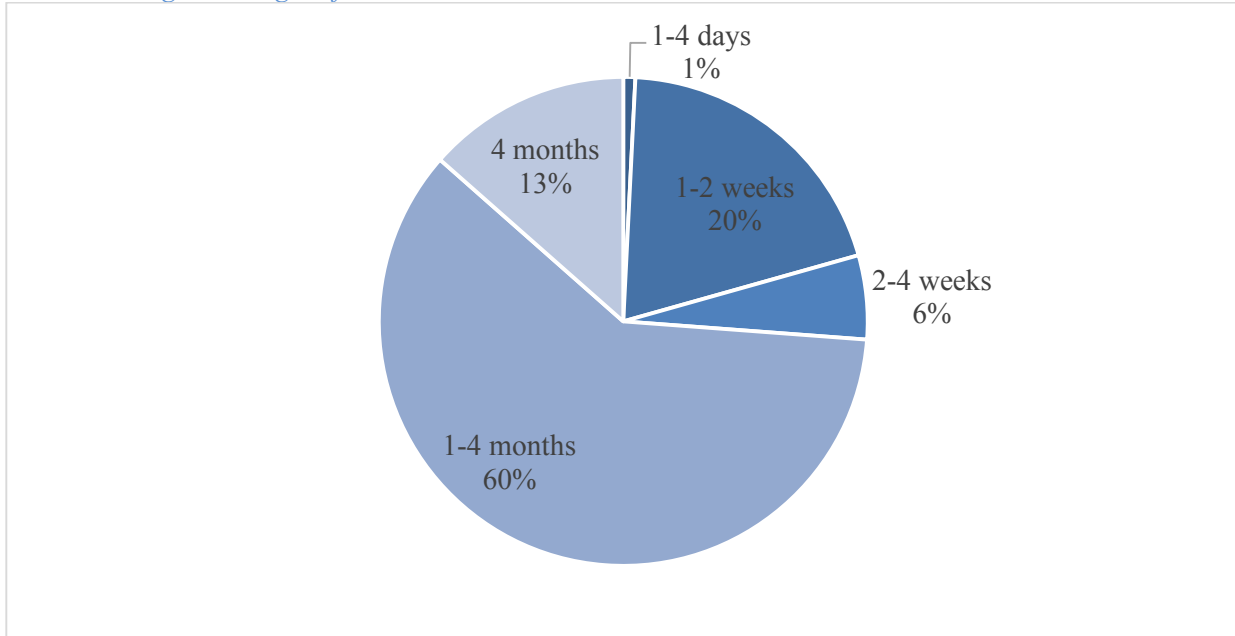
			Gender and Ethnicity							Geographical Point of Origin	
	Program Type	Total Participants	Female	# Reporting Gender	African American	American Indian	Asian	Hispanic	# Reporting Ethnicity	US Based	Foreign Based
	Summer@ICERM 2016	5	2	5	0	0	1	0	3	5	0
	7 Collaboration Groups	1	0	1	0	0	0	0	1	0	1
Fall Semester '16	Semester Program	17	5	17	0	0	3	2	18	13	4
	Workshop 1	19	5	19	1	0	3	2	20	15	4
	Workshop 2	28	6	24	0	0	6	2	23	23	5
	Workshop 3	25	5	25	0	0	4	1	23	14	11
	Total	89	21	85	1	0	16	7	84	65	24
	% of # Reporting		25%		1%	0%	19%	8%		73%	27%
Spring Semester '17	Semester Program	7	1	7	0	0	5	0	8	6	1
	Workshop 1	14	3	10	0	0	8	0	11	12	2
	Workshop 2	15	3	14	0	0	9	1	15	13	2
	Workshop 3	6	1	6	0	0	5	0	7	5	1
	Workshop 4	19	3	17	0	0	9	0	18	15	4
	Total	61	11	54	0	0	36	1	59	51	10
	% of # Reporting		20%		0%	0%	61%	2%		84%	16%
Topical '16 - '17	Workshop A	15	4	15	0	0	4	1	15	15	0
	Workshop B	12	3	12	0	0	6	0	10	10	2
	Workshop C	11	5	10	0	0	3	1	10	10	1
	Workshop D	10	4	10	1	0	2	0	10	10	5
	Workshop E	27	3	26	0	0	8	0	24	24	6
	Workshop F	11	4	9	0	0	5	0	6	6	1
	Workshop G	22	5	17	0	0	7	1	17	17	1
	Total	108	28	99	1	0	35	3	92	92	16
	% of # Reporting		28%		1%	0%	38%	3%		85%	15%

Due to some participants reporting multiple ethnicities, some Total Reported Ethnicity columns may be higher than the corresponding Total Participants column.

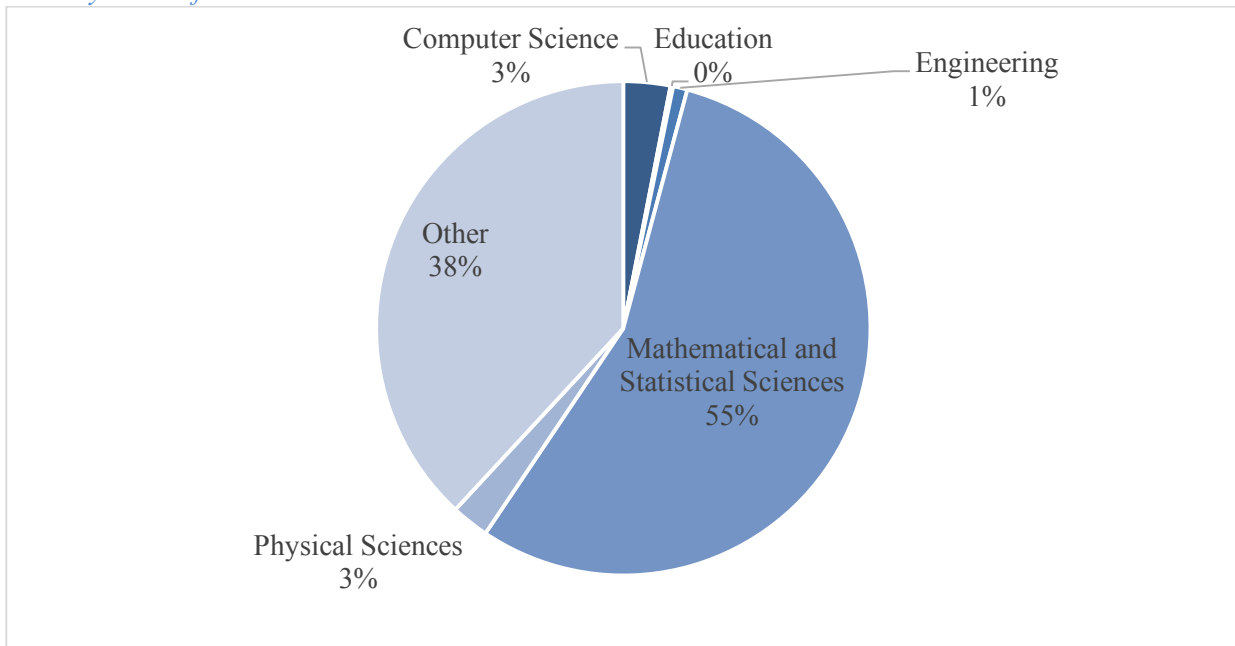
Additional Participant Data

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.

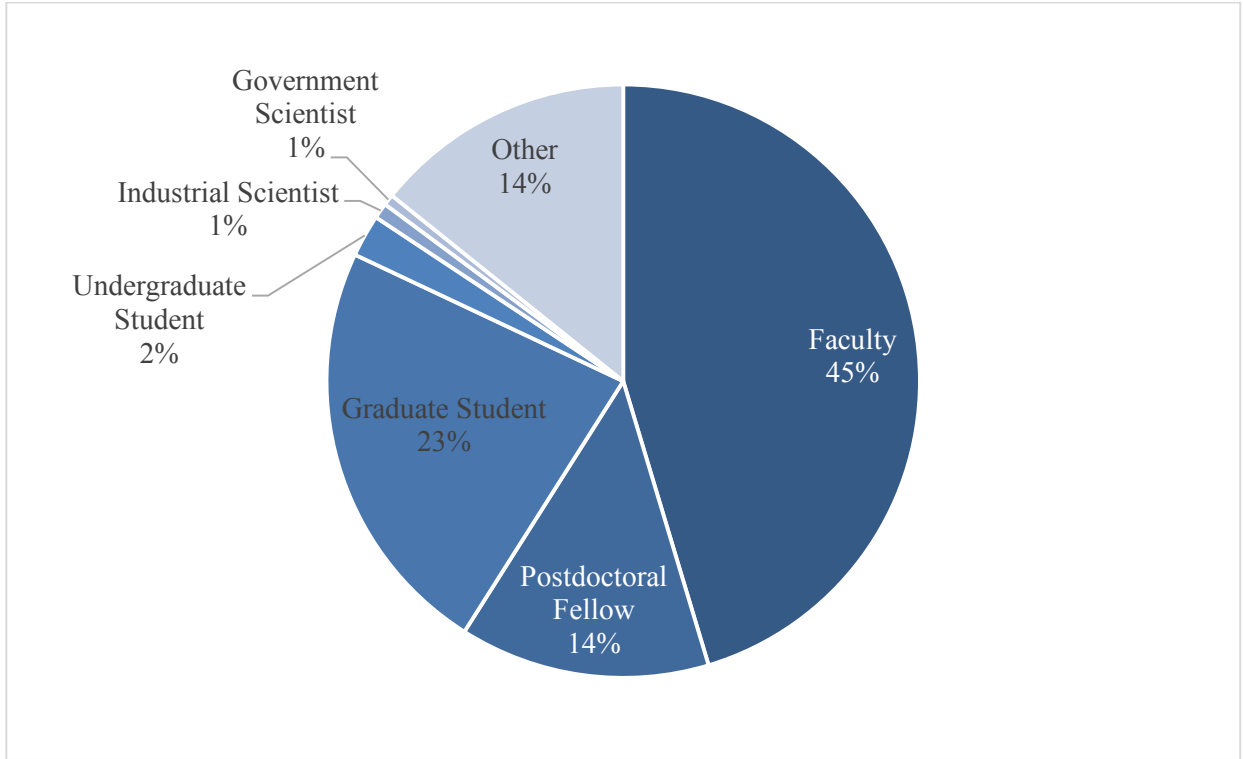
Semester Program Length of Visits



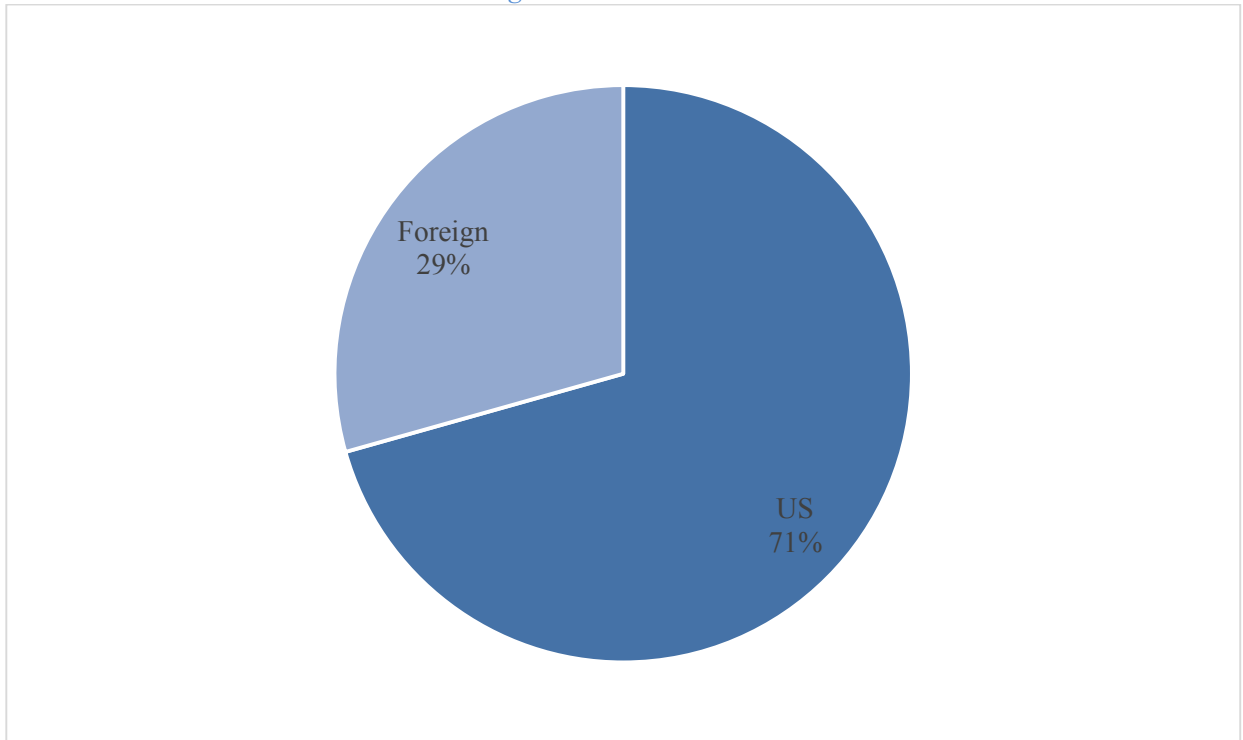
Primary Field of Interest



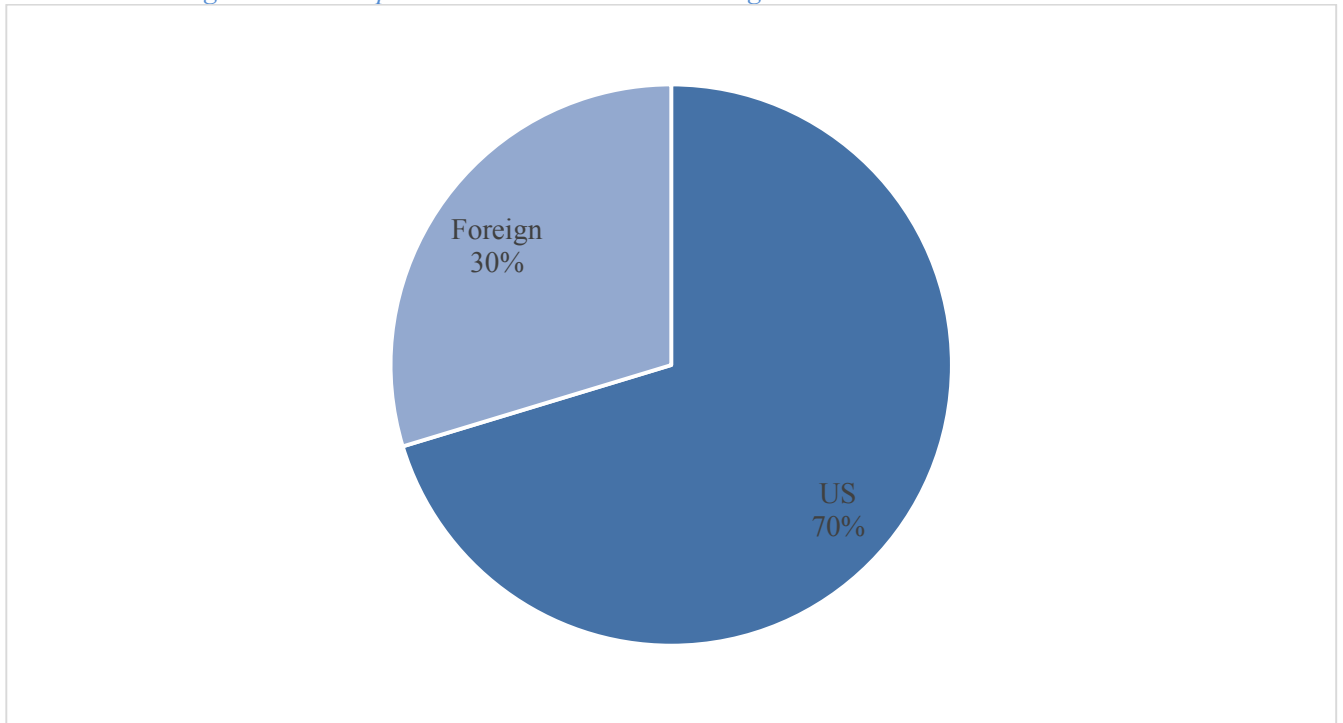
Academic Breakdown



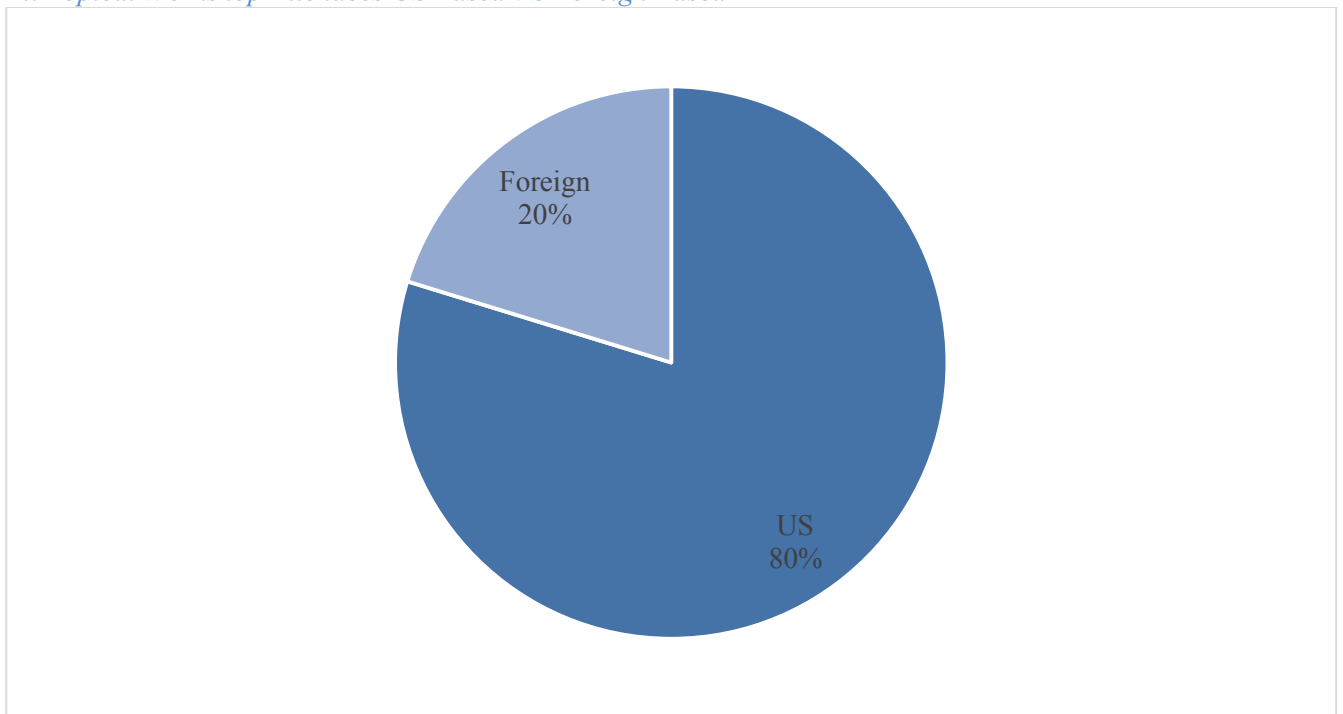
All Semester Attendees US Based VS Foreign Based



All Semester Program Workshop Attendees US Based VS Foreign Based



All Topical Workshop Attendees US Based VS Foreign Based



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 2016 annual meeting and a subsequent conference call in June resulted in the selection of semester programs and topical workshops through Spring 2019.

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 October 1st and May 1st. 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 Cube 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 proprietary “Cube” database (see also the “Recruiting and Selection of ICERM-Funded Posdocs” later in this report). 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

ICERM's proprietary "Cube" database and visitor management system is where participants go to apply for our programs. Program organizers are regularly provided a list of applicants and copies of their supporting documents and are asked to recommend a ranking of applicants for their program. 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.

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 postdoctoral fellows and 1 institute postdoctoral fellow each semester, with 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 organizers, may consist of teamwork, daily/weekly seminars, and

closing presentations. In collaboration with an ICERM director, Research Cluster organizers 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

During Semester Workshops

- Workshops last 1 week and usually consist of 50-minute talks with 10 minutes of Q&A.
- Sometimes one afternoon is left “open” for collaborations and small groups
- A poster session is scheduled early in the workshop week

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-day closing event is planned with input from the organizing committee. Some possible models include:

- 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

Note: Sample schedules and organizer timeline can be found in Appendix A

2016-2017 Semester Programs

Fall Semester 2016: Topology in Motion

September 6, 2016 - December 9, 2016

Number of long-term visitors: 66

Organizing Committee

Yuliy Baryshnikov (University of Illinois at Urbana-Champaign)

Fred Cohen (Rochester University)

Matthew Kahle (Ohio State University)

Randall Kamien (University of Pennsylvania)

Sayan Mukherjee (Duke University)

Igor Pak (University of California at Los Angeles)

Ileana Streinu (Smith College)

Rade Zivaljevic (Belgrade University)

Program Description

This thematic semester aims at exploring those areas of topology where the research challenges stem from scientific and engineering problem and computer experiments rather than the intrinsic development of the

topology proper. In this context, topology is a toolbox of mathematical results and constructions which impacts and inspires developments in other areas. Born as a supporting discipline, aimed at creating a foundation of intuitive notions immensely useful in differential equations and complex analysis, algebraic topology remains indispensable in many disciplines.

Our goal here is to concentrate on relatively recent areas of research enabled, in particular, by the computational revolution in mathematical discovery.

The past decade has seen a surge of interest in applied topology, a vaguely defined area that became a focus of attraction for several communities neighboring mathematics proper - biology, engineering, computer science, data analysis, to name a few. The central lure of this emerging area is the feeling that the flexibility afforded by the passage from geometric constructions to analysis *situs*, analysis of (mutual) positions, can be a powerful force in applications. The meta-goal of this project is to contribute to the development of the original view of topology as analysis *situs*: the extraction of discrete, combinatorial invariants from continuous shapes.

