Diversity In Mathematics:

Undergraduate Women's Summer School

August 7-17, 2018

University of British Columbia

PROGRAM SCHEDULE

Pacific Institute *for the* Mathematical Sciences

Getting Started

Get connected: Select the "ubcvisitor" wireless network on your wireless device. Open up a web browser, and you will be directed to the login page.

Frequently Asked Questions:

Q: Where do I check in on the first day?

Check- in and Package pick up can be done on the fifth floor, outside room 5104

Q: Where are the sessions?

All sessions will be in the **Earth Sciences Building at UBC; 2207 Main Mall**

- All sessions in ESB **Room 5104**.
- High School Tutorial Sessions in **Orchard Commons Room 1001**

Q: Will the program change?

Program changes and updates will be announced at each session.

Q: When should I wear my badge?

Please wear your name badges at all times on site so that PIMS Staff recognize you as a guest.

Q: Where can I go for help on site?

If you need assistance or have a question during the conference, please feel free to talk to one of the organizers

Q: Where can I get refreshments and meals?

For snack or quick meals, please view the list of UBC eateries attached at the end of the program or online at http://www.food.ubc.ca/

Program Overview:

Week 1 in ESB 5104 with Prof. Sara Maloni

Time	Mon, Aug 6	Tue, Aug 7 Rm: ESB 5104	Wed, Aug 8 Rm: ESB 5104	Thur, Aug 9 Rm: ESB 5104	Fri, Aug 10 Rm: ESB 5104
8:30am - 8:50am		**Registration, PIMS Welcome & Introductions**			
9:00am - 10:30am		**Course #1** **Prof. Sara Maloni**	**Course #1**	**Course #1**	**Faculty Presentations** Kelli Kadokawa, UBC Stephanie Van Willigenburg, UBC Mona Berciu, UBC
Coffee Break (ESB 5104 Lobby)					
11:00am - 12:30am		**Course #1**	**Course #1**	**Course #1**	**Course #1**
Lunch (See list of Campus Eateries)					
2:00pm- 3:30pm	**Check in at Vanier/ Pacific Spirit Park Hostel***	**Course #1**	**Course #1**	**1:00pm- 3:30pm**** **High School Math Camp:** Joint Session 1. **Location: Orchard 1001**	**Course #1**
Coffee Break (ESB 5104 Lobby)					
4:00pm- 5:30pm			**Guest Lecture** Rachel Ollivier, UBC	**Guest Lecture** Yan Jiang, IHS Markit Melania Alvarez, PIMS Alejandra Herrera, UBC	**Course #1**

* Check- in at Place Vanier residences begins at 3:00pm

** A shared lunch will be available during high school joint sessions. Undergraduate summer school students should meet the high school participants at their location in Orchard Commons, Room 1001

Program Overview:

Week 2 in ESB 5104 with Prof. Karen Yeats

	Monday, Aug 13 Rm: ESB 5104	Tuesday, Aug 14 Rm: ESB 5104	Wednesday, Aug 15 Rm: ESB 5104	Thursday, Aug 16 Rm: ESB 5104	Friday, Aug 17 Rm: ESB 5104
8:30am- 8:50am					
9:00am- 10:30am	Course #2 Prof. Karen Yeats	Course #2	Course #2	Course #2	Course #2
Coffee Break (ESB 5104 Lobby)					
11:00am- 12:30am	Course #2	Course #2	1Qbit	Course #2	Course #2
Lunch					
2:00pm- 3:30pm	Course #2	Course #2	Huawei	1:00pm- 3:30pm High School Math Camp: Joint Session2. Location: Orchard 1001	Departures***
Coffee Break (ESB 5104 Lobby)					
4:00pm- 5:30pm	Public Lecture Ami E. Radunskaya, Pomona Location: ESB1012	Career Panel Jennifer Berdahl, UBC Luz Angelica Mata, UBC Nathalie Sinclair, SFU Ami E. Radunskaya, Pomona	Huawei		
Evening Events		6:30pm Summer School Dinner RSVP required			

*** Check-out from Place Vanier is at 11am. Participants can check-out before 9am and leave their suitcases at the front desk for safe keeping.