Here is a sample of the topics to be covered: moduli spaces of linkages, hinges and origami; configuration spaces of hard disks and coverings; topological robotics; topology of random simplicial complexes and random varieties; topology in condensed matter; high-dimensional expanders; equipartitions and Tverberg type theorems.

Workshop 1: Unusual Configuration Spaces

September 12-16, 2016

Number of Participants: 80

Organizing Committee

Yuliy Baryshnikov (University of Illinois)

Michael Farber (Queen Mary, University of London)

Misha Kapovich (UC Davis)

Randall Kamien (University of Pennsylvania)

Ileana Streinu (Smith College)

Workshop Description

This workshop will bring together researchers interested in a panoply of unusual configuration spaces, arising in applied fields or in plausible models, to look for similarities or creative tensions between them.

Classical configuration spaces in mechanics are spaces of tuples of material points in Euclidean 3D space, sometimes constrained by the mutual distances or just precluding coincidences of any two particles. The no- k -equal configuration spaces and their generalizations relax the no-coincidence conditions allowing some number (greater than 1) of points to coincide. Linkages and origami (hinged structures) represent another well-established class of configuration spaces. Despite many spectacular results on the topology and geometry of the configuration (or moduli) spaces of such mechanical constructions, many natural questions are hard and remain unanswered. In general, neither the topology (even for generic structures), nor singularities of the configuration spaces are known beyond the simplest examples. Beyond serial linkages (robot arms), configuration spaces in robotics are the source of many unsolved questions, such as the tantalizing question concerns caging a polygonal 2D shape by a finite collection of pointlike "fingers". Even more exotic are the configuration spaces of hard balls, arising from the archetypal model of statistical physics, Boltzmann gas. Their topology has not been addressed in any detail until very recently, and many basic questions such as the connectivity of the configuration spaces of the hard balls in the "gaseous" regime are unknown.

Along with the mathematical aspects, computational experimentation aspects will be highlighted, as well as applications ranging from path planning algorithms for robots, reconfiguration strategies for origami and protein folding.

Fall Semester Workshop 1 Participants (Unusual Configuration Spaces)

Name	Organization
Aaron Abrams*	Washington and Lee University
Anani Komla Adabrah	University of Texas at Dallas
Victor Alexandrov*	Sobolev Institute of Mathematics
Roger Alperin	San Jose State University
Hannah Alpert	Massachusetts Institute of Technology
Eric Babson	University of California, Davis
Yuliy Baryshnikov	University of Illinois at Urbana-Champaign
Pavle Blagojevic*	Freie Universität Berlin
Jozef Bodnar	Stony Brook University
Ciprian Borcea*	Rider University
John Bowers*	James Madison University
Philip Bowers	Florida State University
Toen Castle*	University of Pennsylvania
Bryan Chen	University of Massachusetts
Jeremy Cochoy	INRIA
Fred Cohen	University of Rochester
Robert Connelly*	Cornell University
Justin Curry	Duke University
Sergey Dyachenko	University of Illinois
Chaim Even-Zohar	Hebrew University of Jerusalem
Michael Farber	Queen Mary University of London
Eva Marie Feichtner	University of Bremen
Mark Goresky	Institute for Advanced Study
Jelena Grbic*	University of Southampton
Bárbara Gutiérrez	CINVESTAV
Michael Harrison	Pennsylvania State University
Maria Hempel	WPI
Patricia Hersh	North Carolina State University
Anil Hirani	University of Illinois at Urbana-Champaign
Miranda Holmes-Cerfon*	Courant Institute of Mathematical Sciences
Pat Hooper	City College of New York
Thomas Hull	Western New England University
Marija Jelic	University of Belgrade
Filip Jevtic	University of Texas at Dallas
Matthew Kahle	Ohio State University

Randall Kamien	University of Pennsylvania
Michael Kapovich	University of California, Davis
Caroline Klivans	Brown University
Nicholas Kosar	University of Illinois at Urbana-Champaign
Mickaël Kourganoff *	Grenoble University
Vaibhav Kukreja	Quantitative Scientific Solutions, LLC
Miroslav Kures	Technical University of Brno (VUT)
Woden Kusner	Graz University of Technology
Rob Kusner	University of Massachusetts, Amherst
Deniz Kutluay	Indiana University at Bloomington
Wai Yeung Lam	Freie Universität Berlin
Quang-Nhat Le	Brown University
Isaac Mabillard	IST Austria
Robert MacPherson	Institute for Advanced Study
Greg Malen	Ohio State University
Alessia Mandini*	Università di Pavia
Jeremy Mason	Bogaziçi University
John McCleary	Vassar College
John Millson*	University of Maryland
Graeme Milton*	University of Utah
Tom Needham	University of Georgia
Andrew Newman	Ohio State University
Anthony Nixon	Lancaster University
Naomi Oppenheimer*	Princeton University
Steve Oudot	INRIA
Gaiane Panina*	St. Petersburg Institute of Informatics
Kyle Parsons	Ohio State University
Jose Perea	Michigan State University
Martin Raussen	Aalborg University
Katie Ritchey	Ohio State University
Érika Roldán Roa	Center of Investigations in Mathematics (CIMAT)
Jose Alejandro Samper Casas	University of Washington
Vikram Saraph	Brown University
Josef Schicho*	Johannes Kepler University
Michael Schmiedeberg*	Universität Erlangen-Nürnberg
Dirk Schuetz*	University of Durham
Bernd Schulze	Lancaster University
Benjamin Schweinhart	Harvard University
Don Shimamoto	Swarthmore College
Yitzchak Solomon	Brown University

Ileana Streinu	Smith College
Daniel Sussman*	University of Pennsylvania
Sergei Tabachnikov*	Pennsylvania State University
Victor Turchin*	Kansas State University
John Wiltshire-Gordan	University of Michigan
Rade Zivaljevic	University of Belgrade

*Workshop Speaker

Some Workshop Organizer Comments for “Briefly describe workshop highlights”:

“The main goal, which was successfully met, was to bring together researchers from different areas of mathematics (including applied math) and physics studying various aspects of exotic configuration spaces, establish new connections, etc.”

Some Workshop Participant Comments for “Briefly describe workshop highlights”:

“I was able to present new results and inform my colleagues on the problems I believe to be relevant and important. In parallel I managed to discuss important work and get progress with other colleagues I already collaborated with.”

“(1) Randy Kamien and his team offered a wonderful perspective of applying topological methods to real physical systems. (2) Different manifestations of Gauss curvature modifications in discrete setting (kirigami, fullerene modifications). (3) Models based on special bar linkages (equilateral, equiangular polygons in the plane and space (Robert Connelly)) and more.”

“The workshop brought in people of different areas of research including topology, geometry, mechanics, fluid dynamics, physics of crystals, etc, to discuss similar techniques, methods, spaces, and objects appearing in all these areas.”

“This was a nice possibility to present my own recent results to my colleagues which have very high scientific reputation, discuss my results with those colleagues, learn more about recent (very often, yet unpublished) results of other participants of the workshop, and discuss technical peculiarities of the methods they use in their study. All these possibilities are very important for me.”

Workshop 2: Stochastic Topology and Thermodynamic Limits

September 12-16, 2016

Number of Participants: 89

Organizing Committee

Matthew Kahle (Ohio State University)

Sayan Mukherjee (Duke University)

Shmuel Weinberger (University of Chicago)

Ileana Streinu (Smith College)

Patrick Charbonneau (Duke University)

Workshop Description

This workshop will explore topological properties of random and quasi-random phenomena in physical systems, stochastic simulations/processes, as well as optimization algorithms. Practitioners in these fields have written a great deal of simulation code to help understand the configurations and scaling limits of both the physically observed and computational phenomena. However, mathematically rigorous theories to support the simulation results and to explain their limiting behavior are still in their infancy.

Randomness is inherent to models of the physical, biological, and social world. Random topology models are important in a variety of complicated models including quantum gravity and black holes, filaments of dark matter in astronomy, spatial statistics, and morphological models of shapes, as well as models appearing in social media. The probabilistic method, theory of point processes, and ideas from stochastic and integral geometry have been central tools for proofs and efficient algorithms to measure topological quantities, such as Betti numbers of random geometric complexes.

The workshop topics include: random simplicial complexes, topological invariants in Gaussian random fields, and topological aspects of phase transitions, and geometry and topology of hard disks. A major theme of this workshop will center around computational issues and numerical experiments based on existing models and implementations.

Fall Semester Workshop 2 Participants (Stochastic Topology and Thermodynamic Limits)

Name	Organization
Ian Alevy	Brown University
Hannah Alpert	Massachusetts Institute of Technology
Antonio Auffinger*	Northwestern University
Eric Babson*	University of California, Davis
Tom Banchoff	Brown University
Loretta Barolini	Springer
Yuliy Baryshnikov	University of Illinois at Urbana-Champaign
Abdessamad Ben Hamza	Concordia University
Andrew Blumberg	University of Texas at Austin
Omer Bobrowski*	Duke University
Ciprian Borcea	Rider University
Magnus Botnan	Technical University of Munich
Michael Catanzaro	University of Florida
Benoit Charbonneau*	University of Waterloo
Patrick Charbonneau	Duke University
Bryan Chen	University of Massachusetts
Sergei Chmutov*	Ohio State University
Jeremy Cochoy	INRIA
Fred Cohen	University of Rochester
Moon Duchin*	Tufts University
Chaim Even-Zohar	Hebrew University of Jerusalem
Michael Farber*	Queen Mary University of London
Christopher Fowler	University of Washington
Silvio Franz*	Universite Paris-Sud
Joseph Fu	University of Georgia
Terrence George	Brown University
Mark Goresky	Institute for Advanced Study
Anna Gundert	University of Cologne

Felix Günther	Technische Universität Berlin
Maria Hempel	WPI
Patricia Hersh	North Carolina State University
Yasu Hiraoka*	Tohoku University
Christopher Hoffman*	University of Washington
Matt Insall	Missouri University of Science and Technology
Sorin Istrail	Brown University
Marija Jelic	University of Belgrade
Filip Jevtic	University of Texas at Dallas
Natasa Jonoska*	University of South Florida
Matthew Kahle	Ohio State University
Yoav Kallus*	Santa Fe Institute
Richard Kenyon*	Brown University
Steven Kim	Brown University
Jaek Kim	Princeton University
Caroline Klivans*	Brown University
Nicholas Kosar	University of Illinois at Urbana-Champaign
Robin Koytcheff	University of Massachusetts, Amherst
Deniz Kutluay	Indiana University at Bloomington
Wai Yeung Lam	Technische Universität Berlin
Quang-Nhat Le	Brown University
Antonio Lerario*	International School for Advanced Studies (SISSA/ISAS)
Michael Lesnick	Princeton University
Daniel Luckhardt	Universität Göttingen
Erik Lundberg*	Florida Atlantic University
Zheng Ma	Princeton University
Isaac Mabillard	IST Austria
Robert MacPherson	Institute for Advanced Study
Greg Malen	Ohio State University
Jeremy Mason	Bogaziçi University
Elizabeth Meckes*	Case Western Reserve University
Anthea Monod	Duke University
Sayan Mukherjee	Duke University
Vidit Nanda	University of Pennsylvania
Andrew Newman	Ohio State University
Steve Oudot	INRIA
Elliot Paquette*	Weizmann Institute of Science
Kyle Parsons	Ohio State University
Sanjay Ramassamy	Brown University
Jacob Richey	University of Washington

Katie Ritchey	Ohio State University
Vanessa Robins*	The Australian National University
İarika Roldı́n Roa	Center of Investigations in Mathematics (CIMAT)
Ron Rosenthal*	ETH Zurich
Jose Alejandro Samper Casas	University of Washington
Vikram Saraph	Brown University
Benjamin Schweinhart	Harvard University
Lily Silverstein	University of California, Davis
Yitzchak Solomon	Brown University
Ileana Streinu	Smith College
Jonathan Taylor	Stanford University
Salvatore Torquato*	Princeton University
Katharine Turner*	EPFL
Shmuel Weinberger	University of Chicago
John Wiltshire-Gordan	University of Michigan
Takeru Yano	Osaka University
Ren Yi	Brown University
Xufan Zhang	Brown University
Rade Zivaljevic	University of Belgrade

*Workshop Speaker

Some Workshop Organizer Comments for “Briefly describe workshop highlights”:

“For me personally this workshop provided new insight and opened a window for the applications of probabilistic methods to problems relevant my research (Topology in discrete setting, higher dimensional expanders, etc.).”

“I wish we had found a better way to bridge the different perspectives of the participants. We clearly had a lot of interest in common, but we could have benefitted from having some (more) “translators” between fields.”

“I would like to use the new model for random simplicial complexes, as proposed in the lecture of Michael Farber, for testing the threshold probabilities for some properties of complexes (r -unavoidable complexes) which play a central role in Tverberg-Van Kampen-Flores type results.”

“The discovery of random-simplicial complexes....”

Some Workshop Participant Comments for “Briefly describe workshop highlights”:

“I met a slice of a community doing research very much related to my own, but I didn't know it existed until this workshop.”

“Every single female speaker gave a fantastic talk. I enjoyed meeting people working on similar research topics, but who I'd not encountered before. The social functions were great (Monday reception and poster session).”

“The highlight of this workshop for me was two conversations that I had during the lunch breaks on Thursday and Friday. These separately outlined research projects that could take several years to complete, and would establish strong ties between the field of topology and mathematical physics. One of them involved a potential collaboration with a researcher who I met for the first time at this workshop, and the other involved colleagues I had already known.”

Workshop 3: Topology and Geometry in a Discrete Setting

November 28 – December 2, 2016

Number of Participants: 92

Organizing Committee

- Eva Maria Feichtner (ALTA, University of Bremen)
- Larry Guth (Massachusetts Institute of Technology)
- Gil Kalai (Hebrew University of Jerusalem)
- Roman Karasev (Moscow Institute of Physics and Technology)
- Elchanan Mossel (University of Pennsylvania and U.C. Berkeley)
- Igor Pak (UCLA)
- Rade Zivaljevic (Mathematical institute SASA, University of Belgrade)

Workshop Description

While the semester program as a whole is inspired by the original view of topology as analysis situs fueled by applications in natural sciences and engineering, this workshop emphasizes the impact of topology and geometry on discrete structures.

Combinatorially inspired configuration spaces, such as arrangements of points, lines, hyperplanes, polytopes, and the like, provide intricate material and ongoing challenge for topological and geometric techniques. The latter have often gone through a process of adjustment towards their discrete, stratified objects, as in the case of discrete Morse theory or application of Fourier analysis. Notably, the recent solution of the log-concavity conjecture for matroids by Adiprasito, Huh and Katz was achieved by developing Hodge theory for combinatorial geometries which opens up most exciting perspectives on further applications. The construction of higher dimensional expanders is yet another promising direction. Inspired by the rich theory of graph expanders and drawing on the techniques of combinatorial algebraic topology, the goal is to design high-dimensional simplicial complexes with strong connectivity properties. New applications abound, like the impact of discrete geometry on social choice and mathematical economics through balancing theorems and equilibrium configurations.

This workshop is about building bridges - providing intricate, combinatorially inspired spaces to the topologist and geometer, and versatile geometric tools to the combinatorialist. Computational and algorithmic aspects as well as experimental evidence are crucial for this purpose.

Fall Semester Workshop 3 Participants (Topology and Geometry in a Discrete Setting)

Name	Organization
Henry Adams	Colorado State University
Karim Adiprasito*	Hebrew University of Jerusalem
Sharareh Alipour	Sharif University of Technology
Hannah Alpert	Massachusetts Institute of Technology
Laura Anderson*	Binghamton University (SUNY)
Ahmed Umer Ashraf	University of Western Ontario

Serhii Avvakumov	IST Austria
Eric Babson*	University of California, Davis
Alexander Barvinok*	St. Petersburg State University
Yuliy Baryshnikov*	University of Illinois at Urbana-Champaign
Ulrich Bauer	Technical University of Munich (TUM)
Bruno Benedetti*	Freie Universität Berlin
Bhaswar Bhattacharya	University of Pennsylvania
Ciprian Borcea	Rider University
Bryan Chen	University of Massachusetts
Jeremy Cochoy	INRIA
Fred Cohen	University of Rochester
James Davis	Indiana University at Bloomington
Emanuele Delucchi*	University of Fribourg
Graham Denham	University of Western Ontario
Anton Dochtermann	Texas State University
Alperen Ergur	North Carolina State University
Chaim Even-Zohar	Hebrew University of Jerusalem
Eva Marie Feichtner	University of Bremen
Christopher Fowler	University of Washington
Florian Frick*	Cornell University
Alex Gamburd*	CUNY
Alexey Garber	The University of Texas Rio Grande Valley
Chad Giusti	University of Pennsylvania
Mark Goresky *	Institute for Advanced Study
Gillian Grindstaff	University of Texas at Austin
Anna Gundert*	University of Cologne
Larry Guth	Massachusetts Institute of Technology
Zach Haney	Northeastern University
Maria Hempel	WPI
Patricia Hersh*	North Carolina State University
Christopher Hoffman	University of Washington
June Huh*	Princeton University
Kristof Huszar	IST Austria
Matt Insall	Missouri University of Science and Technology
Marija Jelic	University of Belgrade
Cliff Joslyn	Pacific Northwest National Laboratory
Martina Juhnke-Kubitzke*	University of Osnabrück
Matthew Kahle	Ohio State University
Yael Karshon*	University of Toronto
Caroline Klivans	Brown University

Nicholas Kosar	University of Illinois at Urbana-Champaign
Slava Krushkal*	University of Virginia
Deniz Kutluay	Indiana University at Bloomington
Wai Yeung Lam	Technische Universität Berlin
Emanuel Lazar	University of Pennsylvania
Quang-Nhat Le	Brown University
Avi Levy	University of Washington
Isaac Mabillard*	IST Austria
Robert MacPherson	Institute for Advanced Study
Greg Malen	Ohio State University
Fedor Manin	University of Toronto
Benjamin Matschke	University of Bordeaux
Roy Meshulam*	Technion-Israel Institute of Technology
Isabella Novik*	University of Washington
Steve Oudot	Inria
Giovanni Paolini	Scuola Normale Superiore of Pisa
Kyle Parsons	Ohio State University
Pavel Paták	Hebrew University of Jerusalem
Zuzana Patáková *	Hebrew University of Jerusalem
Christoph Pegel	Universität Bremen
Thomas Peters	University of Connecticut
James Pommersheim	Reed College
Margaret Readdy	University of Kentucky
Érika Roldán Roa	Center of Investigations in Mathematics (CIMAT)
Elia Saini	Université de Fribourg
Jose Alejandro Samper Casas	University of Washington
Vikram Saraph	Brown University
Benjamin Schweinhart	Harvard University
Don Shimamoto	Swarthmore College
Steven Simon*	Wellesley College
Pablo Soberón*	Northeastern University
Yitzchak Solomon	Brown University
Mentor Stafa	Indiana University-Purdue University
Ileana Streinu	Smith College
Ngoc Mai Tran*	University of Texas at Austin
José Antonio Vilches	University of Sevilla
Uli Wagner*	IST Austria
Han Wang	North Carolina State University
John Wiltshire-Gordan	University of Michigan
Charles Wolf	Rutgers University

Russ Woodroffe	Mississippi State University
Masashi Yasumoto	Kobe University
Josephine Yu*	Georgia Institute of Technology
Stephan Zhechev	IST AUSTRIA
Alena Zhukova	St. Petersburg State University
Rade Zivaljevic	University of Belgrade

*Workshop Speaker

Some Workshop Organizer Comments for “Briefly describe workshop highlights”:

“The lectures of Mark Goresky, Uli Wagner, June Huh, and many others were (as expected) a combination of mathematical insight, depth and content. This is what we expected, as organizers, from them and other principal invited speakers. For this reason I would select the lecture of Laura Anderson (about the role of hyperfields in matroid theory and tropical geometry), as one of the key events and highlights of the workshop. Roy Martina, June Krushkal.”

“A brief look at the directory where I collected events and interactions during the program "Topology in Motion" shows that I have have created 33 sub-directories with names, themes, and events. A large part of that is directly related to the third workshop. My strongest impression is that, considering the interactions and contacts, this was one of the most intense periods in my life.”

Our intention (as the organizers of the workshop) was to bring together some of the leading experts in the field (as invited speakers). As it turned out some other well-known experts were in the audience which created a very stimulating and lively atmosphere for discussion and exchange of ideas.

Some Workshop Participant Comments for “Briefly describe workshop highlights”:

“I enjoyed seeing collaborators, and working with them during "off-times" of the workshop. I enjoyed many of the talks, though one stood out in my mind. I really enjoyed Laura Anderson's talk about matroids over hyperfields. Perhaps due to my ignorance, the idea of a hyperfield was new to me, and I enjoyed learning something new that felt fundamental in some sense. It was nice to have a talk that did not attempt -- I think -- to present new independent research, but instead presented results of someone else, since Laura was able not only to present new ideas, but also put them into context and say why they were so interesting and wonderful, in a way that the original "inventor" of the mathematics perhaps could not, either due to his proximity to his own work, or else tact. I thought to myself, oh, it would be so nice if every workshop would have some at least one or two talks that were so "basic" in this sense, and presented by someone other than the author.”

“In addition to the stimulating talks and collaborative research environment, the highlight of this workshop for me was the poster session. Many very engaging projects with a significant visual component were presented, and allowed me to gain a sense for a variety of research topics I had not encountered previously.”

“It was gathering full of brilliant mathematicians. I have enjoyed to talk several people that I have never met before. There was a nice mixture of topics presented. On the other hand workshop was dominated by algebraic topologist. It was a pity that combinatorics part of the organizing crew did not even show up, not to mention absence of combinatorial talks.”

“I made myself familiar with the state of the art in several different fields in computational topology and discrete geometry. Most importantly I met people with similar interests and had many conversations

which influenced my current work. I am generally very happy I attended the workshop. Thank you for giving me this opportunity.”

All Long-term Visitors to Fall 2016 Semester Program

Gray highlight represents anyone staying over 9 days. Speakers...

Name	Organization	Time Spent at ICERM (days)
Henry Adams	Colorado State University	8
Hannah Alpert	Massachusetts Institute of Technology	127
Eric Babson	University of California, Davis	95
Yuliy Baryshnikov	University of Illinois at Urbana-Champaign	92
Andrew Blumberg	University of Texas at Austin	11
Ciprian Borcea	Rider University	97
Bryan Chen	University of Massachusetts	94
Jeremy Cochoy	INRIA	90
Fred Cohen	University of Rochester	88
Robert Connelly	Cornell University	7
Justin Curry	Duke University	84
Sergey Dyachenko	University of Illinois	95
Chaim Even-Zohar	Hebrew University of Jerusalem	97
Michael Farber	Queen Mary University of London	47
Eva Marie Feichtner	University of Bremen	87
Christopher Fowler	University of Washington	51
Joseph Fu	University of Georgia	5
Mark Goresky	Institute for Advanced Study	108
Anna Gundert	University of Cologne	60
Larry Guth	Massachusetts Institute of Technology	5
Bárbara Gutiérrez	CINVESTAV	101
Maria Hempel	WPI	95
Patricia Hersh	North Carolina State University	100
Anil Hirani	University of Illinois at Urbana-Champaign	7
Christopher Hoffman	University of Washington	70
Miranda Holmes-Cerfon	Courant Institute of Mathematical Sciences	7
Marija Jelic	University of Belgrade	96
Filip Jevtic	University of Texas at Dallas	43
Matthew Kahle	Ohio State University	84
Randall Kamien	University of Pennsylvania	6
Michael Kapovich	University of California, Davis	8
Caroline Klivans	Brown University	97
Nicholas Kosar	University of Illinois at Urbana-Champaign	97
Deniz Kutluay	Indiana University at Bloomington	95

Wai Yeung Lam	Brown University	95
Quang-Nhat Le	Brown University	97
Michael Lesnick	Princeton University	48
Isaac Mabillard	IST Austria	122
Robert MacPherson	Institute for Advanced Study	108
Greg Malen	Ohio State University	95
Jeremy Mason	Bogaziçi University	106
Roy Meshulam	Technion-Israel Institute of Technology	7
Sayan Mukherjee	Duke University	49
Vidit Nanda	University of Pennsylvania	13
Andrew Newman	Ohio State University	41
Anthony Nixon	Lancaster University	15
Steve Oudot	INRIA	77
Gaiane Panina	St. Petersburg Institute of Informatics	85
Kyle Parsons	Ohio State University	86
Martin Raussen	Aalborg University	24
Katie Ritchey	Ohio State University	42
Érika Roldán Roa	Center of Investigations in Mathematics	95
Jose Alejandro Samper Casas	University of Washington	126
Vikram Saraph	Brown University	95
Benjamin Schweinhart	Harvard University	99
Pablo Soberón	Northeastern University	6
Yitzchak Solomon	Brown University	94
Ileana Streinu	Smith College	97
Jean Taylor	Courant Institute, NYU	7
Jonathan Taylor	Stanford University	7
Uli Wagner	IST Austria	19
Shmuel Weinberger	University of Chicago	55
John Wiltshire-Gordan	University of Michigan	122
Christian Wolf	City College of New York	9
Rade Zivaljevic	University of Belgrade	100

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

Some Semester Organizer Comments for “Briefly describe program highlights”:

“The facilities at ICERM are first rate, and I would compare it to any mathematics research institute in the world. The highlight of this particular program was the unique mix of researchers who the program attracted. The mix of topics was broad but coherent, and it was also a very friendly group so there was a good feeling of congeniality and community.”

“I felt that ICERM exposed me to new aspects of the subject, and provided the opportunity to work with graduate students, and postdocs. Some examples are listed next. 1. Jose Samper and I started to consider “exterior Stanley-Reisner rings” with associated combinatorics. We experimented with several cases

which we were using as a guide. I learned much more about combinatorial aspects of this setting. 2. John Gordon explained some new directions with configuration spaces together with how and why they are compelling from his point of view. 3. Chaim Even Zohar, Eric Babson, and I considered spaces of tangles, and their properties. 4. A grad student in engineering at MIT named Greg Dreyfus (not officially part of ICERM) visited to try to develop a "configuration space of obstructions" to certain questions in 3D printing. This represents some initial attempts at some simple models. 5. I was also exposed to some very interesting work by Eric Babson, Matt Kahle, Rade Zivaljevic, and Mark Goresky."

Some Semester Organizer Comments for "What, if any, specific projects or collaborations did you pursue during this program?":

"Continued a long-running project with Bob MacPherson on configuration spaces. Continued a collaboration with Christopher Hoffman, Chris Fowler, and Greg Malen on random simplicial complexes. Also, enjoyed several conversations with people. In particular I had several productive conversations with Sayan Mukherjee. it was valuable for me to meet with Uli Bauer when he visited, to talk about discrete Morse theory."

"1. A project with Jose Samper on distinguishing simplicial complexes via exterior Stanley-Reisner rings. 2. A project with Chaim Even Zohar, and Eric Babson on spaces of tangles. 3. A project with Mark Goresky concerning Jacobi forms, and the cohomology of some natural spaces. 4. A project with Greg Dreifus (engineering grad student at MIT, not an official participant at ICERM) on a model for 3D printing."

Some Long-Term Participant Comments for "Briefly describe program highlights":

"I appreciated the stimulating events and the excellent conditions for research. The opportunity to develop a nuanced dialog and discuss interesting problems with young researchers was another highlight."

"The facilities at ICERM are first rate, and I would compare it to any mathematics research institute in the world. The highlight of this particular program was the unique mix of researchers who the program attracted. The mix of topics was broad but coherent, and it was also a very friendly group so there was a good feeling of congeniality and community."

" Several very enlightening talks during the workshop on configuration spaces * Discussions with Baryshnikov, Zivaljevic and their students * Time and facilities to pursue own research efforts"*

Some Long-term Visitor Comments for "What, if any, specific projects or collaborations did you pursue during this program?":

"I collaborated (under very favorable conditions offered by ICERM) with Prof. Ileana Streinu on a project with the title "Auxetic deformations and elliptic curves". The resulting paper was recently posted on the arXiv: 1612.02100."

"The systematic construction of discrete Morse function. Realizations of persistence barcodes by smooth Morse functions."

"We initiated a project to calculate the entropy of point clouds in compact spaces. We continued a project to identify the geometric signatures of phase transitions in configurations spaces of disks. I continued to refine metrics on the space of regular cell complexes embedded in Euclidean space."

"1. A project with Jose Samper on distinguishing simplicial complexes via exterior Stanley-Reisner rings. 2. A project with Chaim Even Zohar, and Eric Babson on spaces of tangles. 3. A project with Mark Goresky concerning Jacobi forms, and the cohomology of some natural spaces. 4. A project with Greg

Dreifus (engineering grad student at MIT, not an official participant at ICERM) on a model for 3D printing.”

“Continued a long-running project with Bob MacPherson on configuration spaces. Continued a collaboration with Christopher Hoffman, Chris Fowler, and Greg Malen on random simplicial complexes. Also, enjoyed several conversations with people. In particular I had several productive conversations with Sayan Mukherjee. it was valuable for me to meet with Uli Bauer when he visited, to talk about discrete Morse theory.”

Some Postdoc Comments for “Briefly describe program highlights”:

“The last workshop and the space to meet new people in the institute.”

“I enjoyed Matt Kahle's group meetings where I got to know the participants mathematically. I expect to interact with them in the future.”

“Making new scientific connections during the workshops, especially the last one.”

Some Postdoc Comments for “What, if any, specific projects or collaborations did you pursue during this program?”:

“On Stanley-Reiner ideals associated to general Cohomology rings. With fellow participants. Various projects of how to compute invariants for configuration spaces, posets and related Combinatorial objects. Continued some work left from my phd thesis.”

“I worked on a project (not related to the program) with Moon Duchin about step 2 nilpotent groups and their CC metrics. I worked on some ideas about discrete versions of configuration spaces of disks with Matt Kahle and Larry Guth. I helped Erika Roldan investigate some easy questions about non-attacking rooks on polyominoes, to prepare for a talk proposal.”

“All are currently in very early development: 1. Methods to compute entropy of materials (with Jeremy Mason) 2. Knotting of embedding graphs (with Bob MacPherson) 3. New definition of fractal dimension based on Persistent Homology (with Henry Adams).”

Some Graduate Student Comments for “Briefly describe program highlights”:

“ICERM was a great experience for me! Amazing motivating atmosphere and opportunity to work with other students and with experts! I have some good results any many new connections, so I really give thanks to ICERM!”

“The Grad Students and PostDoc Seminars where very good and we had the opportunity to share what we are working on and to have very interesting feedback, comments and suggestions. The workshops also where very good. The computational facilities that we have to do simulations and computations are very good.”

“The computational boot camp, all three conferences, talks in Brown math department, postdoc/grad student seminars, presenting my poster, working together with other participants.”

Some Graduate Student Comments for “What, if any, specific projects or collaborations did you pursue during this program?”:

“I continued to work on the project with my advisor and a professor who was at Icerm, and I started three other collaborations.”

“Two projects related to the combinatorial properties of discrete metric spaces.”

“I began a collaboration with others at ICERM which experimentally studied torsion in homology of Linial–Meshulam random simplicial complexes. We have a paper in progress on the results which will appear on the arXiv soon.”

“Random Polyominoes and non-attacking rook positions. Configurations spaces of Polyominoes. Topology features of the Discrete Eden Growth Model.”

“I started a joint project with another participant about a program which simulates random walk on the space of knot diagrams for given knot type. I also had the opportunity to learn about representations of finite categories from another participant and we formulated an alternative definition of Khovanov Homology.”

Note: for upcoming programs please see Appendix B.

Spring Semester 2017: Singularities and Waves in Incompressible Fluids

January 30 – May 5, 2017

Number of long-term visitors: 60

Organizing Committee

Bernard Deconinck (University of Washington)

Yan Guo (Brown University)

Diane Henderson (Pennsylvania State University)

Helena Nussenzweig Lopes (Federal University of Rio de Janeiro)

Govind Menon (Brown University)

Paul Milewski (University of Bath)

Walter Strauss (Brown University)

Jon Wilkening (University of California - Berkeley)

Program Description

Incompressible fluids are an abundant source of mathematical and practical problems. The question of global-in-time regularity versus finite-time singularity formation for incompressible fluids, governed by the Navier-Stokes or Euler equations, has been one of the most challenging outstanding problems in applied PDE. There have also been new developments in the study of the onset of turbulence due to linear and nonlinear instabilities in incompressible fluids. Interfacial and surface water waves are physical phenomena that, in addition to the challenges outlined above, involve the evolution of free boundaries. These problems embody many of the mathematical challenges found in studies of nonlinear PDEs.

Progress on these topics is possible because of advances in analysis, numerical computations and physical experiments. In addition, ocean field observations provide a reality test to all conclusions and invite new problems to be addressed. In this program, we provide a venue for interaction among researchers engaged in all of these problem-solving techniques to focus on topics arising in incompressible fluids.

Topics of particular interest include: singularity formation, stability and bifurcation; the modeling and analysis of simplified phenomenological models for the description of coherent structures; and time-dependent and steady free boundary problems including water waves, vortex sheets, capillary problems with contact lines and viscous waves with boundary layers.

Workshop 1: Dynamics of Small Scales in Fluids

February 13 - 17, 2017

Number of Participants: 80

Organizing Committee

Yan Guo (Brown University)

Tom Hou (California Institute of Technology)

Helena Nussenzveig Lopes (Universidade Federal do Rio de Janeiro)

Robert Pego (Carnegie Mellon University)

Vladimir Sverak (University of Minnesota)

Edriss S. Titi (Texas A&M University and Weizmann Institute of Science)

Workshop Description

Most of the scientific interest in incompressible fluid dynamics is, in one way or another, associated with the dynamics of small scales. In particular, the generation and amplification of small-scale motions is at the heart of the analysis of instabilities, of the problem of finite-time singularities, of fluid-structure interaction and of the study of both onset and fully developed turbulence. This topic has a long history and remains very active today. As the mathematical toolbox increases and with the improvement of high-speed computing, it has seen considerable progress in recent years. In this workshop we will focus on exploring this point-of-view while showcasing recent results and encouraging new collaborations.

Spring Semester Workshop 1 Participants (Dynamics of Small Scales in Fluids)

Name	Organization
Hannah Alpert	Massachusetts Institute of Technology
David Ambrose	Drexel University
Claude Bardos*	University of Paris
Dwight Barkley*	University of Warwick
Dongfen Bian	Beijing Institute of Technology
Animikh Biswas	University of Maryland Baltimore County
Anne Bronzi	State University of Campinas (UNICAMP)
Tristan Buckmaster*	New York University
Roberto Camassa	University of North Carolina
Kyudong Choi	Ulsan National Institute of Science and Technology
Peter Constantin	Princeton University
Anne-Laure Dalibard*	Pierre-and-Marie-Curie University
Prabir Daripa	Texas A&M University
Hongjie Dong	Brown University
Sergey Dyachenko	University of Illinois
Tarek Elgindi*	Princeton University
Volker Elling*	University of Michigan
Baylor Fox-Kemper	Brown University
Isabelle Gallagher*	Université Paris Diderot
Pierre Germain	New York University
Javier Gomez-Serrano*	Princeton University
Julien Guillod	University of Minnesota
Yan Guo	Brown University

Daozhi Han	Indiana University at Bloomington
Diane Henderson	Pennsylvania State University
Seok Hyun Hong	Pohang University of Science and Technology (POSTECH)
Wenqing Hu	Missouri University of Science and Technology (formerly University of Missouri, Rolla)
Chunyan Huang	Brown University
Vera Mikyoung Hur	University of Illinois at Urbana-Champaign
Sameer Iyer	Brown University
Jin Woo Jang	Institute for Basic Science
In-Jee Jeong	Princeton University
Jiayin Jin	Georgia Institute of Technology
Jim Kelliher*	University of California, Riverside
Kazuki Koga	Kyoto University
Hyunju Kwon	University of British Columbia
Donghyun Lee	University of Wisconsin-Madison
Zongyuan Li	Brown University
Linhan Li	Brown University
Zhilin Li	North Carolina State University
Jinkai Li*	Weizmann Institute of Science
Zhiwu Lin*	Georgia Institute of Technology
Erin Linebarger	University of Utah
Jian-Guo Liu*	Duke University
Milton Lopes Filho	Federal University of Rio de Janeiro
Anna Mazzucato*	Pennsylvania State University
Govind Menon	Brown University
Cecilia Mondaini	Texas A&M University
Toan Nguyen*	Pennsylvania State University
Dongjuan Niu	Capital Normal University
Helena Nussenzveig Lopes	Federal University of Rio de Janeiro
Katie Oliveras	Seattle University
Benoit Pausader	Princeton University
Bob Pego	Carnegie-Mellon University
Bartosz Protas	McMaster University
Yue Pu	Carnegie-Mellon University
Antoine Remond-Tiedrez	Carnegie-Mellon University
Aakash Sane	Brown University
Harvey Segur	University of Colorado at Boulder
Joseph Skitka	Brown University
Robert Strain*	University of Pennsylvania

Walter Strauss	Brown University
Changhui Tan	Rice University
Lizheng Tao	University of California, Riverside
Ian Tice	Carnegie-Mellon University
Edriss Titi	University of California, Irvine
Olga Trichtchenko	University College London
Vishal Vasan	International Centre for Theoretical Sciences
Fabian Waleffe*	University of Wisconsin-Madison
Zhenfu Wang	University of Maryland
Xuecheng Wang	Princeton University
Clarence Wayne	Boston University
Miles Wheeler	Courant Institute of Mathematical Sciences
Klaus Widmayer	Brown University
Jon Wilkening	University of California, Berkeley
Xiaoqian Xu	University of Wisconsin-Madison
Ling Xu	University of Michigan, Ann Arbor
Yao Yao*	Georgia Institute of Technology
Chongchun Zeng*	Georgia Institute of Technology
Andrej Zlatos*	University of California, San Diego

*Workshop Speaker

Some Workshop Organizer Comments for “Briefly describe workshop highlights”:

“As a theoretician who works mainly on other topics, I seldom have had an opportunity to hear about the kind of progress that has been made in numerical computation of transition to turbulence. The speakers on numerics in this workshop successfully communicated to the theoreticians some outstanding open problems that may be accessible to analysis. In particular there was the discussion of Waleffe on the possible nature of the separatrix in Couette flow, and that of Barkley on how directed polymer percolation models appear appropriate to describing spatio-temporal transition.”

“The talks on vortex sheets and on non-uniqueness of Navier-Stokes equations were breakthroughs in the fields.”

“There was more than one, but the most relevant to my current research was the wonderful talk of Isabelle Gallagher on the rigorous derivation of linearized Boltzmann dynamics from deterministic particle dynamics. How the BBGKY hierarchy was handled and estimated will be directly relevant for a current project of ours.”

Some Workshop Participant Comments for “Briefly describe workshop highlights”:

“This was a very nice workshop in my area of expertise. However, I would have liked to see more talks of computational and experimental nature. The two computational talks were about the results of the simulations, not the techniques to simulate.”

“There was more than one, but the most relevant to my current research was the wonderful talk of Isabelle Gallagher on the rigorous derivation of linearized Boltzmann dynamics from deterministic particle dynamics. How the BBGKY hierarchy was handled and estimated will be directly relevant for a current project of ours.”

“The highlight of this workshop for me was the high quality work presented on the talks. Many new ideas and tools has been recently developed and it is great to have to opportunity to learn more about it. Certainly, this will help me in the development of my projects.”

“(a) Edriss Titi did a great job of asking questions to the speakers. Often these questions clarified what the speaker tried to say. (b) The lectures that struck me as the most interesting were those by Volker Elling, Isabelle Gallagher, Dwight Barley and Tristan Buckmaster.”

“Lots of good time for discussions following the talks. Several of the talks were really amazing, and because they were somewhat outside my main research area, I learned a lot about things I am not so familiar with.”

Workshop 2: Making a Splash - Droplets, Jets and Other Singularities

March 20-24, 2017

Number of Participants: 82

Organizing Committee

Govind Menon (Brown University)

Paul Milewski (University of Bath)

Benoit Pausader (Brown University)

Jon Wilkening (University of California - Berkeley)

Workshop Description

This conference will explore several themes: (a) physical and computer experiments on the formation of singularities in fluids through state-of-the-art simulations and high speed, high resolution imaging of droplets, filaments, jets, splashes, jumps, and vortical structures, and (b) the development of theoretical models for the analysis of such phenomena. Our principal goal is to stimulate the interaction between analysts, modellers and experimentalists in the area, especially since much of the experimental work remains to be explained.

Spring Semester Workshop 2 Participants (Making a Splash - Droplets, Jets and Other Singularities)

Name	Organization
Siddhant Agrawal	University of Michigan
Hannah Alpert	Massachusetts Institute of Technology
David Ambrose	Drexel University
Mayank Bajpayi	Brown University
Claude Bardos	University of Paris
Andrea Bertozzi*	University of California, Los Angeles
Dongfen Bian	Beijing Institute of Technology
James Bird*	Boston University
Lydia Bourouiba*	Massachusetts Institute of Technology
Frederik Brasz	Boston University
Kenny Breuer*	Brown University
Anne Bronzi	State University of Campinas (UNICAMP)
John Bush*	Massachusetts Institute of Technology

Roberto Camassa	University of North Carolina
Radu Cimpanu	Imperial College London
Didier Clamond	University of Nice-Sophia Antipolis
Diego Cordoba*	ICMAT
Bernard Deconinck	University of Washington
Hongjie Dong	Brown University
James Duncan	University of Maryland
Matthew Durey	University of Bath
Sergey Dyachenko	University of Illinois
Jens Eggers*	University of Bristol
Thomas Fai	Harvard University
Baylor Fox-Kemper	Brown University
Carlos Galeano Rios*	University of Bath
Roseanna Gossmann	Tulane University
Yan Guo	Brown University
Diane Henderson	Pennsylvania State University
Seok Hyun Hong	Pohang University of Science and Technology (POSTECH)
Chunyan Huang	Brown University
Vera Mikyoung Hur	University of Illinois at Urbana-Champaign
William Irvine*	University of Chicago
Ildoo Kim	Brown University
Georgy Kitavtsev*	University of Bristol
Kazuki Koga	Kyoto University
Yue Liu	University of Texas at Arlington
Detlef Lohse*	Twente University
Milton Lopes Filho	Federal University of Rio de Janeiro
Pavel Lushnikov*	University of New Mexico
Shreyas Mandre*	Brown University
Martin Maxey	Brown University
Anna Mazzucato	Pennsylvania State University
Govind Menon	Brown University
Paul Milewski	University of Bath
Cecilia Mondaini	Texas A&M University
Andre Nachbin*	IMPA
Toan Nguyen	Pennsylvania State University
Trinh Nguyen	Pennsylvania State University
Helena Nussenzweig Lopes	Federal University of Rio de Janeiro
Katie Oliveras	Seattle University
Amir Pahlavan	Massachusetts Institute of Technology
Benoit Pausader	Princeton University

Bob Pego	Carnegie-Mellon University
Dirk Peschka*	Weierstrass Institute for Applied Analysis and Stochastics (WIAS)
Yue Pu	Carnegie-Mellon University
Saad Qadeer	University of California, Berkeley
Antoine Remond-Tiedrez	Carnegie-Mellon University
Rolf Ryham	Fordham University
Aakash Sane	Brown University
Harvey Segur	University of Colorado at Boulder
Michael Siegel*	Boston University
Denis Silantyev	University of New Mexico
Walter Strauss	Brown University
Esteban Tabak	New York University
Sigurdur Throroddsen*	King Abdullah University of Science & Technology
Ian Tice	Carnegie-Mellon University
Edriss Titi	University of California, Irvine
Anna-Karin Tornberg*	Kungliga Tekniska Högskolan
Olga Trichtchenko	University College London
Vishal Vasan	International Centre for Theoretical Sciences
Petia Vlahovska*	Brown University
Xuecheng Wang	Princeton University
Miles Wheeler	Courant Institute of Mathematical Sciences
Klaus Widmayer	Brown University
Jon Wilkening	University of California, Berkeley
Thomas Witelski*	Duke University
Xiaoqian Xu	University of Wisconsin-Madison
Ling Xu	University of Michigan, Ann Arbor
Ehud Yariv	Technion
Longhua Zhao	Case Western Reserve University
Chunyue Zheng	Pennsylvania State University

*Workshop Speaker

Some Workshop Organizer Comments for “Briefly describe workshop highlights”:

“All the experimental techniques showcased in this workshop were new to me.”