2018 Undergraduate Participants

1. Sidan A, Mcgill
2. Veronica Blackwell, UOregon
3. Samantha Carter, UVic
4. Xinle Dai, UWaterloo/ Zurich
5. Gina Faraj, York U
6. Kara Fitze, TrentU
7. Sahar Haidary, Concordia U
8. Loretta McClellan, UOregon
9. Jennifer McNichol, UNew Brunswick
10. Alex McSween, UOttawa
11. Eden Morris, Mcgill
12. Xinjie Qian, UCalgary
13. Sweta Shrestha, Kwantlen Polytechnic
14. Patricia Sorya, Université du Québec à Montréal
15. Grace Tompkins, St. Francis Xavier University
16. Alexandria Vassallo, McMaster, SFU
17. Melissa Van Bussel, TrentU
18. Boyang Wang, UWashington
19. Leonie Way, UOregon
20. Runting Yang, UToronto

2018 Organizers

1. Malgorzata Dubiel, SFU
2. Veselin Jungic, SFU
3. Malabika Pramanik (Committee Chair), UBC
4. Pacific Institute for the Mathematical Sciences

Course Reading and Preparation Material

Prof. Sara Maloni , Week 1

A journey through Hyperbolic Geometry and its applications in the real world

Hyperbolic geometry is a no-Euclidean geometry that is a space in which Euclid's parallel postulate fails. One way to state Euclid's parallel postulate is: for every line L, and point P not on L, there is a unique line L' through P which does not meet L. The study of hyperbolic geometry

is related to the study of spaces of constant negative curvature. Hyperbolic geometry is closely connected to many other parts of mathematics (differential geometry, complex analysis, topology, dynamical systems, number theory, geometric group theory, Riemann surfaces, Teichmuller theory) and to many other fields (biology, art, architecture, physics, cosmology, social networks, crystallography, neuroscience). Hyperbolic space has many interesting features; some are similar to those of Euclidean geometry, but some are quite different. In this class we will define and study this less known geometry: its conformal models, its isometries and some of its properties, its relationship with discrete actions and examples of spaces endowed with this geometry. We will also do a brief excursion into 3-manifolds and Thurston's geometries. The last lectures will be devoted to some examples of applications of hyperbolic geometry in some of the different fields mentioned above.
Pre-requisites: Linear Algebra, Calculus III. Suggested: Abstract algebra, Topology.

Prof. Karen Yeats, Week 2

Combinatorics of Feynman diagrams

We will be studying some combinatorial aspects of Feynman diagrams, with particular links to number theory via multiple zeta values. These objects relate to many deep topics, but are also concrete and accessible. We will take a hands on approach, playing primarily with discrete objects such as graphs and words, but also looking at some nontrivial consequences in mathematics and physics.
Pre-requisites: First year calculus and linear algebra. A first discrete math course is a bonus.

Field Trips

1Qbit: https://1qbit.com/

1QBits mission is to apply breakthroughs in computation to machine intelligence and optimization science through a widely accessible, hardware-agnostic software platform. 1QBit was founded by a group of intellectually curious entrepreneurs and researchers during the early stages of commercial quantum computing and embarked on building the expertise and technology required to connect industry problems to this new hardware. Over the past four years, 1QBit has grown into a globally respected team of experts dedicated to taking quantum computing from theory to application, and continues to attract global talent in mathematics, engineering, physics, chemistry, operations research, and software development.