Some Workshop Participant Comments for “Briefly describe workshop highlights”:

“The week's presentations showed latest developments in electrokinetic phenomena (Vlahovska) and numerical methods (Tornberg), both areas close to mine. I feel confident now with knowledge of state of the art.”

“The program was perfectly constructed in order to facilitate useful discussions between the participants. As opposed to many of the conferences with many parallel sessions and lots of running around, the fact that we had some of the key researchers in the field spend ample time for collaborative discussions was very useful, particularly from my perspective as an early career scientist.”

“I was able to see advanced applications of some tools of which I knew only what is essentially necessary for what I have done so far. I was also able to discuss these subjects with experts and to obtain suggestions on how to improve my modelling methods based on work I was previously unfamiliar with.”

“There were people with a wide range of interests. There was a particularly strong array of innovative experimental people. I learned about new phenomena, but also about new techniques, probing problems on smaller length and time scales than I had known before. There were also impressive talks on more specialised numerical techniques, such as the boundary integral method.”

“During the talks, some secondary topics came up, which in a sense accidentally are also highly interesting for me at the moment. I had the chance to discuss this with some people. Also, some of the theoretical results which I showed, had been of immediate interest for experimentalists. So I am very happy how the workshop went.”

Workshop 3: Computational Aspects of Water Waves

April 21, 2017

Number of Participants: 33

Organizing Committee

Paul Milewski (University of Bath)

Emilian Parau (University of East Anglia)

Workshop Description

Water wave problems often require specific computational tools, and computations often inform the search for theoretical results. This workshop will bring both of these aspects together. Topics to be discussed include methods and results for steady and unsteady waves, including boundary integral, conformal maps and Euler truncations, with applications to capillary, gravity, flexural, vortical, electrohydrodynamic, and geophysical waves.

Spring Semester Workshop 3 Participants (Computational Aspects of Water Waves)

Name	Organization
Hannah Alpert	Massachusetts Institute of Technology
Dongfen Bian	Beijing Institute of Technology
Mark Blythe*	University of East Anglia
Anne Bronzi	State University of Campinas (UNICAMP)
Roberto Camassa	University of North Carolina
John Carter	Seattle University
Didier Clamond	University of Nice-Sophia Antipolis
Bernard Deconinck	University of Washington
Hongjie Dong	Brown University
Sergey Dyachenko	University of Illinois
Carlos Galeano Rios	University of Bath
Yan Guo	Brown University
Diane Henderson*	Pennsylvania State University
Seok Hyun Hong	Pohang University of Science and Technology (POSTECH)

Vera Mikyoung Hur	University of Illinois at Urbana-Champaign
Kazuki Koga	Kyoto University
Yue Liu	University of Texas at Arlington
Milton Lopes Filho	Federal University of Rio de Janeiro
Govind Menon	Brown University
Paul Milewski	University of Bath
Cecilia Mondaini	Texas A&M University
Toan Nguyen	Pennsylvania State University
Helena Nussenzveig Lopes	Federal University of Rio de Janeiro
Katie Oliveras	Seattle University
Demetrios Papageorgiou*	Imperial College London
Emilian Parau*	University of East Anglia
Benoit Pausader	Princeton University
Bob Pego	Carnegie-Mellon University
Yue Pu	Carnegie-Mellon University
Saad Qadeer	University of California, Berkeley
Antoine Remond-Tiedrez	Carnegie-Mellon University
Harvey Segur	University of Colorado at Boulder
Walter Strauss	Brown University
Ian Tice	Carnegie-Mellon University
Edriss Titi	University of California, Irvine
Olga Trichtchenko	University College London
Jean Marc Vanden Broeck	University College London
Vishal Vasan	International Centre for Theoretical Sciences
Samuel Walsh	University of Missouri
Xuecheng Wang	Princeton University
Miles Wheeler	Courant Institute of Mathematical Sciences
Klaus Widmayer	Brown University
Jon Wilkening	University of California, Berkeley
Xiaoqian Xu	University of Wisconsin-Madison

*Workshop Speaker

No surveys were distributed for this one-day workshop.

Workshop 4: Water Waves

April 24-28, 2017

Number of Participants: 89

Organizing Committee

Bernard Deconinck (University of Washington)

Diane Henderson (Pennsylvania State University)

Alexandru Ionescu (Princeton University)

Walter Strauss (Brown University)

Catherine Sulem (University of Toronto)

Workshop Description

The theory of water waves has been at the forefront of mathematics for over two centuries. In recent years there has been an explosion of interest in the subject. This workshop will bring together researchers contributing to all aspects of water waves: experiments, computation and analysis. Currently active topics in water waves include the effects of viscosity, surface tension, vorticity, surface wind and bottom topography on both time-dependent and steady waves. However, the workshop will range well beyond these topics.

Spring Semester Workshop 4 Participants (Water Waves)

Name	Organization
Siddhant Agrawal	University of Michigan
Adelaide Akers	University of Missouri-Columbia
Thomas Alazard*	Ecole Normale Supérieure
Hannah Alpert	Massachusetts Institute of Technology
David Ambrose*	Drexel University
Semenova Anastassiya	University of New Mexico
David Andrade	IMPA
Claude Bardos	University of Paris
Dongfen Bian	Beijing Institute of Technology
Anne Bronzi	State University of Campinas (UNICAMP)
Roberto Camassa	University of North Carolina
John Carter*	Seattle University
Ming Chen	University of Pittsburgh
Min Chen*	Purdue University
Didier Clamond*	University of Nice-Sophia Antipolis
Christopher Curtis	San Diego State University
Constantine Dafermos	Brown University
Bernard Deconinck	University of Washington
Yu Deng	New York University
Hongjie Dong	Brown University
Matthew Durey	University of Bath
Sergey Dyachenko*	University of Illinois
Mats Ehrnstrom*	Norwegian University of Science and Technology
Baylor Fox-Kemper*	Brown University
Carlos Galeano Rios	University of Bath
Yan Guo	Brown University
Tetsu Hara*	University of Rhode Island
Mariana Haragus*	Université de Franche-Comté
Benjamin Harrop-Griffiths	New York University
Diane Henderson	Pennsylvania State University

David Henry	University College Cork
Seok Hyun Hong	Pohang University of Science and Technology (POSTECH)
Chunyan Huang	Brown University
Vera Mikyoung Hur*	University of Illinois at Urbana-Champaign
Alexandru Ionescu*	Princeton University
Sameer Iyer	Brown University
Jiayin Jin	Georgia Institute of Technology
Estapraq Kahlil	Langston University
Spyridon Kakaroumpas	Brown University
Eduard-Wilhelm Kirr	University of Illinois at Urbana-Champaign
Georgy Kitavtsev	University of Bristol
Kazuki Koga	Kyoto University
David Lannes*	Université de Bordeaux
Quyuan Lin	Texas A&M University
Zhiwu Lin	Georgia Institute of Technology
Yue Liu	University of Texas at Arlington
Milton Lopes Filho	Federal University of Rio de Janeiro
Pavel Lushnikov	University of New Mexico
Govind Menon	Brown University
Paul Milewski	University of Bath
Cecilia Mondaini	Texas A&M University
Toan Nguyen*	Pennsylvania State University
Dag Nilsson	Lund University
Helena Nussenzveig Lopes	Federal University of Rio de Janeiro
Katie Oliveras*	Seattle University
Ashish Pandey	University of Illinois at Urbana-Champaign
Demetrios Papageorgiou	Imperial College London
Emilian Parau	University of East Anglia
Benoit Pausader	Princeton University
Bob Pego	Carnegie-Mellon University
Yue Pu	Carnegie-Mellon University
Fabio Pusateri*	Princeton University
Saad Qadeer	University of California, Berkeley
Antoine Remond-Tiedrez	Carnegie-Mellon University
Harvey Segur*	University of Colorado at Boulder
Anastassiya Semenova	University of New Mexico
Denis Silantyev	University of New Mexico
Patrick Sprenger	University of Colorado at Boulder
Walter Strauss	Brown University
Qingtang Su	University of Michigan

Catherine Sulem*	University of Toronto
Ian Tice*	Carnegie-Mellon University
Edriss Titi	University of California, Irvine
Olga Trichtchenko*	University College London
Foteini Tsitoura	Technical University Hamburg
Jeremy Upsal	University of Washington
Jean Marc Vanden Broeck*	University College London
Kristoffer Varholm	Norwegian University of Science and Technology
Vishal Vasan*	International Centre for Theoretical Sciences
Erik Wahlén*	Lund University
Samuel Walsh*	University of Missouri
Xuecheng Wang	Princeton University
Miles Wheeler*	Courant Institute of Mathematical Sciences
Klaus Widmayer	Brown University
Jon Wilkening	University of California, Berkeley
Sijue Wu*	University of Michigan
Yulong Xng	University of California, Riverside
Xiaoqian Xu	University of Wisconsin-Madison
Harry Yeh*	Oregon State University
Jie Yu	Stony Brook University

*Workshop Speakers

Some Workshop Organizer Comments for “Briefly describe workshop highlights”:

“The opportunity to step away from administrative responsibilities and do research. Some by myself, some with collaborators.”

“I have started new collaborations on two new projects and had very fruitful discussions concerning an on-going project. I learned quite a lot of new theoretical results.”

Some Workshop Participant Comments for “Briefly describe workshop highlights”:

“A highlight for me of the entire program was the opportunity to interact with other people with similar interests over an extended time, so differences in our viewpoints could be analyzed in depth.”

“Most of the talks were extremely interesting. I particularly liked Sijue Wu's talk on corner waves, and Fabio Pusateri's talk was also useful to me as it suggested some new lines of research to pursue. It was great that the workshop was so well attended. The room was completely packed in every session except the last one. It was also nice to start collaborating with one of Pavel Lushnikov's students, Anastassiya Semenova, on traveling-standing water waves.”

“It is great experience. I had a chance to see what people have been done in the field, I had a chance to introduce myself as a new faculty at a HBC university. I learnt "A LOT" experimentally and theoretically. Thank you, you made a big difference on the minorities by inviting me.”

“The presentation of talks from a wide spectrum of researchers, ranging from experimentalists to analysts. The use of analytical and mathematical methods by experimentalists was something that I was aware of but did not see exposed so well before. This was probably the highlight.”

“There were a few talks outside of my specific research in which presenters demonstrated techniques that I may have read about, but had never seen as a common or useful practice.”

“This was an excellent atmosphere to interact, and discuss, with fellows scientists in a broad field. The wide variety of participants, and the international dimension, was particularly impressive.”

“Most importantly I was able to talk to people who work on traveling water waves and I now know the main results and the methodology. I have always been quite confused about the literature on this topic and it was great to meet and talk with experts and clear up all the confusion. Also another confusion about my advisor and my work was addressed and I think it was great that all the issues we're finally addressed from all sides and now everybody is on the same page.”

All Long-term Visitors to Spring 2017 Semester Program

Gray highlight represents anyone staying over 9 days

Name	Organization	Time spent at ICERM (days)
Hannah Alpert	Massachusetts Institute of Technology	127
David Ambrose	Drexel University	96
Claude Bardos	University of Paris	97
Dongfen Bian	Beijing Institute of Technology	80
Anne Bronzi	State University of Campinas (UNICAMP)	98
Roberto Camassa	University of North Carolina	96
John Carter	Seattle University	37
Ming Chen	University of Pittsburgh	10
Didier Clamond	University of Nice-Sophia Antipolis	61
Bernard Deconinck	University of Washington	64
Hongjie Dong	Brown University	129
James Duncan	University of Maryland	14
Sergey Dyachenko	University of Illinois	273
Baylor Fox-Kemper	Brown University	152
Isabelle Gallagher	Université Paris-Diderot	7
Emmanuel Grenier	Ecole Normale Supérieure de Lyon	7
Julien Guillod	University of Minnesota	32
Yan Guo	Brown University	129
Diane Henderson	Pennsylvania State University	99
Seok Hyun Hong	Pohang University of Science and Technology	221
Vera Mikyoung Hur	University of Illinois at Urbana-Champaign	143
Jim Kelliher	University of California, Riverside	48
Georgy Kitavtsev	University of Bristol	21
Kazuki Koga	Kyoto University	81
Yue Liu	University of Texas at Arlington	77
Milton Lopes Filho	Federal University of Rio de Janeiro	96
Pavel Lushnikov	University of New Mexico	42

Anna Mazzucato	Pennsylvania State University	67
Govind Menon	Brown University	121
Paul Milewski	University of Bath	47
Cecilia Mondaini	Texas A&M University	148
Andre Nachbin	Instituto Nacional de Matematica Pura e Aplicada	7
Toan Nguyen	Pennsylvania State University	90
Helena Nussenzveig Lopes	Federal University of Rio de Janeiro	182
Katie Oliveras	Seattle University	101
Demetrios Papageorgiou	Imperial College London	10
Emilian Parau	University of East Anglia	13
Benoit Pausader	Princeton University	102
Bob Pego	Carnegie-Mellon University	100
Yue Pu	Carnegie-Mellon University	96
Saad Qadeer	University of California, Berkeley	66
Antoine Remond-Tiedrez	Carnegie-Mellon University	99
Frédéric Rousset	Département de Mathématiques d'Orsay	7
Harvey Segur	University of Colorado at Boulder	99
Denis Silantyev	University of New Mexico	11
Walter Strauss	Brown University	96
Vladimir Sverak	University of Minnesota	4
Ian Tice	Carnegie-Mellon University	104
Edriss Titi	University of California, Irvine	106
Olga Trichtchenko	University College London	143
Jeremy Upsal	University of Washington	15
Jean Marc Vanden Broeck	University College London	11
Vishal Vasan	International Centre for Theoretical Sciences	98
Samuel Walsh	University of Missouri	15
Xuecheng Wang	Princeton University	129
Miles Wheeler	Courant Institute of Mathematical Sciences	96
Klaus Widmayer	Brown University	96
Jon Wilkening	University of California, Berkeley	96
Xiaoqian Xu	University of Wisconsin-Madison	129
Harry Yeh	Oregon State University	5
Alejandra Alvarado	Eastern Illinois University	5
Angelos Koutsianas	University of Warwick	5
Beth Malmskog	Villanova University	5
Christopher Rasmussen	Wesleyan University	5
Christelle Vincent	Stanford University	5
McKenzie West	Reed College	5

Here follows a sample of the most substantive comments from our long-term visitors (note: this exit survey was out in the field for only one week at the time of writing this report):

Semester Organizer Comments for “Briefly describe program highlights”:

“Working with colleagues on a long-standing problem. We made progress by being together that just would not have happened otherwise. Starting a new project that has many different directions. Learning about the state of the art of theoretical advancements. Hearing from two oceanographers - hearing what the problems are in the field that mathematics could be useful for, and hearing what the issues are that we may or may not be considering in our modeling.”

Some Semester Organizer Comments for “What, if any, specific projects or collaborations did you pursue during this program?”:

“I am designing a new experimental facility to generate Faraday waves (parametrically excited interfacial waves) to examine the effects of bathymetry, as a model problem for investigating the effects of an elastic interface, and as a test of numerics. This work was the direct result of meeting with one person during the waves workshop and discussions throughout the semester with two long-term attendees.”

“Collaboration on full CFD computations of drops onto a fluid bath.”

*“Continue: Project on Water Waves with Adverse Vorticity Project on Rotating Stars and Galaxies
Initiate: Project on computation of Steady Water Waves Project on Rotating Vortex Patches Project on Stability of Vlasov-Maxwell Equilibria in a Sphere Project on MHD Stars Project on Plasmas with Strong Magnetic Field.”*

Some Long-Term Participant Comments for “Briefly describe program highlights”:

“Seeing theory and computations side by side. Open discussions in an excellent atmosphere.”

“The highlight of the program for me was a discussion held during a coffee break. A person I know, but do not collaborate with, explained a classical result to me. I knew the result, but never understood it and was never sure of it. However, after his explaining it to me, I am now happy with the result! (This may not seem like a big deal, but this question has been in the back of my mind for years.)”

“Being free to focus intently on a problem with my collaborators, while at the same being surrounded by experts who could answer even the most technical questions or suggest new approaches when we were at an impasse.”

“Working with colleagues on a long-standing problem. We made progress by being together that just would not have happened otherwise. Starting a new project that has many different directions. Learning about the state of the art of theoretical advancements. Hearing from two oceanographers - hearing what the problems are in the field that mathematics could be useful for, and hearing what the issues are that we may or may not be considering in our modeling.”

“Simply working with colleagues. In the ICERM in the mean time I had the opportunity to continue to interact with long term coworkers like D. Levermore, F. Golse, I. Gamba and E. Titi. In the mean time I found also the possibility to discover new collaborators as Nguyen Toan or Ann Nouri (I did not had before the opportunity to work with Ann in France . And in the ICERM that was very fruitful.”

“It was a great experience to learn more about experimental and computational methods, this helped me to understand better the theory I work with and provided a source of new problems to work from a theoretical point of view. Furthermore, the program provided a great opportunity for me to interact with

the more important researches in the area of Fluid Dynamics and this will certainly help in my personal development.”

Some Long-Term Participant Comments for “What, if any, specific projects or collaborations did you pursue during this program?”:

“Two papers, one on non-decaying solutions to the Euler equations and one on regularity of solutions to aggregation equations. Also two possible papers on boundary layer analysis.”

“- proving existence of solitary waves over periodic topography. (They may not exactly exist..) - finding exact water droplet solutions connecting given equal-volume shapes. (Much harder than I had thought.) - finding 2D traveling waves for water wave models more faithful than the KP-II equation - extending random shock-wave collision analysis to more general sticky particle models”

“Book project with T. Nguyen New direction of research with R. Rousset and B. Pausader”

“I continued to work with Helena Nussenzveig Lopes, Milton Lopes, and Jim Kelliher on boundary layers, with David Ambrose on the 2D Kuramoto-Sivashinsky equation, and with Xiaoqian Xu on optimal mixing. I have discussed possible joint projects with Claude Bardos and Anne Bronzi.”

“(1) New computational approaches to solving Euler's Equations (2) New methods for deriving and numerically solving the shallow-water equations (including dispersion) (3) several more all related to surface-gravity waves, internal waves, stability, and computation”

“I continued developing a project with Cecilia Mondaini (this is also a joint work with Ricardo Rosa) on the abstract theory of statistical solutions. I have some problems that were proposed to me during the program and that may result in future joint work.”

“1) I continued my work on the bidirectional Whitham equations. 2) I continued my work on the particle paths problem in deep water. 3) I began working on a problem related to using NLS-type models to model real-world ocean data.”

“R. M. Chen, M. H. Wheeler, and I worked extensively on a project concerning the existence, non-existence, and asymptotic properties of solitary waves in deep water having a localized distribution of vorticity. This was a continuation of ongoing work that was essentially completed during our time at ICERM. I had several conversations with V. Vasan that will hopefully develop into a concrete project in the near future.”

Some Postdoc Comments for “Briefly describe program highlights”:

“It is very interesting to know how people in different areas think about the same equation and can say different behaviors if the initial data is different”

“The highlights are learning about what is currently worked on in the field, and more so on the theoretical side. Also, the facilities and computational resources available.”

“A diverse participation from researchers with different and complementary backgrounds: computational, experimental and theoretical.”

Some Postdoc Comments for “What, if any, specific projects or collaborations did you pursue during this program?”:

“I started discussing how computations can help improve bounds on existence of solutions for long times and will attempt to compute some solutions to problems of interests. I also had the chance to continue

some of the numerical work I started before arriving here and discuss in more detail what more we need in order to finish the numerical projects. I was able to do this more efficiently by having the people who I work with be physically present in the same location. Also, I was able to run some computations on the computational cluster available.”

“On the convergence of statistical solutions of evolution equations - with A. Bronzi and R. Rosa Data Assimilation for Statistical Solutions of the Navier-Stokes equations - with A. Biswas, C. Foias and E. S. Titi”

Some Graduate Student Comments for “Briefly describe program highlights”:

“I am currently a graduate student at a non-US university, and since my mentor retired in last March, I do not have a professor at my home institution who can really understand my research topic. Fortunately, I started a collaborative work with a professor in the US who know much about my research.”

“Talking with colleagues during in between talks was extremely helpful.”

Some Graduate Student Comments for “What, if any, specific projects or collaborations did you pursue during this program?”:

“Development of sophisticated numerical schemes for vortex sheets with surface tension and its implementation on GPUs”

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 1st and May 1st. 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 deadline for proposals is mid-October, prior to the annual November SAB meeting, and mid-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 Cube 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.

6. Applicant Selection

ICERM's proprietary "Cube" database and visitor management system is where participants go to apply for our programs. Program organizers are regularly provided a list of applicants and copies of their supporting documents and are asked to recommend a ranking of applicants for their program. 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.

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 2016-2017

ICERM has hosted 7 topical workshops from June 2016 to May 2017. These workshops focus on topics of current interest in the mathematical sciences.

Topical Workshop 1: Effective and Algorithmic Methods in Hyperbolic Geometry and Free Groups

May 16-20, 2016

Number of participants: 66

Organizing Committee

Tarik Aougab (Brown University)

Jeffrey Brock (Brown University)
 Mladen Bestvina (University of Utah)
 Eriko Hironaka (Florida State University)
 Johanna Mangahas (University at Buffalo)

Workshop Description

The recent proof of Thurston's virtual fibering conjecture brought together tools at the forefront of geometric group theory, dynamics, and hyperbolic geometry. We still lack, however, an effective or constructive understanding of three-dimensional hyperbolic geometry, and more generally, 3-manifold topology. For example, a closed hyperbolic 3-manifold admits a finite cover which fibers over the circle, but can one construct such a cover from a presentation of the fundamental group? Can one implement an algorithm -- perhaps with the help of preexisting software such as SnapPea -- to obtain such a cover?

While much work remains, both computation and theory have progressed. Fast algorithms have been developed for running computations in the mapping class group and other finitely generated groups, as well as for recognizing certain types 3-manifolds and knot and link complements up to homeomorphism. These have been supplemented by a new wave of constructive theorems which explicitly relate the algebra of the fundamental group of a hyperbolic 3-manifold to its geometry, and to the geometry of various simplicial complexes, such as the curve complex. This ICERM workshop will focus on such advances, as well as on the development of new algorithms and extension of algorithmic techniques to the study of free groups. The workshop aims to bring together researchers from a broad range of related fields to work towards a more effective and quantitative understanding of 3-manifold topology, geometric group theory, and hyperbolic geometry.

Workshop 1 Participants (Effective and Algorithmic Methods in Hyperbolic Geometry and Free Groups)

Name	Organization
Yael Algom-Kfir*	University of Haifa
Tarik Aougab	Brown University
Caleb Ashley	Morehouse College
Christopher Atkinson	University of Minnesota Morris
Mark Bell	University of Illinois
Michael Ben-Zvi	Tufts University
Mladen Bestvina	University of Utah
Joan Birman*	Columbia University
Sarah Bray	Tufts University
Jeffrey Brock	Brown University
Kenneth Bromberg*	University of Utah
Nicholas Cahill	University of Utah
Abhijit Champanerkar	College of Staten Island, CUNY
Matt Clay*	University of Arkansas
Matthew Day*	University of Arkansas
Valentina Disarlo*	Indiana University at Bloomington
Spencer Dowdall*	Vanderbilt University
Moon Duchin*	Tufts University
Mark Feighn*	Rutgers University

David Futer*	Temple University
Radhika Gupta	University of Utah
Asaf Hadari*	University of Hawaii at Manoa
Brendan (Burns) Healy	Tufts University
Eriko Hironaka	Florida State University
Peihong Jiang	Brown University
Ilya Kofman	College of Staten Island, CUNY
Aleksandr Kolpakov	University of Toronto
Michael Landry	Yale University
Justin Lanier	Georgia Institute of Technology
Chris Leininger*	University of Illinois at Urbana-Champaign
Joel Louwsma	Niagara University
Johanna Mangahas	University at Buffalo
Dan Margalit*	Georgia Institute of Technology
Nicholas Miller	Purdue University
Yair Minsky	Yale University
Babak Modami	Yale University
Thomas Ng	Temple University
Christopher O'Donnell	Tufts University
Mark Pengitore	Purdue University
Bram Petri	Max Planck Institute for Mathematics in Bonn
Alexandra Pettet*	University of British Columbia
Catherine Pfaff	University of California, Santa Barbara
Jessica Purcell*	Monash University
Yulan Qing	University of Toronto
Shawn Rafalski	Fairfield University
Kasra Rafi*	University of Toronto
Alexander Rasmussen	Yale University
Andrew Sanchez	Tufts University
Jennifer Schultens*	University of California, Davis
Shane Scott	Georgia Institute of Technology
Samuel Senti	Federal University of Rio de Janeiro
Juan Souto*	Universite de Rennes 1
Balazs Strenner	Institute for Advanced Study
Robert Tang	University of Oklahoma
Jing Tao*	University of Oklahoma
Samuel Taylor*	Yale University
Maria Trnkova	University of California, Davis
Karen Vogtmann*	University of Warwick
Genevieve Walsh*	Tufts University

Yohsuke Watanabe	University of Hawaii at Manoa
Richard Webb*	University College London
Ashley Weber	Brown University
Peter Wong	Bates College
Yunhui Wu	Rice University

*Workshop Speaker

Some Workshop Organizer Comments for “Describe the highlight of this workshop”:

“The talks were great and the computer demo by Mark Bell was particularly cool.”

“All the speakers were great, including the short talks by junior researchers that were squeezed in between sessions.”

Some Workshop Participant Comments for “Describe the highlight of this workshop”:

“I gave a 50 minute talk, and was gratified that some of the grad students expressed interest in working on the open problems that I has suggested.”

“Richard Webb's talk describing a polynomial time algorithm to compute geodesics in the curve complex. This is an important development and Richard gave an excellent and very informative talk announcing and explaining this algorithm.”

“The collaborative atmosphere and balance between formal talks and breaks for informal conversation were a big highlight for me. I thought the schedule was well laid out to not only have a lot of talks but also leave time for me to make scientific connections and learn through informal conversations. I met a number of prominent researchers in the field and had the opportunity to hear about their latest work. I also had the opportunity to share my own research and research interests with many people.”

Communicating mathematics on the boards with people during the breaks and inbetween the talks. The topics were on low dimensional objects, graphs, surface, and 3 manifold where they all interact. Furthermore, this workshop was organized very well in a sense that topics presented there are mainly about computing. I gained knowledge and met many new people in these fields.

“1) learning about new developments in computational group theory, as related to mapping class groups or Artin groups 2) establishing a connection with a new collaborator; collaboration started 3) renewing a connection with a firmer collaborator; our project proposal has been outlined and submitted to relevant funding agencies.”

“The talk by Joan Birman on geodesics in the curve complex was the highlight for me.”

“talking with some giants in the field was fun. lunches and coffees with folks working on similar problems encouraging. the talks were all great and I will use my notes and also video to pursue ideas previously unknown to me. (thank you much. great time.)”

“The talks were the best part for me as a graduate student because they gave me a flavor of the kinds of work that the experts are working on.”

“Interactions with other leading researchers that has led to invitations to other conferences.

1) Talk by Dan Margalit, 2) Demo by Mark Bell, 3) Discussions with people

The lectures by Dan Margalit and Richard Webb describing new polynomial-time algorithms in curve complexes and mapping class groups. The informal discussions with other participants were also enormously helpful.”

Topical Workshop 2: Algorithmic Coding Theory

June 13 - 17, 2016

Number of participants: 35

Organizing Committee

Mary Wootters (Carnegie Mellon University)

Atri Rudra (University at Buffalo, SUNY)

Hamed Hassani (ETH Zurich)

Workshop Description

In the theory of error correcting codes, a sender (Alice) wants to send a message to a receiver (Bob), over a noisy channel. Strategies for Alice and Bob have been studied since the works of Shannon and Hamming from the late 1940's, from many different communities. Coding theory is a fundamental solution to challenges that arise in communication, storage, cryptography, and others; as the world changes, our challenges in these areas change, and the scenario changes for Alice and Bob. Fueled by these new scenarios, coding theory remains a rapidly advancing area of research.

One trend in many of these new scenarios in coding theory is the need for algorithmic solutions. For many problems in coding theory, it is possible to come up with nearly optimal solutions (information-theoretically speaking) which are likely very hard for Alice and Bob to actually implement. The goal of algorithmic coding theory is to design solutions which are not only combinatorially good, but are also computationally efficient.

The goal of this workshop is to bring together researchers from several different communities -- applied math, theoretical computer science, communications and electrical engineering -- to focus on a few quickly-moving topics in algorithmic coding theory. Topics will include:

- Polar codes
- Codes for interactive communication
- Local decoding and coding for distributed storage
- Non-malleable codes

This workshop is part of a series of NSF Secure and Trustworthy Cyberspace funded workshops designed to make mathematicians aware of issues in cybersecurity.

Workshop 2 Participants (Algorithmic Coding Theory)

Name	Organization
Ramy Ali	Pennsylvania State University
Erdal Arıkan*	Bilkent University
Hridam Basu	Northeastern University
Jessalyn Bolkema	University of Nebraska
Klim Efremenko*	Tel Aviv University
Venkata Gandikota	Purdue University

Ran Gelles*	Princeton University
Dina Goldin*	Tel Aviv University
Elena Grigorescu*	Purdue University
Venkat Guruswami*	Carnegie-Mellon University
Hamed Hassani	ETH Zurich
Anoosheh Heidarzadeh	Texas A&M University
Brett Hemenway*	University of Pennsylvania
Sidharth Jaggi	Chinese University of Hong Kong
Swanand Kadhe	Texas A&M University
Yael Kalai*	Microsoft
Swastik Kopparty*	Rutgers University
Biswaroop Maiti	Northeastern University
Sai Vikneshwar Mani Jayaraman	University at Buffalo
Carolyn Mayer	University of Nebraska
Marco Mondelli*	Ecole Polytechnique Federale de Lausanne (EPFL)
Hieu Nguyen	Rowan University
Joseph Renes*	ETH Zurich
Noga Ron-Zewi*	Institute for Advanced Study
Atri Rudra	University at Buffalo (SUNY)
Shubhangi Saraf*	Rutgers University
Madhu Sudan	Harvard University
Rüdiger Urbanke*	Ecole Polytechnique Federale de Lausanne (EPFL)
Carol Wang*	National University of Singapore
Daniel Wichs*	Northeastern University
Mary Wootters	Carnegie-Mellon University
Sergey Yekhanin*	Microsoft Research
Samson Zhou	Purdue University
David Zuckerman*	University of Texas at Austin

*Workshop Speaker

Some Workshop Organizer Comments for “Briefly describe workshop highlights”:

“I got to know several main contributors to the field of coding theory, and learned about the important challenges in the next 10 years.”

“I had a lot of really good discussions outside of the talks. In particular, I think I have a much better understanding of the EE/Information theory perspective on a few problems, and I hopefully have a few new research questions to think about (or a new way of thinking about them).”

“I have learned a lot from experts in coding theory about practical/algorithmic challenges in this field. The workshop brought together an excellent mixture of theoreticians and practitioners which led to very interesting exchange of ideas.”

“Coming from the theoretical computer science side, it was really great to see a perspective from the engineering side.”

Some Workshop Participant Comments for “Briefly describe workshop highlights”:

“The highlights of this workshop for me is to learn new things and know about important results in coding theory as I work on information-theoretic cryptography and also to network with people within the theoretical computer science community in general which I think is great. Also I was impressed by the collaborations among different researchers during the breaks of the workshop.”

“Although I was not well-versed with many of the topics presented at the workshop, I feel I learned much of the material, as the barrier of entry was surprisingly low, due to the quality of the presentations. Furthermore, the intimate but energetic environment allowed for discussion of topics, and design of the workspace (many whiteboards, separate rooms) allowed for frequent in-depth follow ups.”

I am leaving the workshop with several new ideas that were inspired by the talks I attended. The highlight for me was the exposure to a wide range of ideas and techniques that will prove useful in my research. I also formed research connections with people whom I would not have met elsewhere. The cross-fertilization of ideas is the main highlight of this workshop for me.”

“I had a lot of really good discussions outside of the talks. In particular, I think I have a much better understanding of the EE/Information theory perspective on a few problems, and I hopefully have a few new research questions to think about (or a new way of thinking about them).”

“The excellent location and seminar facilities. Good balance between various strands of research in coding theory, and between the scheduled program and breaks to discuss with other participants. Overall, an excellent workshop!”

Topical Workshop 3: Illustrating Mathematics

June 27 - July 1, 2016

Number of participants: 74

Organizing Committee

Kelly Delp (Cornell University)

Saul Schleimer (University of Warwick)

Henry Segerman (Oklahoma State University)

Laura Taalman (James Madison University)

Workshop Description

Research and outreach are normally thought to divide mathematics in two. This separation is, however, completely artificial; it is impossible to “find” a mathematical idea without explaining it. Exploration and exposition are two sides of the same coin. One striking example of this is the epochal work of William Thurston; often his theorems were accompanied by pictures, and computer programs, illustrating the underlying ideas.

The goal of this conference is to bring together mathematicians from a range of fields, and practitioners from the digital arts (animation, 3D printing, laser cutting, CNC routing, virtual reality, computer games, etc). The attendees will share their expertise in mathematics and with the procedural tools used to illustrate mathematics. In addition to talks in the traditional style, we plan to hold several workshops to train attendees about a variety of digital media, in particular 3D printing.

Workshop 3 Participants (Illustrating Mathematics)

Name	Organization
Aaron Abrams	Washington and Lee University
David Bachman*	Pitzer College
Ellie Baker	ellie-baker.com
Kenneth Baker	University of Miami
Tom Banchoff	Brown University
Carlos Barrera-Rodriguez	National Autonomous University of Mexico
Peter Boyer	Autodesk, Inc.
Heidi Burgiel	Bridgewater State University
Dina Buric	University of Victoria
Danny Calegari*	University of Chicago
Moira Chas	Stony Brook University
Arnaud Chéritat*	Institut de Mathématiques de Toulouse
Ester Dalvit	University of Toronto
Kelly Delp	Cornell University
Elizabeth Denne	Washington and Lee University
Moon Duchin	Tufts University
David Dumas*	University of Illinois at Chicago
William Dunbar	Bard College at Simons Rock
Richard Esterle	youarespace
Frank Farris*	University of Santa Clara
Rebecca Field	James Madison University
Steven Frankel	Institute for Advanced Study
Michael Gagliardo	California Lutheran University
Susan Goldstine	St. Mary's College of Maryland
Bathsheba Grossman	Bathsheba Sculpture
Matthew Haines	Augsburg College
Casey Handmer	Hyperloop Technologies Inc
Zach Haney	Northeastern University
Christopher Hanusa	Queens College, CUNY
Edmund Harriss*	University of Arkansas
Andrea Hawksley*	eleVR
Eriko Hironaka	Florida State University
Kelsey Houston-Edwards	Cornell University
Robert Jacobson	Roger Williams University
Peihong Jiang	Brown University
Craig Kaplan	University of Waterloo
Dan Katz	Brown University
Richard Kenyon*	Brown University
Boyan Kostadinov	New York City College of Technology, CUNY

Siddhi Krishna	Boston College
Oliver Labs*	MO-labs
Evelyn Lamb	freelance
Justin Lanier	Georgia Institute of Technology
Quang-Nhat Le	Brown University
Jesse Louis-Rosenberg*	Nervous System
John McCleary	Vassar College
Elizabeth Merriman	University of Illinois at Urbana-Champaign
Roice Nelson	GE Aviation
Donald Plante	University of New Hampshire
Konrad Polthier*	Freie Universität Berlin
James Propp	UMass Lowell
Sanjay Ramassamy	Brown University
Faniry Razafindrazaka	Freie Universität Berlin
David Reimann	Albion College
Jessica Rosenkrantz*	Nervous System
Andrew Sanchez	Tufts University
Saul Schleimer	University of Warwick
Richard Schwartz*	Brown University
Henry Segerman	Oklahoma State University
Fabienne Serrière*	Knit Yak LLC
Jennifer Shin	8 Path Solutions LLC
Clayton Shonkwiler*	Colorado State University
Katherine Stange*	University of Colorado
Ivan Sterling	St. Mary's College of Maryland
Carol Strohecker	Rhode Island School of Design
John Sullivan*	Technische Universität Berlin
Laura Taalman*	James Madison University
Bruce Torrence	Randolph-Macon College
Mikael Vejdemo Johansson	University of Stockholm
Greg Warrington	University of Vermont
Christof Weber	University of Applied Sciences Northwestern Switzerland
Jeff Weeks*	Geometry Games
Lauren Williams	Mercyhurst University
Drew Zemke	Cornell University

*Workshop Speaker

Some Workshop Organizer Comments for “Describe the highlight of this workshop”:

“Most of the talks were very, very good. I think that the “two short talks from one speaker” mostly worked well. There were a (very) few speakers who perhaps should have had a bit less time, and a few who should have had a bit more.”

“The art exhibit, Fabienne Serriere & Nervous System, Jeff Weeks...really there were many highlights.”

“The unstructured time on Wednesday afternoon. Many small groups discussed and worked on diverse topics, everyone seemed to be excited.”

Some Workshop Participant Comments for “Describe the highlight of this workshop”:

“One excellent portion of the program was the software workshops on Wednesday morning. The speakers did an excellent job of surveying the uses of OpenSCAD, Rhino, and Grasshopper and also giving the participants some useful hands-on experience with the software.”

“Making connections and being aware of recent tendencies on technology applies to Math education.”

“Being in a space with so many creative people and being able to touch and behold their handiwork.”

“Several new computational technologies for 3D modeling and 3D printing plus the mathematical framework of Fourier analysis for creating mathematical illustrations.”

“The multidisciplinary aspect was the highlight. The talks were generally excellent -- much better than at most conferences. Also, the RISD tour was really great.”

“The opportunity to meet people I have only followed online was awesome. I was able to learn from them how they conducted their research in a way that is not possible without having time to have a face to face discussion. I was also very impressed with the organization of talks and the time allotted for collaboration and show and tell.”

“The display room for scientific visualization objects was perfect. You got to see the cool physical objects in advance, and hear about the math later. I think this created more interest in the talks and generated better questions.”

“1) The participants - what an incredible group of people. 2) The workshop time where we learned the basics of the programs (OpenSCAD, Rhino etc) 3) The "show and tell" session, highlighting point (1) all over again. 4) The exhibits 5) The talks.”

“Two highlights were learning about the industrial applications of Nervous System and the knitting machine. Also the display of mathematical art and objects was inspiring.”

“Talking about issues in mathematical illustration with people from very different backgrounds. Most importantly for my own work, I was very happy to make contact with Frank Farris, whose approach to symmetry groups is in effect complementary to my own, and with whom I may begin collaborating as a direct result of this workshop. I also enjoyed talking with people with strong artistic backgrounds (my own artistic background is weak), and getting their advice for improving my own work.”

“There are so many things I loved, but probably the most important to me was that most of the talks had actual math content and didn't just poke around in vague generalities. I think my favorite talk(s) were Kate Stange, Nervous System, and Konrad Polthier, but there were so many that I enjoyed.”

“This workshop is quite simply the best conference I have attended, and it is difficult to pick a single highlight! If pressed, the highlight was meeting two participants in person for the first time and making connections with our current projects. I'm grateful for those connections and the chance for them to affect future work.”

“The highlight of the workshop were the ideas I was exposed to. Seeing the possibilities of 3d computers, laser cutters, CNC machines and VR was quite amazing. I was in absolute awe watching Nervous System's presentation. They had amazing idea on top of amazing idea, 3d printing a dress, puzzles within puzzles, it went on and on. Arnaut's models finally helped me see a sphere inversion, he exemplified what it meant to illustrate a mathematical concept with a model. Actually getting a chance to play with some of these technologies was the icing on the cake. Getting a chance to play Hypernom on Andrea's computer was incredible (this did not happen during her workshop but a day or two after). After playing the game I immediately went and looked up Henry's article on the Quaternion's as a symmetry group to understand what was going on in the game Hypernom. I can't wait to share this game with my students. Playing with OpenSCAD was perfect for me because after working with visual based 3D programs for so long and knowing that there must be an easier way, Laura finally showed me that, in fact, there is an easier way, and it's script based OpenSCAD. I left the conference inspired, it was incredible to see people illustrating mathematics in such innovative ways.”

Topical Workshop 4: Stochastic Numerical Algorithms, Multiscale Modeling and High-dimensional Data Analytics

July 18-22, 2016

Number of participants: 56

Organizing Committee

Mark Girolami (Warwick University)

Susan Holmes (Stanford University)

Benedict Leimkuhler (University of Edinburgh)

Mauro Maggioni (Duke University)

Workshop Description

This workshop is concerned with sampling challenges, modeling and simulation for data-rich applications in high dimensions. It brings together mathematicians, statisticians and computational scientists to explore the interplay between computational applied mathematics and data science. On the agenda will be novel developments in the study of complex phenomena based on data-analytic techniques, such as efficient calculation of ergodic (long term) averages and statistical inference under a wide range of geometric, physical and analytical constraints.

In applied mathematics and computational science, in particular in molecular modeling, image analysis and geosciences, among others, many objects of interest are high-dimensional and stochastic, and a wide variety of techniques have been developed for sampling and approximating the quantities of interest. Similar issues arise in the area of data science and statistical modeling, where learning problems in the presence of high-dimensional data require efficient computational algorithms for sampling and approximation.

The workshop will focus on recent advances in the design of rigorous discrete-dynamics based sampling approaches, algorithms development for large-scale data analysis and stochastic dynamical systems, scalable and rigorous numerical methods for stochastic differential equations and sampling from high-dimensional distributions, and exploitation of low-dimensional structures in high-dimensional data and stochastic dynamical systems for model reduction and efficient Monte-Carlo schemes. The meeting will foster the interchange and deployment of the latest methodologies for sampling and approximation.

Workshop 4 Participants (Stochastic Numerical Algorithms, Multiscale Modeling and High-dimensional Data Analytics)

Name	Organization
Assyr Abdulle*	École Polytechnique Fédérale de Lausanne
Elena Akhmatskaya*	Basque Center for Applied Mathematics
Sergio Bacallado*	Stanford University
Jens Bendel	Imperial College London
Michael Betancourt*	University of Warwick
Xin Bian	Brown University
Vrushali Bokil	Oregon State University
Tamara Broderick*	Massachusetts Institute of Technology
Julio Castrillon	SRI Center for Uncertainty Quantification in Computational Science & Engineering
Peng Chen*	University of Texas at Austin
Yang Chen	Harvard University
Duan Chen	UNC Charlotte
Cecilia Clementi	Rice University
Keisha Cook	University of Alabama
Simon Cotter*	University of Manchester
Matthew Dobson	University of Massachusetts, Amherst
Tingran Gao	Duke University
Arash Ghasemi	University of Tennessee at Chattanooga
Mark Girolami	University of Warwick
Kostis Gourgoulias	University of Massachusetts, Amherst
Eric Hall	University of Massachusetts, Amherst
George Karniadakis*	Brown University
Markos Katsoulakis*	University of Massachusetts, Amherst
Tali Kaufman	Bar-Ilan University
Yannis Kevrekidis*	Princeton University
Heinz Koeppl*	Technische Universtaet Darmstadt
Benedict Leimkuhler*	University of Edinburgh
Xingjie Li	UNC Charlotte
Yao Li	University of Massachusetts, Amherst
Eardi Lila	University of Cambridge
Zhao Liu	University of Texas at Austin
Fei Lu*	University of California, Berkeley
Yian Ma*	University of Washington
Mauro Maggioni*	Duke University
Youssef Marzouk*	Massachusetts Institute of Technology
Charles Matthews*	University of Chicago
Stanislav Minsker*	University of Southern California

Linda Ness	Rutgers University
Paulina Rowinska	Imperial College & University of Reading
Matthias Sachs	University of Edinburgh
Jesus Maria Sanz-Serna*	Universidad Carlos III de Madrid
Leila Setayeshgar	Providence College
Babak Shababa*	University of California - Irvine
Xiaocheng Shang*	University of Edinburgh
Robert Skeel*	Purdue University
Konstantinos Spiliopoulos*	Boston University
Erik Sudderth	Brown University
Michael Tretyakov*	University of Nottingham
Zofia Trstanova	Inria Rhones-Alpes
Konstantinos Vamvourellis	ACS
Jonathan Weare*	University of Chicago
Darren Wilkinson*	University of Newcastle
Kit Sum Wu	Brown University
Zhongqiang Zhang	Worcester Polytechnic Institute
Ming Zhong	University of Maryland
Konstantinos Zygalakis*	University of Edinburgh

*Workshop Speaker

Some Workshop Organizer Comments for “Describe the highlight of this workshop”:

Nothing to report.