Huawei Research: https://www.huawei.com/ca

Huawei is a leading global provider of information and communications technology (ICT) infrastructure and smart devices. With integrated solutions across four key domains – telecom networks, IT, smart devices, and cloud services – we are committed to bringing digital to every person, home and organization for a fully connected, intelligent world. Huawei's end-to-end portfolio of products, solutions and services are both competitive and secure. Through open collaboration with ecosystem partners, we create lasting value for our customers, working to empower people, enrich home life, and inspire innovation in organizations of all shapes and sizes. At Huawei, innovation focuses on customer needs. We invest heavily in basic research, concentrating on technological breakthroughs that drive the world forward. We have more than 180,000 employees, and we operate in more than 170 countries and regions. Founded in 1987, Huawei is a private company fully owned by its employees.

PIMS Public Lecture: Ami E. Radunskaya, Pomona College

Using Mathematics to Fight Cancer

What can mathematics tell us about the treatment of cancer? In this talk I will present some of work that I have done in the modeling of tumor growth and treatment over the last fifteen years. Cancer is a myriad of individual diseases, with the common feature that an individual's own cells have become malignant. Thus, the treatment of cancer poses great challenges, since an attack must be mounted against cells that are nearly identical to normal cells. Mathematical models that describe tumor growth in tissue, the immune response, and the administration of different therapies can suggest treatment strategies that optimize treatment efficacy and minimize negative side-effects.

However, the inherent complexity of the immune system and the spatial heterogeneity of human tissue gives rise to mathematical models that pose unique challenges for the mathematician. In this talk I will give a few examples of how doctors, immunologists, and mathematicians can work together to understand the development of the disease and to design effective treatments.

Biography:

A California native, Professor Radunskaya received her Ph.D. in Mathematics from Stanford University. She has been a faculty member in the Math Department Pomona College since 1994. In her research, she specializes in ergodic theory, dynamical systems, and applications to various "real-world" problems. Some current research projects involve mathematical models of cancer immunotherapy, developing strategies for targeted drug delivery to the brain, and studying stochastic perturbations of dynamical systems. Prior to her academic career, Professor Radunskaya worked extensively as a cellist and composer. Her music, described as "techno-clectic", combines traditional forms with improvisation, acoustic sounds with electronic, computer-generated, and found sounds, and abstract structures with narrative visual and sonic elements.

Contrary to popular belief, Professor Radunskaya thinks that anyone can succeed in mathematics, and she has committed herself to increasing the participation of women and underrepresented groups in the mathematical sciences. She is currently the President of the Association for Women in Mathematics, and co-directs the EDGE (Enhancing Diversity in Graduate Education) program, which won a "Mathematics Program that Makes a Difference" award from the American Mathematics Society in 2007, and a Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM) in 2015.Professor Radunskaya was recently been elected as a Fellow of the American Math Society, and she is the recipient of several awards, including a WIG teaching award in 2012, and the 2017 AAAS Mentor award.

Guest & Panel Speaker Biographies

Melania Alvarez, PIMS Math Education Coordinator

Melania Alvarez de Adem is a Mexican mathematics educator who works as education coordinator and mathematics outreach coordinator at PIMS. She is known for the summer mathematics camps she developed to improve the mathematical education of indigenous secondary-school students. She is a winner of the Adrien Pouliot Award, given by the Canadian Mathematical Society for significant contributions to mathematics education in Canada.

Alvarez grew up in Mexico City, where she completed her undergraduate education at the National Autonomous University of Mexico. She later earned master's degrees in economics from the University of Wisconsin—Madison and in operations research from Stanford University. In 2016 she completed a Ph.D. in mathematics education at Simon Fraser University.

She moved to Vancouver in 2004, and began her mathematics camp program at UBC in 2007.In addition to her work with indigenous people, Alvarez has been active in organizing mathematics competitions, workshops, and fundraising for mathematics education among the general population. During her free time Melania loves doing puzzles and regularly goes on long distance walks. She intends on doing the Shikoku Pilgrimage in Japan in 2019.

Mona Berciu, University of British Columbia

Mona earned a BSc from the University of Bucharest, Romania, in 1994, and then completed her MSc and PhD in Physics at the University of Toronto, graduating in 1999. From 2000 - 2002 she was a postdoctoral fellow at Princeton University. In 2002 she was awarded a University Faculty Award and was hired as an Assistant Professor by UBC, where she is a Professor since 2012.

She is a theoretical condensed matter physicist, interested in understanding why some materials exhibit certain useful properties, such as high-temperature superconductivity, and how can such properties be tailored and used for technological applications. Her awards include a Sloan Fellowship in 2006, a Killam Faculty Research Fellowship in 2008 and being named a Scholar and then Fellow of the Nanoelectronics Program of the Canadian Institute for Advanced Research from 2005-2012. She was awarded UBC Killam Prizes for Excellence in Teaching in 2006 and 2014, as well as the Canadian Association of Physicists' Medal for excellence in undergraduate teaching in 2013. She is one of the founding members of the Stewart Blusson Quantum Matter Institute.

Mona loves the outdoors and in her free time can be found hiking, biking, swimming, skate skiing, snowshoeing, etc. She is keen to learn new things -- currently she is working on earning her scuba diving accreditation.

Jennifer L. Berdahl, UBC

Jennifer L. Berdahl (PhD, University of Illinois) is the Professor of Leadership Studies: Gender and Diversity, at the University of British Columbia's Sauder School of Business. She began her career as a faculty member at the Haas School of Business at the University of California, Berkeley, before joining the University of Toronto's Rotman School of Management for 13 years before joining UBC in 2014. Berdahl's research focuses on the social psychology of gender and power in the workplace, with a focus on sexual harassment. Her work has informed the U.S. Equal Employment Opportunity Commission and discrimination cases in both the U.S. and Canada. Berdahl recently coedited a journal issue exploring masculinity contest cultures in organizations.

Alejandra D. Herrera Reyes, University of British Columbia

Alejandra is currently completing her Ph.D. in the math biology group, at UBC, under the supervision of Professor Daniel Coombs. Her research is a collage of different mathematics and different biological systems, but all connected by the use of fluorescence microscopy. She analyzes cell adhesions and immunologic systems with differential equations, stochastic processes, numerical simulations, and statistics. Alejandra is from a small city in Mexico, Aguascalientes, where she was lucky enough to learn about math Olympiads through her high-school math teacher. The Olympiads allowed her to discover that the subject both challenged and entertained her, ultimately reaching to national level and winning a bronze medal. This gave her the opportunity to interview for an undergraduate degree in mathematics, at the Universidad de Guanajuato where she started her real journey in Mathematics in 2004. She first fell in love with probability, but was curious about biology, and so decided to focus on Applied Mathematics. In 2010, she began her master's degree at UBC and continued on for a PhD, which she is in the process of completing. Alejandra likes to color, read, write, embroider, listen to music and podcasts, and dance. She enjoys the company of her friends and family, and loves to travel whenever time permits.

Yan Jiang, IHS Markit

Yan is a Senior Financial Engineer (Director) working in IHS Markit. Right after her graduate study, she started to work in Quadrus Financial Technologies (Vancouver, BC) at 2005 (later acquired by IHS Markit at 2011). Their software is primarily used for counterparty risk management inside financial institutions. Her job has spanned around financial modeling, security pricing and software design. Her education includes B.S. in Mathematics from Beijing University (Beijing, P. R. China), MSc. in Mathematics from University of Washington (Seattle, WA, USA) focusing on continuous time probability theory.

Kelli Kadokawa, University of British Columbia , Faculty of Graduate Studies

UBC offers over 300 graduate degree options across over 100 departments within 11 faculties. Our graduate community is vibrant, innovative, and focused on exploring the world's most fascinating questions and solving our most pressing problems across almost every imaginable field.

Graduate and Postdoctoral Studies (G+PS) connects with prospective students to provide resources that help them put together strong applications and make good choices about where they want to go to graduate school. G+PS supports applicants as they transition into their lives as newly admitted graduate students with pre-arrival resources, orientation events, and other administrative services. As graduate students reach their academic milestones, G+PS offers personal and professional development workshops and events, as well as support on thesis formatting and the doctoral exam process. G+PS works with graduate programs to ensure successful program completion and graduation adjudication. The Postdoctoral Fellows Office (PDFO) provides support, development opportunities, and advocacy for UBC postdoctoral fellows.