Some Workshop Participant Comments for “Describe the highlight of this workshop”:

“The two talks on probabilistic numerics Geometric methods for approximation for high-dimensional dynamical systems Scalable Bayesian Inference with Hamiltonian Monte Carlo Stratification for Markov chain Monte Carlo sampling Jonathan Weare, University of Chicago”

“I got a chance to present my work as an oral presentation and it was a great experience.”

“I really liked the talks by Simon Cotter and Assyr Abdulle. These talks will influence my research as I will likely use the techniques they described in the problems that I am working on. There were other talks that I learned a lot from too.”

“1. The time slots and number of talks are organized in an excellent way! 2. Length of coffee break is very good! and Thanks to the staff and organizers for the food and coffee! 3. There is one talk in the division of applied math at Brown, which gives us a very nice opportunity to visit the nice campus. I had the opportunity of being exposed to a number of recent developments.”

“Many things. The connections I made, figuring out the a posteriori error bounds since I was stuck until then. Meeting and learning from people I have been following their work for many years.”

“1. I came away with a broad overview of the techniques used in solving SDEs and the intersection areas with statistics and computer science. 2. Got the chance to talk one on one with many researchers in just a few days. 3. Got new ideas for future directions 4. I was amazed at how MCMC methodology had such a profound impact in this field. It's amazing to realize that just one scientific improvement can make such a

big difference in science in general.”

Topical Workshop 5: Cycles on Moduli Spaces, Geometric Invariant Theory, and Dynamics

August 1 – 5, 2016

Number of participants: 67

This workshop is partially supported by NSF CAREER award DMS-1350396.

Organizing Committee

Ana-Maria Castravet (Northeastern University)

Dawei Chen (Boston College)

Maksym Fedorchuk (Boston College)

Anton Zorich (Institut de Mathématiques de Jussieu)

Workshop Description

A moduli space parameterizes geometric objects with alike structures and encodes in itself the geometry of all possible families of such objects. This workshop will focus on three aspects of moduli spaces: Cycles, Geometric Invariant Theory, and Dynamics. One of our main goals is to synthesize the recent progress on moduli of abelian differentials on algebraic curves motivated by dynamics and in the GIT constructions of related moduli spaces, with the view towards better understanding of geometric cycles on these moduli spaces.

In many cases, computer programming and experiments are important tools to discover new phenomena, both in dynamics and in the study of cycles on moduli spaces. Hence many talks will emphasize computational and experimental aspects of these fields and the workshop will feature a computational problem session whose goal is to disseminate computational techniques and problems to a wider body of researchers.

An integral part of the workshop is a series of three mini-courses on the following subjects:

- Cycles and birational geometry of moduli spaces of curves,
- Geometric invariant theory, with applications to constructions of moduli spaces, and
- Affine invariant manifolds and invariants in Teichmüller dynamics.

The mini-courses will be aimed primarily at non-experts and will benefit graduate students and early career researchers in related areas, who are particularly encouraged to apply to participate in the workshop.

Workshop 5 Participants (Cycles on Moduli Spaces, Geometric Invariant Theory, and Dynamics)

Name	Organization
Dan Abramovich	Brown University
Hamid Al-Saqban	University of Maryland
Jarod Alper*	Australian National University
Paul Apisa	University of Chicago
Kenny Ascher	Brown University
Jayadev Athreya	University of Washington
David Auricino	University of Chicago

Matthew Bainbridge*	Indiana University at Bloomington
Frederol Benirschke	Stony Brook University
Mercer Bridges	University of Illinois at Chicago
Ana-Maria Castravet*	Northeastern University
Qile Chen*	Boston College
Dawei Chen	Boston College
Rex Cheung	Yale University
Karl Christ	Roma Tre University
Matteo Costantini	Johann Wolfgang Goethe-Universität
Diana Davis	Northwestern University
Anand Deopurkar*	Columbia University
Benjamin Dozier	Stanford University
Maksym Fedorchuk	Boston College
Simion Filip*	University of Chicago
Ian Frankel	University of Chicago
Gerard Freixas i Montplet*	Institut de Mathématiques de Jussieu
Quentin Gendron	Leibniz Universität Hannover
Elise Goujard*	Paris-Sud University
Matt Grimes	University of Colorado at Boulder
Samuel Grushevsky*	Stony Brook University
Brendan Hassett*	Brown University
Zhuang He	Northeastern University
Wade Hindes	CUNY Graduate Center
Xuntao Hu	Stony Brook University
Kristof Huszar	IST Austria
Charles Johnson	Wake Forest University
Chris Judge	Indiana University at Bloomington
Seoyoung Kim	Brown University
Zhiyuan Li*	University of Bonn
Kathryn Lindsey*	University of Chicago
Daniel Luetgehetmann	Freie Universität Berlin
Jake Marcinek	Harvard University
Steffen Marcus	The College of New Jersey
Curtis McMullen*	Harvard University
Babak Modami	Yale University
Gabriele Mondello	Università di Roma "La Sapienza"
Ronen Mukamel	Rice University
Scott Mullane	Boston College
Martin Möller*	Goethe-Universität Frankfurt
Dat Nguyen	Stanford University

Chaya Norton	Technical University of Denmark
Anand Patel	Boston College
Sanjay Ramassamy	Brown University
Eliane Salem	Université de Paris 6
Martin Schmoll	Clemson University
Samuel Senti	Federal University of Rio de Janeiro
Anastasia Shepelevtseva	Higher School of Economics
Joseph Silverman	Brown University
Robert Silversmith	University of Michigan
Changjian Su	Columbia University
Jenia Tevelev*	University of Massachusetts, Amherst
Siming Tu	University of Chile
Martin Ulirsch	University of Bonn
Filippo Viviani*	Roma Tre University
Christian Wolf	City College of New York
Alex Wright*	Stanford University
Chenxi Wu	Cornell University
Lei Yang	Northeastern University
Jonathan Zachhuber	Goethe Universitaet Frankfurt
Anton Zorich	Institut de Mathématiques de Jussieu

*Workshop Speaker

Some Workshop Organizer Comments for “Describe the highlight of this workshop”:

“The highlights for me were the talks by Curt McMullen, Sam Grushevsky, Alex Wright and Filippo Viviani. I’ve also enjoyed the talks of Jarod Alper and Anand Deopurkar, but the subject matter of these talks were very familiar to me.”

“I’ve learned more about Teichmueller dynamics, a subject which is surprising close to my own area of interest. I’ve also learned about several open problems which I plan to tackle in the future.”

Some Workshop Participant Comments for “Describe the highlight of this workshop”:

“It was a great opportunity to see two mathematical community, the one of Algebraic Geometry and the other one of Teichmuller theory/Dinamics, to interact around the same subject and discuss the same problems with a different language and different techniques.”

“For me this workshop was the opportunity to establish contact with experts of a field connected to mine, but not enough, so that in the usual events I participate I would not have meet them. Thanks to this, I realized that the kind of methods I use can be of interest for these new colleagues. More concretely, the contact with the community of experts in the topic of the conference has given a new collaboration with some of them, and this was only possible thanks to gathering together people with different background.”

“This workshop brought people from both the algebraic geometric side and dynamics side. It provides us a great chance to learn from each other. For example, the work from dynamics side is a source of motivations of studying sub-varieties in the Hodge strata as orbit closures. People in algebraic geometry have studies various compactification for years. These experiences could potentially be helpful for people

wants to under the dynamics of the orbit closures.”

“Poster session, since it gave me the opportunity to present my research to leader in the field.”

“I felt that Brendan Hassett's lectures typified what I was hoping to get from this conference. He took the time to explain the material he was presenting in a way that was accessible to the two different groups of mathematicians present at the conference. This was greatly appreciated.”

“- the talk of C.Mc Mullen for his result. He is putting all the results into perspective, and using 19th century techniques on curves. He is extremely inspiring. - the mini courses by B. Hassett and M. Moller - I got an idea that I think I can use from the talk of S. Filip - the talk of S. Grushevsky.”

“New developments in Teichmuller dynamics and connections between Lyapunov exponents and algebro-geometric invariants.”

“The highlights for me were the talks by Curt McMullen, Sam Grushevsky, Alex Wright and Filippo Viviani. I've also enjoyed the talks of Jarod Alper and Anand Deopurkar, but the subject matter of these talks were very familiar to me.”

Topical Workshop 6: Predictive Policing

August 8 - 12, 2016

Number of participants: 33

Organizing Committee

Andrea Bertozzi (UCLA)

Jeffrey Brantingham (UCLA)

Martin Short (Georgia Tech)

Workshop Description

This workshop is a one-week program aimed at 20-25 researchers interested in the opportunity to shape the future of research on the mathematics of crime. Small teams will come together to work on real problems with real crime and policing data provided by the Providence Police Department. Five teams will be assembled, each with a technical advisor who will share their expertise and serve as an anchor point and leader for hands-on research that will take place over the course of the week. This will be a truly hands-on experience in which groups will spend time brainstorming mathematical methods and models to approach the problem at hand, analyzing data provided, and creating code to implement ideas as necessary. There will also be research presentations from the technical advisors throughout the week, as well as closing presentations by each team to present their ideas and progress at the end of the workshop. We fully anticipate that lasting collaborations will be formed, and that work on the projects will continue after the workshop ends. The following topical problems will focus the research activities:

- **Police Patrol Analysis:** Police departments are increasingly adopting technologies such as GPS to track police patrols, but widespread adoption is far off. However, departments commonly track calls for service, giving brief glimpses into where officers are located at specific points in time. Can this limited data be used to estimate more detailed pictures of police distribution across the city? And, given these estimates, can we attempt to measure quantitatively the effect that patrols have on crime?
- **Dynamic prediction of crime events and crime patterns:** Work on this topic has greatly expanded in recent years, using statistical techniques and differential equation based methods. But, new

methods of data analytics and techniques such as data assimilation may also prove promising. Can the team use historical crime records from Providence to develop new methods of predicting future crime?

- Criminal networks big and small: Criminal offending is often a solo activity, but it also can occur in a social context. Can arrest and event data as well as fragmentary information on co-offending patterns be used to infer criminal network structure and processes? Can we detect when larger criminal networks adopt formal organizational structures?
- Crowds and social unrest: Social unrest is a common occurrence, but only recently have technologies such as smartphones and social media enabled specific events to be quantitatively analyzed after the fact and potentially even predicted in real time. Can data such as geocoded social media activity be used to understand the dynamics of events such as riots, and be used to identify them as they begin to occur?
- Social media and hate: Social media, and the internet more broadly, is a tremendous platform for creativity, but it also has a dark side. Hate speech is common and hate groups are well represented and not just in the corners of the internet. Can natural language processing and other machine learning methods be used to detect and map the spread of hate speech within social media spaces?

Note: some familiarity with coding, statistics, networks/graphs, the concept of "machine learning", ordinary and partial differential equations, analysis, and numerical solving will be helpful to applicants, but not required.

Workshop 6: Participants (Predictive Policing)

Name	Organization
Mahesh Agarwal	University of Michigan - Dearborn
Scott Anderson	Washington State Dept. of Corrections
Alethea Barbaro	Case Western Reserve University
Jorge Barreras	Quantil S.A.S.
Jeff Brantingham	University of California, Los Angeles
Chris Browne	Cornell University
Cynthiaann Bryant	Hunter College, CUNY
Haiyan Cheng	Willamette University
Philip Chodrow	Massachusetts Institute of Technology
Daniel Cooney	Princeton University
Yifan Cui	University of North Carolina at Chapel Hill
Toby Davies	University College London
Stephen DeSalvo	University of California, Los Angeles
Kun Dong	Cornell University
Louis Ellam	University of Warwick
Hannah Fry	University College London
Marta Gonzalez	Massachusetts Institute of Technology
Blake Hunter	Claremont McKenna College

Zhenzhen Li	Hong Kong University of Science and Technology
David Lloyd	University of Surrey
Bryan Martin	University of Washington
Monica Moreno	Edmonton Police Service
Rose Nguyen	University of Washington
Monica Ribero	Quantil
Najmeh Salehi	Temple University
Martin Short	University of California, Los Angeles
Matthew Simonson	Northeastern University
Stephan Sturm	WPI
Robin Thompson	University of Oxford
Chad Topaz	Macalester College
Yves van Gennip	University of Nottingham
Chuntain Wang	University of California, Berkeley
Talitha Washington	Howard University

Some Workshop Organizer Comments for “Describe the highlight of this workshop”:

Nothing to report.

Some Workshop Participant Comments for “Describe the highlight of this workshop”:

“I had a nice time being in an "ambitious" environment. This has helped motivate me to do more math / work more. It was nice to be around social mathematical people who had similar research interests.”

“The program was an opportunity to exchange ideas and methodologies. It gave space to fields priorly not involved in crime research and allowed to discover and explore new directions. It was very gratifying to have the chance to work with committed and brilliant people.”

“The possibility of getting to work intensely for a whole week really opened up a lot of research possibilities and interesting results. Being able to work mano a mano with such brilliant people was totally motivating and a game changer for my career. Besides, getting to personally meet the leaders of a field I’m so deeply interested in was absolutely great. I thank you so much for this.”

“1. Ability to look at actual Police data and interaction with the Police Department - this is very rare 2. Ability to look at a different aspect of mathematics that I knew little about i.e. queuing theory

“The best part of the workshop is that it's a hands-on working session. We actually get things done. The police ride along activity was an excellent experience to connect researchers and the real life situation to help us better understand the problem and the data.”

“Working on real data in collaboration with local law enforcement officials was definitely a highlight for me.”

“I enjoyed the inter and intra collaboration from each group. I learned about different areas of study and was exposed to different areas of study. I was introduced to very motivated and encouraging scholars. I was inspired by all the passion and the different fields of study. I enjoy the hands on work shop, I thought that forced me to tackle problems hands on. I loved the introduction to various programming languages. I would love to do this again”.

“It was the first time that I had joined a team and we all worked for one reason! It was a good experience for me and I learned something new in JavaScript and how to upload and read data from file by using browser! It was a good opportunity.”

Topical Workshop (Co-hosted with Brown’s Division of Applied Math): Frontiers in Applied and Computational Mathematics

January 4-6, 2017

Number of participants: 76

Organizing Committee

Sigal Gottlieb (University of Massachusetts)

Johnny Guzman (Brown University)

Fengyan Li (Brown University)

Jennifer Ryan (University of East Anglia)

Speakers

Remi Abgrall, University of Zurich

Marsha Berger, Courant Institute

Bernardo Cockburn, University of Minnesota

Phillip Colella, Berkeley Lab

Constantine Dafermos, Brown University

Wai-Sun Don, Ocean University of China, Qingdao

Weinan E, Princeton University

Bjorn Engquist, University of Texas, Austin

Irene Gamba, University of Texas, Austin

James Glimm, SUNY

Sigal Gottlieb, University of Massachusetts, Dartmouth

Jan Hesthaven, EPFL

Thomas Hou, California Institute of Technology

Antony Jameson, Stanford University

Randy LeVeque, University of Washington

Stanley Osher, University of California, Los Angeles

Philip Roe, University of Michigan, Ann Arbor

Gilbert Strang, Massachusetts Institute of Technology

Eitan Tadmor, University of Maryland

Mary F. Wheeler, University of Texas

Shing-Tung Yau, Harvard University

Workshop Description

The Division of Applied Mathematics at Brown University is pleased to announce the 60th Birthday Conference of Professor Chi-Wang Shu, to be held from January 4 - 6, 2017. The conference is being organized by Sigal Gottlieb, Fengyan Li, Jennifer Ryan, and Johnny Guzman. An outstanding group of the world's most distinguished mathematicians will gather to celebrate Professor Shu's legacy by presenting some of their most influential work in the field of applied and computational mathematics. The conference will take place at ICERM. More details can be found at:

<https://www.brown.edu/academics/applied-mathematics/events/frontiers-applied-and-computational-mathematics>

Note: ICERM provided the event space and recorded the lectures for this program. The institute did not provide any funding to the participants. Therefore, they are not listed in this report. No exit surveys were distributed.

Topical Workshop 7: Current Developments in Mathematical Fluid Dynamics: Regularity, Instabilities, and Turbulence

January 24-27, 2017

Number of participants: 68

Organizing Committee

Peter Constantin (Princeton University)

Nataša Pavlović (University of Texas at Austin)

Vlad Vicol (Princeton University)

Workshop Description

The purpose of the topical workshop is to gather leading experts, postdoctoral scholars, and graduate students, to present exciting new developments in the field of mathematical fluid dynamics. The focus of the meeting will be placed on current research on regularity, instabilities, and the onset of turbulence in fluid flow, from a theoretical and from a computational perspective. Despite their long and fruitful history, to date these topics continue to enchant and inspire mathematicians, physicists, and computational scientists: in part due to their ubiquitous applications in areas from aeronautical engineering to medicine, and in part because the basic mathematical questions are still open. Among these are global in time existence of solutions to the equations describing motion of inviscid and viscous fluids in three spatial dimensions, and the conjectured relation between the phenomenological theories of turbulence and the statistical properties of solutions to the underlying partial differential equations of fluid dynamics. These questions have inspired generations of researchers. In particular, the conference will celebrate the work of Susan Friedlander, who has been making important contributions in the field since 1970s.

Workshop 7 Participants (Current Developments in Mathematical Fluid Dynamics: Regularity, Instabilities, and Turbulence)

Name	Organization
Sona Akopian	University of Texas at Austin
M Shahrooz Amin	Navy
Andrea Bertozzi*	Universtiy of California, Los Angeles
Jerry Bona*	University of Illinois at Chicago
Anne Bronzi	State University of Campinas (UNICAMP)
Sean Carney	University of Texas at Austin
Xuwen Chen	University of Rochester
Alexey Cheskidov*	University of Illinois at Chicago
Peter Constantin	Princeton University
Constantine Dafermos	Brown University
Mimi Dai	University of Illinois at Chicago
Tam Do	Rice University
Charles Doering*	University of Michigan
Hongjie Dong	Brown University
Chenjie Fan	Massachusetts Institute of Technology

Susan Friedlander*	USC
Rosa Fuster Aguilera	Tulane University
Irene Gamba*	University of Texas at Austin
Matthew Gilchrest	Naval Undersea Warfare Center Division Newport
Nathan Glatt-Holtz*	Tulane University
Cole Graham	Stanford University
Moussa GUEYE	Pennsylvania State University
Julien Guillod	University of Minnesota
Yan Guo*	Brown University
Michael Hott	University of Texas at Austin
Thomas Hou*	California Institute of Technology
Xiaokai Huo	Tsinghua University
Philip Isett*	Massachusetts Institute of Technology
Sameer Iyer	Brown University
Juhi Jang*	University of Southern California
In-Jee Jeong	Princeton University
David Kaspar	Brown University
Richard Katz	Naval Undersea Warfare Center
Sam Krupa	University of Texas at Austin
Aradhana Kumari	CUNY Graduate Center
Marta Lewicka*	University of Pittsburgh
Zongyuan Li	Brown University
Linhan li	Brown University
Erin Linebarger	University of Utah
Andrew Ma	University of Texas at Austin
Anna Mazzucato*	Pennsylvania State University
Donald McClure	Brown University
Colin Merrrah	NCWC
Cecilia Mondaini	Texas A&M University
Huy Nguyen	Princeton University
Matthew Novack	University of Texas
Helena Nussenzveig Lopes*	Federal University of Rio de Janeiro
Zhimeng Ouyang	Brown University
Neel Patel	University of Pennsylvania
Natasa Pavlovic	University of Texas at Austin
Leo Rebholz	Clemson University
Walter Rusin*	Oklahoma State University
Leila Setayeshgar	Providence College
Beniada Shabani	Stanford University
Joseph Shomberg	Providence College

Roman Shvydkoy*	University of Illinois at Chicago
Gigliola Staffilani*	Massachusetts Institute of Technology
Logan Stokols	University of Texas at Austin
Walter Strauss*	Brown University
Oliver Sun	Naval Undersea Warfare Center
Maja Taskovic	University of Pennsylvania
Ian Tice	Carnegie-Mellon University
Edriss Titi*	University of California, Irvine
Alexis Vasseur*	University of Texas at Austin
Vlad Vicol	Princeton University
Klaus Widmayer	Brown University
Zhongqiang Zhang	Worcester Polytechnic Institute
Zhiyuan Zhang	Brown University

*Workshop Speaker

Some Workshop Organizer Comments for “Describe the highlight of this workshop”:

“Being able to hear about new developments in fluid dynamics, both theoretical and computational, from not only deterministic but also probabilistic points of view, in a warm and friendly atmosphere was the highlight of the meeting. The atmosphere at talks as well as during breaks was welcoming to junior researchers too and it was great to see so many graduate students and postdocs participating at the workshop.”

“Talks at the workshop presented the state of the art results in both theoretical and computational developments.”

Some Workshop Participant Comments for “Describe the highlight of this workshop”:

“The workshop had interesting connections between usual techniques for incompressible fluid mechanics and dispersive/kinetic equations”

“This workshop gave me the opportunity to interact with some of the most important researches of my area and also with some young postdocs and grad students. This increased my network and it will certainly contribute to the development of my projects.”

“Edriss Titi's talk on rotational stabilization for 3D Navier-Stokes was brilliantly motivated and conveyed. It was inspiring for a young researcher to see a clear, clever idea taken to fruition, and communicated in a direct, transparent fashion.”

“Celebrating S. Friedmann's birthday who I didn't know before and see the impact she had on mathematicians and math itself.”

“Meeting and speaking with lots of researchers in my field with varying levels of experience. Titi's presentation.”

“Meeting researchers whose work has inspired the field of fluid PDE was the highlight of my visit.”

“The topics were diverse, yet complement each other. There was a lot of young participants, which is a big plus of this workshop.”

Note: for upcoming programs please see Appendix B.

Collaborate@ICERM

Collaborate@ICERM is ICERM’s newest program. It offers teams of 3-6 researchers the opportunity to spend five days at the institute during the summer (May-August) or in the month of January. The team research project should have a computational or experimental component. ICERM provides access to a variety of software packages as well as to high performance computing through Brown's Center for Computation and Visualization.

Proposals should specify the research project, the members of the team, the case for convening at ICERM, and possible dates. The proposal narrative should be no longer than 2-3 pages. Supporting materials should include short CVs of team members. This program provides funding for travel to the institute and local accommodations for six nights. International travel is partially supported. The entire team should be present for the week at ICERM, and are required to write a 2-page follow-up report within a month of being at ICERM. Proposals involving research projects that continue a collaboration fostered at one of the past ICERM semester programs are encouraged.

Collaborate@ICERM Process

The Collaborate@ICERM selection process follows these steps:

1. Solicitation of Proposals

ICERM solicits and recruits proposals from faculty nationally.

2. Future Proposal Selection

Programs are selected from proposals submitted to ICERM in an open competition. Proposals are reviewed by the ICERM Science Board during their November annual meeting and spring conference call.

The inaugural Collaborate@ICERM program ran in the summer of 2016; since then 7 have been held at ICERM.

Collaborate@ICERM Titles and Participants

TITLE	DATE	Participants
Compatible Discretizations for Efficient Uncertainty Quantification of Magneto-Hydro-Dynamic (MHD) Models	6-10 June 2016	Vrushali Bokil (Oregon State), Yingda Cheng (Michigan State), Fengyan Li (Rensselaer Polytechnic Institute)
On The Structure of Orbit Decompositions of the Generalized Symmetric Spaces of $SL_n(k)$	11-15 July 2016	Catherine Buell (Fitchburg State), Aloysius Helminck (North Carolina State), Vicky Klima (Appalachian State), Jennifer Schaefer (Dickinson College), Carmen Wright (Jackson State), Ellen Ziliak (Benedictine University)
Hilbert Series of Symplectic Torus Quotients	11-15 July 2016	Hans-Christian Herbig (Universidade Federal de Rio de Janeiro), Daniel Herden (Baylor), Christopher Seaton (Rhodes College)
Computational Arithmetic Dynamics	25-29 July 2016	Paul Fili (Oklahoma State), Benjamin Hutz (St. Louis University), Patrick Ingram (Colorado

		State), Holly Krieger (MIT), Michelle Manes (University of Hawaii), Joseph Silverman (Brown)
Turbulent Flows	1-5 August 2016	John Bowman (University of Alberta), Michael Jolly (Indian University), Adam Larios (University of Nebraska), Jared Whitehead (Brigham Young), Djoko Wirosoetisno (Durham University)
Solving S-unit Equations in Sage	9 - 13 January 2017	Alejandra Alvarado (Eastern Illinois University), Angelous Koutsianas (Universitat Ulm), Beth Malmskog (Villanova University), Christopher Rasmussen (Wesleyan), Christelle Vincent (University of Vermont), Mckenzie West (Reed College)
How to Compute Localized Entropy	23 - 27 January 2017	Christian Wolf (City University of New York), Martin Schmoll (Clemson University), Michael Burr (Clemson University)

Note: For summary reports from each of the Collaborate@ICERM programs listed above please see Appendix C.

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 made available to all ICERM participants, and various on-line math organization calendars (SIAM, AMS, European Mathematical Society, National Math Institutes, and Conference Service Mandl, etc.).

ICERM's email database is made up of former and upcoming 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:

- Modern Math Workshop at SACNAS, Fall 2016 (Los Angeles, CA)
- Blackwell-Tapia Conference and Award Ceremony, Fall 2016 (Knoxville, TN)
- Mathematical Field of Dreams Conference, Fall 2016 (St. Louis, MO)
- SIAM Annual Meeting, Summer 2016 (Boston, MA)
- Joint Mathematics Meeting (JMM), Winter 2017 (Atlanta, GA)

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, advising on the appointment of new directors and actively recruiting for the position as needed, 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.

Board of Trustee member appointments are for four 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.

ICERM Board of Trustees

Name	Institution
Douglas Arnold	University of Minnesota
Sir John Ball	University of Oxford
Jennifer Chayes	Microsoft Research
Bruce Hendrickson (new member)	Lawrence Livermore Laboratory
Peter Jones (Chair)	Yale University
David Keyes	Columbia University/KAUST
Yann LeCun	NYU and Director of Research, Facebook
Yvon Maday	Université Pierre et Marie Curie
Jill Pipher (new member)	Brown University

Bruce Hendrickson and Jill Pipher joined the SAB in 2016. Both Barbara Keyfitz (2011-2016) and Bin Yu (2012-2016) rotated off. Peter Jones was nominated and voted-in as the Chair of the BOT.

Note: See Appendix D for the minutes of the June 13, 2016 annual Board of Trustees meeting.

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. 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
Jeffrey Brock (new member)	Brown University
Henry Cohn	Microsoft Research
Qiang Du	Columbia University
Vanja Dukic (new member)	University of Colorado, Boulder
Charles Epstein (Chair)	University of Pennsylvania

Anna Gilbert	University of Michigan
Rachel Kuske (new member)	University of British Columbia
Ricardo Nochetto	University of Maryland
Guillermo Sapiro	Duke University
Anne Schilling	University of California, Davis
Richard Schwartz	Brown University
Cosma Shalizi	Carnegie Mellon University
Carol Woodward (new member)	Lawrence Livermore National Laboratory

Jeffrey Brock, Vanja Dukic, Rachel Kuske and Ricardo Nochetto joined the SAB in 2016. Sally Goldman, Cynthia Phillips, Robert Sutor and Yuri Tschinkel rotated off. Charles Epstein was selected as Chair, replacing Anna Gilbert who will rotate off as of June 2017.

Note: see Appendix E for the Scientific Advisory Board meeting minutes from the mid-year conference call on May 26, 2016 and subsequent minutes from the November 18-19, 2016 annual meeting.

Education Advisory Board (EAB)

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

Principally, the focus of the EAB will be the educational activities pertaining to Undergraduates, Secondary and Primary school students, Teachers in STEM fields, and the community at large. Subcommittees will have oversight over the following activities:

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

Terms are three years. The ICERM Directors act as ex officio members of this committee.

ICERM Education Advisory Board

Name	Institution
John Ewing	Math <i>for</i> America
Karen Haberstroh	Brown University
Katy Ott	Bates College
Lynn Rakatansky	RI Math Teachers Association Executive Board

Sergei Tabachnikov (Chair)	Brown University
Ulrica Wilson	Morehouse College

Irina Mitrea (2011-2016) and Allison Pacelli (2014-2016) rotated off.

Note: see Appendix F or the minutes of the September 16, 2016 annual Education Advisory Board meeting.

Mathematics Institute Directors Meeting (MIDs)

See Appendix G for the May 2016 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.

2016-2017 ICERM Postdoctoral Cohort

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

Name	Previous Institution	Semester
Chaim Even-Zohar	The Hebrew University of Jerusalem	Fall 2016 TIM
Isaac Mabillard	IST Austria	Fall 2016 TIM
Greg Malen	The Ohio State University	Fall 2016 TIM
Jose Alejandro Samper Casas	University of Washington	Fall 2016 TIM
John Wiltshire-Gordon	University of Michigan	Fall 2016 TIM
Seok Hyun Hong	POSTECH	Spring 2017 SWIF
Cecilia Mondaini	Texas A&M	Spring 2017 SWIF
Olga Trichtchenko	University College London	Spring 2017 SWIF
Xeucheng Wang	Princeton University	Spring 2017 SWIF
Xiaoqian Xu	University of Wisconsin-Madison	Spring 2017 SWIF

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

Name	Previous Institution	Semester
Hannah Alpert	MIT	2016-17: focus Fall TIM
Sergey Dyachenko	University of Illinois Urbana-Champaign	2016-17: focus Spring SWIF

Based on available information, the ICERM stipend-supported postdocs for 2016-2017 break down as follows:

	<u>Male</u>	<u>Female</u>
Black	0	0
Hispanic	1	0
American Indian/Alaskan Native	0	0
Asian/Pacific Islands	3	0
White	5	3
Other (specify)	<u>0</u>	+ <u>0</u>
	9	3 = 12 Total

Keeping Track of Former Postdocs (Institute and Semester)

ICERM Research Fellows are supported with a salary 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	Where are they now?
Emre Esenturk	Fall 2011	University of Cambridge
Jeffrey Haack	Fall 2011	Los Alamos National Laboratory
Andong He	Fall 2011 - Spring 2012	Passed away in 2016
Ahmed Kaffel	Fall 2011	University of Wisconsin
Daniela Tonon	Fall 2011	Maître de Conférence,

		Université Paris Dauphine
Dongming Wei	Fall 2011	VP at PNC Bank
Cecile Armana	Spring 2012	University of Franche-Comté
Anupam Bhatnagar	Spring 2012	Unity Technologies
Alon Levy	Fall 2011 – Spring 2012	KTH
Bianca Viray	Spring 2012	University of Washington
Xiaoguang Wang	Spring 2012	Zhejiang University
Daniel Cargill	Fall 2012	Southern Methodist University
Arnab Ganguly	Fall 2012	University of Louisville
Peng Hu	Fall 2012	Oxford-Man University
Hao Ni	Fall 2012	University College
Aaron Smith	Fall 2012 - Spring 2013	University of Ottawa
Julio Andrade	Fall 2012 - Spring 2013	Universty of Exeter
Kwangho Choiy	Spring 2013	Southern Illinois University
Zajj Daugherty	Spring 2013	CCNY
Martina Lanini	Spring 2013	University of Melbourne
Ben Salisbury	Spring 2013	Central Michigan University
BoGwang Jeon	Fall 2013	Columbia University
Rodolfo Rios-Zertuche	Fall 2013	Ecole Normale Supérieure
Ryan Greene	Fall 2013	The Ohio State University
Giulio Tiozzo	Fall 2013 – Spring 2014	University of Toronto
Anastasiia Tsvietkova	Fall 2013	Rutgers University
Danupon Nanongkai	Spring 2014	KTH
Amanda Redlich	Spring 2014	Bowdoin College
Kyle Fox	Spring 2014	Duke University
Charalampos Tsourakakis	Spring 2014	Boston University
Grigory Yaroslavtsev	Fall 2013 - Spring 2014	Indiana University
Ali Ahmed	Fall 2014	MIT
Jacqueline Davis	Fall 2014	Arizona State University
Pawel Siedlecki	Fall 2014	University of Warsaw
Li Wang	Fall 2014	University of Illinois
Tyler Helmuth	Spring 2015	UC Berkeley
Marcin Lis	Spring 2015	Chalmers University
Xuan Wang	Spring 2015	Georgia Institute of Technology
Samuel Watson	Spring 2015	Brown University
Ulas Ayaz	Fall 2014 – Spring 2015	MIT
Emily Russell	Fall 2014 – Spring 2015	Google
Olga Balkanova	Fall 2015	University of Turku, Finland
Sandro Bettin	Fall 2015	University of Genova
Edgar Costa	Fall 2015	Dartmouth College
Anna Medvedovsky	Fall 2015 - Spring 16	Max Planck Institute
James Weigandt	Fall 2015 – Spring 16	Purdue University
Marta Canadell	Fall 2015- Spring 16	Georgia Tech
Nishant Chandgotia	Spring 2016	Tel Aviv University
Abel Farkas	Spring 2016	Hebrew University of Jerusalem
Zhiqiang Li	Spring 2016	Stony Brook University

Polina Vytnova	Spring 2016	University of Warwick
Chaim Even-Zohar	Fall 2016	Krener Assistant Professor, University of California, Davis
Isaac Mabillard	Fall 2016	University of Chicago
Greg Malen	Fall 2016	Duke University
Jose Alejandro Samper Casas	Fall 2016	University of Miami
John Wiltshire-Gordon	Fall 2016	University of Wisconsin, Madison
Hannah Alpert	Fall 2016 – Spring 2017	Zassenhaus Assistant Professor at The Ohio State University
Sergey Dyachenko	Fall 2016 – Spring 2017	University of Illinois, Urbana- Champaign
Seok Hyun Hong	Spring 2017	Penn State University
Cecilia Mondaini	Spring 2017	Texas A&M
Olga Trichtchenko	Spring 2017	University of Toronto Institute for Aerospace Studies
Xeucheng Wang	Spring 2017	Tenure track at YMSC, Tsinghua University
Xiaoqian Xu	Spring 2017	Carnegie Mellon University

Graduate Students

Support for Graduate Students

The research semester program budget includes partial support for a cohort of graduate students. A housing allowance \$850/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 directors. 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. Currently, Associate Director Caroline Klivans 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. In most cases, postdocs are matched with mentors at Brown in Math, Applied Math, or Computer Science in order to continue their ICERM research. During this reporting cycle, Institute

Postdoc, Hannah Alpert, continued her ICERM “off semester” research at MIT with Larry Guth. Professor Guth is her faculty advisor and he also attended the fall 2016 semester program.

ICERM Postdoctoral Participant and Mentor list by Semester Program

Postdoc	Mentor	Program
Hannah Alpert*	Larry Guth	Fall 2016 ICERM Institute Postdoc
Bryan Chen*	Randall Kamien	Fall 2016 ICERM/Independent
Chaim Even-Zohar	A. Engstrom	Fall 2016 ICERM Postdoctoral Fellow
Isaac Mabillard	Rade Zivaljevic	Fall 2016 ICERM Postdoctoral Fellow
Greg Malen*	Matthew Kahle	Fall 2016 ICERM Postdoctoral Fellow
Vidit Nanda	Yuliy Baryshnikov	Fall 2016 ICERM/Independent
Jose Samper Casas	Karim Adiprasito	Fall 2016 ICERM Postdoctoral Fellow
Benjamin Schweinhart*	Robert MacPherson	Fall 2016 ICERM/Independent
John Wiltshire-Gordan	Patricia Hersh	Fall 2016 ICERM Postdoctoral Fellow
Sergey Dyachenko*	Vera Hur	Spring 2017 ICERM Institute Postdoc
Juliean Guillod	Edriss Titi	Spring 2017 ICERM/Independent
Seok Hyun Hong	Vera Hur	Spring 2017 ICERM Postdoctoral Fellow
Cecilia Mondaini	Anne Bronzi	Spring 2017 ICERM Postdoctoral Fellow
Olga Trichtchenko	Bernard Deconinck	Spring 2017 ICERM Postdoctoral Fellow
Xuecheng Wang	Yan Guo	Spring 2017 ICERM Postdoctoral Fellow
Miles Wheeler	Walter Strauss	Spring 2017 ICERM/Independent
Klaus Widmayer	Yan Guo	Spring 2017 ICERM/Independent
Xiaoqian Xu	Anna Mazzucato	Spring 2017 ICERM Postdoctoral Fellow

*Advisor also attended the program

Graduate Student Mentoring

Graduate Student	Mentor	Program
Jeremy Cochoy	Steve Oudot	Fall 2016 TIM
Christopher Fowler	Chris Hoffman	Fall 2016 TIM
Bárbara Gutiérrez	Ileana Streinu	Fall 2016 TIM
Marija Jelic	Rade Zivaljevic	Fall 2016 TIM
Filip Jevtic	Rade Zivaljevic	Fall 2016 TIM
Nick Kosar	Yuliy Baryshnikov	Fall 2016 TIM
Deniz Kutluay	Fred Cohen	Fall 2016 TIM
Wai Yeung Lam	Local/at Brown	Fall 2016 TIM
Andrew Newman	Matthew Kahle	Fall 2016 TIM
Quang-Nhat Le	Larry Guth	Fall 2016 TIM
Kyle Parsons	Matthew Kahle	Fall 2016 TIM
Katie Ritchey	Matthew Kahle	Fall 2016 TIM
Érika Roldán Roa*	Matthew Kahle, Víctor Pérez-Abreu	Fall 2016 TIM
Yitzchak Solomon	Local/at Brown	Fall 2016 TIM
Kazuki Koga	Anne Bronzi	Spring 2017 SWIF
Yue Pu	Robert Pego	Spring 2017 SWIF
Saad Qadeer*	Jon Wilkening	Spring 2017 SWIF
Antoine Redmond-Tiedrez	Ian Tice	Spring 2017 SWIF

*Advisor also attended program/acted as mentor

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.

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.

ICERM has been approached several times by past participants asking if ICERM can share its earlier career training and mentoring program materials. For example, “I participated in one of your Professional Development sessions. I was impressed by how organized your program was, and by how positive and non-judgemental your interactions with the post-docs were. After that particular session ended, I wondered if my department (the Applied Math Department at the U. of Colorado, Boulder) might create such a well-designed mentoring program for our doctoral students and post-docs.” ICERM is pleased to make all of its resource materials for its Graduate Students and Postdoctoral Fellows available to the general public on its website, which can be found at: <https://icerm.brown.edu/pds/>

Summer Undergraduate Research Program

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. 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 Education Advisory Board.

3. Application Process

Undergraduates apply to the program through MathPrograms.org and a ranked list of applicants are 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 2016: Summer@ICERM – Dynamics and Stochastics

June 20 – August 12, 2016

Organizing Committee

Margaret Beck, Boston University
Todd Kapitula, Calvin College
Bjorn Sandstede, Brown University

Program Description

The Summer@ICERM: Dynamics and Stochastics program is designed for a select group of 20-25 undergraduate scholars. Students work in groups of two to four, supervised by faculty advisors and aided by teaching assistants. The faculty advisors present a number of research topics that are centered around modeling, dynamical systems, and stochastic systems. Examples include stripe formation in zebrafish, the structure of roll patterns that arise in buckling and vegetation patterns, and the dynamics of planar spiral waves. Tackling these problems will require a combination of analytical and computational approaches. Students form research groups to work on these problems, give talks about their findings, and write up their research into a paper at the end of the program.

Research Project Topics for SUMMER@ICERM 2016

During the 2016 Summer@ICERM program, the faculty organizers will describe a number of open-ended problems at the interface of applications, modeling, and deterministic and stochastic dynamical systems. These problems arise in current research, are amenable to analysis and computation, and may be approached from a number of different angles.

2016 Research Project Topics:

Agent-based modelling of pattern-forming processes
Snaking in the Swift-Hohenberg equation
Patterns in planar systems

Participants will be expected to gain intuition into some of these problems via analysis, computer experimentation, and visualization.

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

2016 Summer@ICERM Cohort

The “Summer@ICERM” program ran from June 20, 2016 through August 12, 2016 with a cohort of 26 students. 13 students were funded through the NSF; 5 via a Brown University Undergraduate Training and Research Award (UTRA), 5 via program organizer Bjorn Sandstede’s NSF Research Training Group (RTG) grant, and 3 via outside funding. UTRA stipends are \$3,500 and RTG stipends are \$3,000.

Name	Home Institute	Funding Source
Madeline Abbott	Macalester College	NSF/ICERM
Dylan Altschuler	Princeton University	RTG
Chloe Avery	University of California/SB	NSF/ICERM
Julia Bujalski	Emmanuel College	NSF/ICERM
Dorothy Catey	University of Idaho	NSF/ICERM
Carter Chain	Purdue University	RTG
Neil Chandra	Brown University	UTRA
Tracy Chin	Brown University	UTRA
Cassandra Cole	Brown University	Outside funding/DAM
Jordan Collignon	California State University/MB	NSF/ICERM
Surabhi Desai	University of St Andrews	NSF/ICERM
Philip Doldo	Rensselaer Polytechnic Institute	NSF/ICERM
Bethany Dubois	Brown University	UTRA
Grace Dwyer	University of Virginia	RTG
Qing (Claire) Fan	Pomona College	NSF/ICERM
Francesca Lim	Brown University	UTRA
Jasleen Malvai	Brown University	Outside funding/Math
Melissa Morrissey	Brown University	Outside funding/DAM
Micah Pedrick	Harvey Mudd College	NSF/ICERM
Jordan Rosenthal-Kay	Tufts University	NSF/ICERM
Jacob Ruth	Brown University	UTRA
Tharathep (Nes) Sangsawang	Pitzer College	NSF/ICERM
Rebecca Santorella	The College of New Jersey	RTG
Melissa Stadt	University of Washington	RTG
Ryan Utke	Grinnell College	NSF/ICERM
Aric Wheeler	UNC/Chapel Hill	NSF/ICERM

In addition to the 26 undergraduate researchers and 3 faculty organizers, 6 teaching assistants were key members of the Summer@ICERM program: Tarik Aougab, Brown University postdoc; Paul Carter, Brown University graduate student; Veronica Ciocanel, Brown University graduate student; Quang Nhat Le, Brown University graduate student; Joshua Ruiter, Calvin College graduate student; and Alexandria Volkening, Brown University graduate student.

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

Summer@ICERM Organizer Comments for “Describe the highlight of this program”:

“I really enjoyed the weekly presentations and the poster session -- the groups prepared very well for those!”

Working with the students in such a great space....”

Summer@ICERM Participant Comments for “Describe the highlight of this program”:

“The research was definitely the highlight of the program for me, especially since it was my first research experience. I also enjoyed meeting fellow students, TAs and math faculty; it was great learning about other peoples' experiences in pursuing mathematics.”

“Our advisor suggested we talk with one of the mathematicians who wrote many of the papers we referenced to ask if our work merited publication, and the chance to talk with someone who was a leading voice in the field we had worked in was amazing.”

“For me, the highlight of this program was probably learning more about how to work in a group in a productive manner. Although we did not make as much progress as I hoped towards our research goal, I believe that this was a very valuable experience and that I have learned many things from it that will enable my future research work to be even more productive.”

“This program was an incredible way to explore one field of research while being very close to many other fields--talking with so many students from different schools, with different backgrounds, along with discussions with the TAs and professors really broadened my perspective on my future!”

“My favorite part of this program is meeting and building relationships with fellow mathematicians/students across the country. I learned so much about what kinds of research are out there, and I now know people throughout the country that have something in common with me! I truly valued the opportunity to become more involved in the mathematical community.”

“Part of our problem made us turn our research in a highly unexpected direction, so that was really exciting.”

Summer@ICERM TA Comments for “Describe the highlight of this program”:

“There is no one event in particular. For me, it was really the day-to-day excitement the students had about their projects. That made it very enjoyable to come in every day and work with them.”

“Working with the students! They've achieved great things and proven very interesting results this summer”

“Working with students on a serious research project, and learning all about the particular dynamical system we chose to study. In particular, learning MATLAB and using it to explore numerical simulation of the system was both educational and exciting for me....”

Participant Selection Process

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 2016 Summer@ICERM program (318) included some 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 qualified applicants, and with consideration towards diversity, a rank-ordered list was generated.