Kelli Kadokawa is the Communications and Business Initiatives Coordinator in the Faculty of Graduate and Postdoctoral Studies. She works on a variety of graduate student recruitment and orientation initiatives, including a series of webinars, in-person presentations and connection events for prospective, newly admitted and current students. One of her favorite parts of her job is reaching out and connecting with students to help them have a great UBC experience.

Sara Maloni, University of Virginia

Sara Maloni is an Assistant Professor of Mathematics at the University of Virginia. She is from Genova (Italy) and earned her M.S. and B.S. from the University of Genova. She is a first-generation student. She received her PhD from the University of Warwick (2013). Before arriving

in Virginia, she was a Tamarkin Assistant Professor at Brown University and a postdoctoral fellow at the University of Paris-Sud 11 and at the University of Toulouse. She also spent the Spring semester of 2015 at the Mathematical Sciences Research Institute (MSRI) in Berkeley as a Huneke Endowed Postdoctoral Fellow.

Sara strongly believes in making the mathematics community open and inclusive for all people regardless of ethnicity, gender, sexual orientation, socioeconomic background or disability. For that reason she is part of the AWM Student Chapters Committee and is an AWM mentor. She is also a mentor for the Math Alliance. She is the faculty mentor for the AWM Chapter at Uva and she organizes the Math Club and the Geometry Seminar, where she tries to promote a diverse and inclusive environment. Sara works at the intersection of geometry and low-dimensional topology. More precisely, she studies deformation spaces of geometric structures on low-dimensional manifolds through their geometric, topological and dynamical properties. Recently, she has been also studying anti-de Sitter geometry, a Lorentzian analogue of hyperbolic geometry.

In her free time, she loves hiking, scuba diving, travelling, reading, and crafting (felting, pottery, woodworking).

Luz Angelica Mata, University of British Columbia

Luz Angelica Caudillo-Mata is a Mexican Computational Scientist and Applied Mathematician. She currently works as a Postdoctoral Research Fellow at the Earth, Ocean and Atmospheric Sciences Department at UBC. Her research focuses on designing numerical methods for Geophysical Electromagnetic imaging. These techniques are applicable for detection, location and characterization of mineral and water deposits, as well as petroleum.

Luz Angelica holds a PhD in Geophysics and Applied Mathematics from UBC, a MSc in Computer Sciences and Industrial Mathematics from CIMAT (Mathematics Research Center), and a BSc in Computer Sciences (with major in Mathematics) from the University of Guanajuato. Throughout her career, she has received numerous awards and scholarships. Additionally, she has conducted several internships at diverse institutions in Spain and the USA, including Berkeley National Laboratory, Livermore National Laboratory, and the Universidad Politecnica de Valencia. She also counts with 5 years of experience working as a professional software developer.

Luz Angelica also loves organizing events to build and advance her communities. Among the events that she has co-founded and/or has served as main organizers are: several Industrial Problem Solving Workshops in Mexico, the 4th gathering of Mexican Mathematicians in the World, and SLAM: Science Leadership and Management - a career development workshop series for science grad students and postdocs at UBC.

In her free time, Luz Angelica loves spending time with her husband and friends, playing volleyball, and hearing podcasts. During her adolescence, she was a competitive athlete for 10 years in chess, and competed in several National tournaments in Mexico.

Rachel Ollivier, University of British Columbia

Rachel Ollivier grew up in France and earned her PhD from University Paris 7. After graduating she held positions at ENS Paris and then at Université de Versailles. Following two visits to the Radcliffe Institute for Advanced Study at Harvard University in 2008 and 2010 she decided to move to Columbia University in 2010. She has been at UBC since 2013.