Based on available information, the 2016 Summer@ICERM *NSF-funded* cohort broke down as follows:

	<u>Male</u>	<u>Female</u>	
Black	0	0	
Hispanic	0	0	
American Indian/Alaskan Native	0	0	
Asian/Pacific Islands	1	2	
White	6	4	
Other (specify)	$\frac{0}{7}$	$\frac{0}{6}$	
	$7 + 6 = 13$ Total		

The 13 externally-funded students were made up of 4 Asian/Pacific Islanders (1 male and 3 female), and 9 whose ethnicity was white (3 males and 6 females).

Summer@ICERM 2016 Scientific Outcomes to Date

Final Student Presentations

- *Plurality and Stability in Continuous Time Opinion Formation on Weighted Directed Graphs* by J. Bujalski, G. Dwyer, H. Malvai, and J. Rosenthal-Kay
- *Propagation of Lead in Mammals* by M. Morrissey and J. Collignon
- *Diffusion Maps in Equation-Free Modeling* by T. Chin, J. Ruth, and R. Santorella
- *Summary of Koopman Theory Results* by C. Chain, M. Pedrick, and R. Utke
- *Nonorientable Bundles* by S. Desai, M. Stadt, and A. Wheeler
- *Snaking in the Swift-Hohenberg Equation in Dimensions 1 Versus 1+* by D. Altschuler, C. Avery and T. Sangsawang
- *Stability of Agent-based Models: Overview* by C. Cole, P. Doldo, Q. Fan
- *Modelling Stripe Formation on Zebrafish Fins* by M. Abbott, D. Catey, N. Chandra, F. Lim, and B. Dubois

Details about these final presentations can be found at:

<https://icerm.brown.edu/summerug/2016/include/summerICERM2016summaries.pdf>

Student Projects

- M. Abbott, D. Catey, N. Chandra, B. Dubois, and F. Lim, and A. Volkening plan to submit a paper on “Stripe formation in zebra fish fins”.
- T. Aougab, M. Beck, P. Carter, S. Desai, B. Sandstede, M. Stadt, and A. Wheeler have a paper drafted for the project “Snaking and localized patterns with twisted invariant manifolds”
- J. Bujalski, G. Dwyer, H. Malvai, and J. Rosenthal-Kay have a paper in progress, “Consensus and clustering in opinion formation on small-world networks”. To peer-reviewed journal by the end of May 2017.
- M. Morrissey and J. Collignon submitted a paper to SIURO entitled, “Propagation of lead in the human body”.

Student posters presented at JMM 2017 in Atlanta Georgia

- *Snaking in the Swift-Hohenberg Equation in Dimensions 1 vs 1 + ε* (C. Avery)
- *Spectral Theory of Koopman Operators* (M. Pedrick, R. Utke, C. Chain)
- *Stability of Agent-based Models* (C. Cole, P. Doldo, Q. Fan)**

**This poster received the MAA's "Outstanding Poster" during the Student Poster Session at JMM 2017

Posters presented during the Nebraska Conference for Undergraduate Women in Mathematics in winter 2017

- *Snaking in Systems with Non-Orientable Manifolds* (S. Desai)
- *Continuous Time Opinion Formation on Directed Weighted Graphs* (J. Malvai)

T. Kapitula gave talks at the AMS SE Sectional meeting in Charleston, SC, and at a seminar at Michigan State U.

The Evaluation Process: Measure to Evaluate Progress

Current Program Evaluation

ICERM continues to work with Strategic Research Group (SRG), an external evaluation company, to build upon its current survey data.

ICERM now automates its survey reporting, using templates that display particular variables of interest across participants and over time. In this way, ICERM can easily recognize a pattern of program strengths in certain areas and may be able to tailor aspects of its programs to successfully equip individuals for a thriving and influential research career.

ICERM also successfully creates two and five-year follow-up surveys that are customized to a single participant instead of distributing a broad and generalized survey to all participants. An example of how customized surveys are being used at the institute is the generation of publication lists for each participant. When the survey is sent, Qualtrics reads the unique identification number of the participant stored in the panel database and generates a list of publications previously collected by ICERM staff and assigned to that specific identification number. Then, the surveyed participant is able to identify the publications that can be attributed to his or her time at ICERM. This novel incorporation of a participant-specific generated publication list has been useful in understanding how influential ICERM programs are to one's research career long-term.

Survey response rates

ICERM strives to get the highest response rate for its surveys. The director informs participants that they will receive a survey during the welcoming remarks. In addition, the institute explains within the body of every survey how it handles responses confidentially and why it collects gender and ethnicity data. Reminders are sent one or two weeks after each survey is first sent out. This year, ICERM averaged a 60% response rate on all of its exit surveys.

Measure impact across subgroups

Qualtrics cloud-based software not only aids in creating customizable surveys for participants, but also serves as a platform for analyzing data according to different subgroups of participants e.g., gender, job title, race/ethnicity.

SRG continues to assist ICERM with using the Qualtrics data analysis tools to better understand how the institute's programs impact different subgroups of researchers in both the immediate i.e., program exit surveys and intermediate-/long-term i.e., two- and five-years after program participation. ICERM is now positioned to conduct appropriate analyses 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 over time. Ultimately, these analyses will provide information as to how ICERM can alter programs to benefit different types of participants who may be at various

points in their research career.

Measure long-term outcomes

Since 2014, ICERM has been administering an intermediate - i.e., two-year follow-up survey to past semester program participants. Using the unique identification numbers and in-survey data analyses as described above, these surveys measure the attributable impact of participation in ICERM research programs by gathering data on published papers, invited talks, and funded or pending grant proposals. These follow-up surveys help us understand the far-reaching impact of ICERM's research programs over time. The first five-year follow-up surveys (for fall 2011 and Spring 2012) were sent in May 2017 (close to the timeframe of submitting this report).

ICERM continues to play a large role in gathering and updating participant information for the two and five year follow-up surveys. Specifically, one question provides participants with a list of their papers, pre-prints, or reports published since their participation at ICERM (or, in the case of the 5 year follow-up, since their initial 2-year survey). Participants then have the opportunity to include/update publications resulting from their participation in an ICERM program or event. ICERM is responsible for finding and compiling these publications for each participant. Additionally, before implementing each survey, ICERM continues to be involved in editing and testing the survey in order to have an end product that will most effectively provide data aligned with its goals.

It is important to note here that although ICERM has hired SRG as its external evaluation company to aid in reaching their evaluation goals, the institute still plays a vital role in the data collection and survey distribution process. In addition, at weekly management meetings, survey results are reviewed and discussed so that improvements can be made as appropriate.

Note: Appendix H shows links to exit survey summaries for programs run during this reporting cycle (May 1, 2016 through April 30, 2017).

Reported Scientific Outcomes/Projects Initiated

In the past, the Director sent a request to all long-term participants asking for updates on their research projects and/or publications that arose during, or were enhanced by, participation in an ICERM program. With the advent of ICERM's 2-year and soon to be added 5-year follow-up survey for each of its semester programs, scientific outcomes have begun to be collected much more systematically and consistently; ICERM can now report scientific outcomes for past programs in a standardized report.

For the purposes of this report, we have summarized "projects initiated" that were reported on the Fall 2016 and Spring 2017 semester program exit surveys. Participants answered the question, "What, if any, specific projects did you initiate or continue while attending this semester program?" Using unique IDs, ICERM will be able to track the advancement of these initial projects through the subsequent standardized 2-year and 5-year follow-up surveys.

Note: see Appendix I for a list of research projects initiated at ICERM during the Fall 2016 and Spring 2017 semester programs.

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 \$27,500 in corporate sponsorship funds.

Corporate sponsors include:

- Microsoft Research
- Schlumberger Limited

The Academic Sponsorship has an annual membership fee of \$1,500 for domestic memberships with small graduate student programs, \$3,000 for domestic membership with large graduate student programs, and \$5,000 for international membership. To date, ICERM has received \$56,875 in academic sponsorship funds.

Academic sponsors include:

- Cornell University, Department of Mathematics
- Georgia Tech, School of Mathematics
- Hong Kong University of Science and Technology, Department 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. Financial Manager Juliet Duyster, has duties which include managing both public and private grants, managing the proposal process and ensuring that follow-up reporting is completed. Assistant Director Ruth Crane 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. This year Brown gave ICERM over \$100,000 (\$75K of which is the university operating budget).

Other Funding Support received in 2016-2017

Additional Grants

	<u>Amount</u>
American Mathematical Society Epsilon Fund	\$ 5,000.00
Sub-total	\$ 5,000.00

University Funding Support

University Research Committee	\$ 75,000.00
Supplemental Administrative Costs	\$ 32,976.19
Brown UTRA Program for Summer@ICERM	\$ 17,500.00
Brown Faculty support for Summer@ICERM	\$ 25,500.00
Sub-total	\$150,976.19

Sponsor Support

Academic Sponsors	\$ 5,000.00
Corporate Sponsors	\$ 0.00
Individual Sponsors	\$ 4,210.00
Sub-total	\$ 9,210.00

TOTAL	\$165,186.19
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Diversity and Outreach

Ulrica Wilson, an Associate Professor of Mathematics at Morehouse College, is also ICERM’s Associate Director of Diversity and Outreach. Ulrica continues to provide 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. In 2014, she volunteered to chair the overarching diversity committee of the Math Institutes Diversity Committee.

ICERM strongly supports the National Science Foundation’s goals of expanding the numbers and diversity of individuals engaged in mathematical sciences through increased participation. Through its membership in the Math Institutes Diversity Committee, the institute actively seeks best practices for securing the 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

ICERM sends diversity guides to all semester program and workshop organizers.

Diversity Events in 2016-2017

- Participated in the Blackwell-Tapia conference, Fall 2016 in Knoxville, TN
- Participated in Mathematical Field of Dreams Conference, Fall 2016 St. Louis, MO
- Participated in Modern Math Workshop at SACNAS, Fall 2016 Long Beach, CA
- Participated in Nebraska Conference for Undergraduate Women in Mathematics, Winter 2017
- Co-sponsored Brown’s Women’s History Month programming, featuring Margot Lee Shetterly, author of Hidden Figures

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

Outreach Activities

Public Lectures

ICERM is pleased to be able to present regular public lectures, inviting the Brown and the local community to participate. During this reporting cycle, 3 public lectures occurred, attracting a broad audience, from high school students on up. In October 2016, 184 people attended a well-timed “Voting Insecurity: Why We Won’t be Able to Verify the Outcome of the 2016 Election”, featuring Barbara Simons. The Rhode Island Secretary of State, Nellie Gorbea, attended this public lecture, and engaged Dr. Simons in a lively Q&A session. In December 2016, 72 people attended “Visualizing the Future of Biomedicine”, featuring Chris Johnson. And in April 2017, 148 people attended “Modeling Sea Ice in a Changing Climate, featuring Kenneth Golden.

ICERM sponsored Erika Roldan Roa, a fall 2016 semester program graduate student participant, who presented a Mayan number system seminar to over 100 high schoolers at 3 different inner-city high schools located in Providence, RI. Her activities exposed the students to the varied cultural history of mathematics through hands-on activities, and helped to garner interest in the GirlsGetMath@ICERM 2017 summer program.

GirlsGetMath@ICERM

For the past 3 years, ICERM has been able to secure funding to run its well-received GirlsGetMath@ICERM program. GirlsGetMath aims to build knowledge and confidence in mathematics ability early in girls’ education, ultimately shaping the way the girls view themselves and their mathematical interests and potential. The program hopes to inspire 25-30 girls to love math by:

- demonstrating through hands-on activities, games, and computer simulations that the study of mathematics can be exciting, fun, and useful;
- introducing the high school participants to a variety of career opportunities for which sophisticated mathematical ability plays a key role, with an emphasis on the central role mathematics plays for success in STEM careers; and
- providing the participants with a support group of like-minded peers and mentors.

GirlsGetMath Broader Impact

The mentorship provided to the participants has been specifically designed by those with experience in outreach to meet a key set of needs identified by research as being most likely to make a difference in the way the girls view mathematics and STEM disciplines. The program content is created by mathematicians who collectively have many years of experience as researchers and educators. It is crafted to be at the appropriate level for the participants, but at the same time challenging and practical. The topics are selected to showcase the beauty and depth of mathematics.

The ultimate goal is the creation of an exportable GirlsGetMath mathematics camp prototype for use at other institutions throughout the United States. The hope is that future editions will take place nationally with ICERM as a model.

ICERM is currently developing methodologies for tracking GirlsGetMath alumnae annually in order to determine if they go on to seek a college degree and if they choose to major in a STEM field. Plans for alumnae reunion events are also being developed (STEM career panel, coding party, etc.).

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 from EPSCoR States (May 1, 2016 through April 30, 2017)

EPSCoR State	# of ICERM Participants
Alabama	1
Arkansas	4
Hawaii	3
Idaho	1
Iowa	1
Kansas	1
Kentucky	1
Louisiana	3
Maine	1
Mississippi	2
Missouri	8
Nebraska	3
New Hampshire	1
New Mexico	8
Oklahoma	6
Rhode Island	132
South Carolina	4
Tennessee	3
Utah	10
Vermont	2
Total	195

Administration and Staff

ICERM Directors funded by the grant are: Jeffrey Brock, Jill Pipher, and Bjorn Sandstede. Jeff Brock and Bjorn Sandstede have committed one half summer month of effort to the institute as Associate Directors, Jill Pipher commits 100% time. 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, with appointments starting July 2013.

ICERM Staff

Juliet Duyster, Manager of Finance and Administration, hired in August 2011: reports to the Assistant Director. Responsible for managing ICERM's finances, strategic planning, financial staff, and human resources. Provides analysis and options to the Directorate who support the resource allocation and decision process. Works with the Directorate to design and implement a strategic plan and fund raising plan. Establishes and maintains financial systems, operational policies and human resource policies and procedures. Represents ICERM to Brown administration, government agencies, industrial and academic partners, program participants, and others. Manages ICERM's financial staff.

Teresa Fitzenry, Program Coordinator, hired October 2016: one of two Program Coordinator positions. Coordinates all logistical aspects of the fall semester/late summer programs and workshops. The position coordinates the speaker invitations, housing, arrival details, and orientation of long-term and short-term visitors for assigned programs. Organizes break food and beverage for assigned workshops and semester program. Maintains participant data on ICERM's customized database. Acts as concierge for all visitors. Assist the Program Manager and Assistant Director with other activities, such as social media and other marketing, as needed.

Brian Lavall, Technical Support Coordinator, hired April 2014: 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. Responsibilities include support of administrative IT and A/V equipment. Provides A/V support for the institute's workshops and events. Monitors and actively controls the Echo 360 lecture capture system and provides first level support for technical issues such as wireless connectivity and printing.

Adam Jilling, Application Developer, hired June 2016: reports to the Senior Application Developer. Performs application testing, development, and maintenance, including development/coding, testing, and ongoing maintenance of the department's front-end applications, back-end applications, java application servers, and databases.

Bernadette McHugh, Web Content Editor, 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.

Kellie Shaughnessy, Program Coordinator, hired February 2017: one of two Program Coordinator positions. Coordinates all logistical aspects of the spring semester/early summer programs and workshops. The position coordinates the speaker invitations, housing, arrival details, and orientation of long-term and short-term visitors for assigned programs. Organizes break food and beverage for assigned workshops and semester program. Maintains participant data on ICERM's customized database. Acts as

conciierge for all visitors. Assist the Program Manager and Assistant Director with other activities, such as social media and other marketing, as needed.

Nina Succi, Financial Coordinator, hired February 2016: reports to the Financial Manager. Serves as fiscal liaison and primary point of contact for ICERM staff, program organizers, visitors, postdocs, students, customers, and vendors for all financial transactions and related issues. The Financial Coordinator processes and reconciles the day-to-day financial activity for expenses supported by sponsored projects and University appropriated budgets, and reconciles the purchasing/accounts payable functions. Processes purchase orders, travel reimbursements, check requests and any other reimbursements.

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

Brendan Hassett (Director) joined the Brown faculty the summer of 2015 as a Professor of Mathematics. He assumed the directorship of ICERM in July 2016. Brendan received his Ph.D. from Harvard in 1996 and then spent four years at the University of Chicago before joining the faculty at Rice University in 2000. He was the chair of the mathematics department at Rice from 2009 to 2014. He has also held visiting positions at the Mittag-Leffler Institute in Stockholm, the Chinese University of Hong Kong, and the University of Paris. Brendan's research focus is algebraic geometry - the study of geometric objects that are defined as solutions to polynomial equations. Brendan has written more than 50 research papers and has authored or co-edited six books. His work has been recognized with a Sloan Research Fellowship, a National Science Foundation CAREER award, and the Charles W. Duncan Award for Outstanding Faculty at Rice. He is a Fellow of the American Mathematical Society.

Mathew Borton was one of ICERM's first employees, hired in December 2011. As the IT Director, he brings big-picture, strategic development skills to the institute. He oversees all daily IT/technology related operational activities, and ensures IT security and stability. He acts as the liaison to the Brown University's IT community. Besides supporting the scientific activities within the institute, his responsibilities include overseeing the support of administrative IT and A/V equipment, and the development and support of key web interfaces and databases. Mat received his BS in Information Technology and his MS in Technology – Information Security, both from Purdue University.

Jeffrey Brock is a Professor of Mathematics and the Director of the Data Science Initiative at Brown University, as well as an ICERM Associate Director. Jeff'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.

Ruth Crane, Assistant Director, joined ICERM in November 2010 as the institute's first employee. She has over 35 years of communications and management experience, ranging from corporate training, health care, and academia. She uses her broad range of experience in order to act as chief-of-staff, and oversees the coordination and administrative aspects of all the research programs of the institute. She

coordinates the institute's fundraising activities and grant proposals, including proposal writing. She works closely with the director and the institute's boards. Crane manages all ICERM marketing and oversees ICERM's web content as well as community outreach activities. Ruth received her BS from Emerson College.

Jeffrey Hoffstein is a Professor of Mathematics at Brown University, and an ICERM Consulting 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, Jeff 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. Jeff has written over seventy 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.

Jill Pipher is the Elisha Benjamin Andrews Professor of Mathematics at Brown University and ICERM's founding director emeritus. She has been named Brown University's Vice President for Research beginning July 1, 2017. Jill served as Chair of the Mathematics Department 2005-2008. Jill 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 jointly holds four patents for the NTRU encryption and digital signature algorithms and was a co-founder of Ntru Cryptosystems, Inc., now owned by 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. She served as President of the Association for Women in Mathematics in 2011-2013 and was a National Women's History Month 2013 Honoree. She was honored to deliver the 2016 Brown University Presidential Faculty Award lecture. Jill is a Fellow of the American Mathematical Society and a member of the American Academy of Arts and Sciences.

Caroline Klivans is an Applied Mathematics and Computer Science Senior Lecturer at Brown University, and an ICERM Associate Director. Her focus is on the Institute's mentoring and professional development programs for students and postdoctoral fellows. In particular she leads the Round-Table discussion sessions building community and career foundations. Carly received a BA degree in mathematics from Cornell University and a PhD in applied mathematics from the Massachusetts Institute of Technology. Before coming to Brown she held positions at MSRI and the University of Chicago. Her research is in algebraic, geometric and topological combinatorics.

Sinai Robins is a deputy director at ICERM, and a Professor of computer science at the University of Sao Paulo, Brasil. He enjoys doing research in discrete and computational geometry, combinatorics, and number theory. His work has revealed new interactions between polytopes and lattices, and some of his current research focuses on computing various different forms of discrete volumes for polytopes, often using Harmonic analysis. Sinai has contributed to the modern field of the geometry of numbers by coauthoring the Springer UTM book "Computing the continuous discretely: integer point enumeration in polyhedra". His research has been funded by the National Science Foundation, the NSA, the Sloan Foundation, the London Mathematical Society, the Singapore Ministry of Education, and the University of Sao Paulo. Sinai received his PhD from UCLA in 1991, and has had numerous research visiting positions, including the CNRS/LAAS lab for architecture of systems (Toulouse, France), the Alfred Renyi research institute (Budapest, Hungary), the Technion institute (Haifa, Israel), MSRI (Berkeley, California), the Institute for Defense Analysis (La Jolla, California), and the Distinguished Visiting Professorship at Brown University in 2014.

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. Bjorn 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. Bjorn is a Fellow of the Society for Industrial and Applied Mathematics.

Homer Walker joined ICERM as a Deputy Director 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. Homer'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 has been 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, 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. As ICERM's 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 Research Experience for Undergraduate Faculty REUF workshops at the American Institute of Mathematics AIM and now at ICERM. Ulrica was recently awarded Morehouse College's 2016-2017 Vulcan Teaching Excellence Award.

Facilities

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 a 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, a 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 Redhat Virtualization. The host operating system is Redhat Linux Server, the guests use Redhat Linux workstation or Windows 10, and the client machines are thin clients using a thin version of Linux. Applications are distributed as needed. Application needs differ from program to program and researcher to researcher. Individuals have administrative control over their own virtual desktops. Researchers are also free to provide their own equipment or use their own laptop. The majority of the applications provided to 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.

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 with an auto-tracking camera 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 Panopto 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

ICERM has developed a visitor management system called CUBE to collect and report on participant data. This system will become a central point of data management for both staff and participants as new feature sets are added.

Brown Computing Resources

ICERM participants are encouraged to use other IT resources available at Brown. Chief among these is the high-performance computing cluster hosted by the Center for Computation and Visualization. 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.

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.

CCV makes other services available to ICERM participants, including access to consultants for code creation and optimization and an immersive display environment.

APPENDIX:

Appendix A: Sample Semester Schedule & Organizer Timeline

Appendix B: Upcoming Programs and Events

Appendix C: Collaborate@ICERM Summary Reports

Appendix D: Minutes from Board of Trustees Meeting

Appendix E: Minutes from Scientific Advisory Board Meetings

Appendix F: Minutes from Education Advisory Board Meeting

Appendix G: MIDs Meeting Minutes

Appendix H: Survey Summaries May 1, 2016-April 30, 2017

Appendix I: Projects Initiated at ICERM 2016-2017

NSF Required Materials Available in the Appendix

Appendix J: ICERM Participant List and Summary Table

Appendix K: ICERM Financial Support List

Appendix L: ICERM Income and Expenditure Report