Rachel's work is motivated by the Langlands program which stems from a set of influential conjectures established in the 1960s by Robert Langlands. This program and its generalizations form a very vivid area of research in pure mathematics. It aims at unifying geometry, representation theory and number theory and has natural connections with mathematical physics. Rachel feels fortunate to work in a

difficult but stimulating area. She enjoys her quiet and meditative mathematical work but is also grateful for some energizing collaborations. Rachel has two children, born in Vancouver. During her free time, she enjoys exploring BC's landscapes and food with her family.

Ami E. Radunskaya, Pomona College

A California native, Professor Radunskaya received her Ph.D. in Mathematics from Stanford University. She has been a faculty member in the Math Department Pomona College since 1994. In her research, she specializes in ergodic theory, dynamical systems, and applications to various "real-world" problems. Some current research projects involve mathematical models of cancer immunotherapy, developing strategies for targeted drug delivery to the brain, and studying stochastic perturbations of dynamical systems. Prior to her academic career, Professor Radunskaya worked extensively as a cellist and composer. Her music, described as "techno-clectic", combines traditional forms with improvisation, acoustic sounds with electronic, computer-generated, and found sounds, and abstract structures with narrative visual and sonic elements.

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Nathalie Sinclair, Simon Fraser University, Canada Research Chair in Education

Nathalie Sinclair is a Professor in the Faculty of Education at Simon Fraser University and Canada Research Chair in Tangible Mathematics Learning. After completing a B.A in Mathematics at McGill University, a Masters in Mathematics at Simon Fraser University (with a thesis on the history of Islamic mathematics) Dr. Sinclair taught mathematics and French for three years at an independent middle school on Bowen Island, BC. She collaborated with researchers such as Jonathan Borwein at the Centre for Experimental and Constructive Mathematics at SFU, which sparked her interest in the roles of technology and aesthetics in mathematics thinking and learning and in the work of Seymour Papert. She then pursued a PhD in Education at Queen's University with mathematics educator William Higginson and mathematicians Peter Taylor. Her first academic position was at Michigan State University and after four years she moved to SFU. She has continued to ground her work in the history and philosophy of mathematics, and in examining how the practice of mathematicians can inform mathematics teaching and learning. She manages to achieve work life balance in large part because of her very supportive immediate and extended family who enable her to attend conferences, teach night classes, and—particularly for the case of her husband Nicholas Jackiw, share in a vibrant intellectual life.

Stephanie Van Willigenburg, University of British Columbia

Steph earned a BSc Hons from St Andrews University in Scotland in 1994 and subsequently she earned her PhD from St Andrews University in 1998. From there she pursued a postdoc at York University in Toronto and a second postdoc at Cornell University before being appointed an Assistant Professor at UBC in 2002, rising through the ranks to Full Professor in 2012. Her awards for research include fellowships from the Leverhulme Trust and the Alexander von Humboldt Foundation, and she has won a Killam Award for her teaching. She is also one of the co-founders and organizers of the Algebraic Combinatorixx workshops at the Banff International Research Station to foster mentoring, collaborations and networking for women in algebraic combinatorics and related areas. Most recently she was the recipient of the 2017

Krieger-Nelson Prize from the Canadian Mathematical Society for "outstanding research by a female mathematician". Living in Hollywood North she and her husband have also enjoyed the chance to sing on one or two movie soundtracks in their spare time.

Lilian Wong, Amazon

Lilian Wong is Applied Scientist in Amazon Web Service (AWS). Her work focuses on forecasting and automation. She was a research mathematician before joining the industry.

Karen Yeats, University of Waterloo

Karen works on combinatorial problems in quantum field theory. She is particularly interested in understanding Feynman integrals using graph theory and in understanding perturbative expansions in quantum field theory using formal power series and tools of algebraic combinatorics.

Karen obtained her PhD from Boston University under the supervision of Dirk Kreimer and less than a year later started as faculty at Simon Fraser University. She is now an associate professor and Canada Research Chair in the department of Combinatorics and Optimization at the University of Waterloo. She will be spending next year in Germany as a Humboldt fellow.