Overview of CRG

Collaborative Research Group (CRG)
L-functions in Analytic Number Theory

CRG Launch Event - November 19, 2022

Banff International Research Station
for Mathematical Innovation and Discovery

PIMS

UBC

University of
Lethbridge

UNBC

## 2022 Collaborative Research Group Funding Awarded to L-functions in Analytic Number Theory

Date: 11/23/2021

The Pacific Institute for the Mathematical Sciences is pleased to award funding for the Collaborative Research Group on L-functions in Analytic Number Theory.

Analytic number theory focuses on arithmetic questions through the lens of L-functions. These generating series encode arithmetic information and have connections with a host of other mathematical fields, such as algebraic number theory, harmonic analysis, Diophantine approximation, probability, representation theory, and computational number theory. The main focuses of this CRG include moments of L-functions and automorphic forms, explicit results in analytic number theory, and comparative prime number theory.

The group's lead collaborators Alia Hamieh (UNBC), Habiba Kadiri (ULethbridge), Greg Martin (UBC), and Nathan Ng (ULethbridge) have expertise in these areas and are enthusiastic about collaborating with graduate students, postdocs, and visiting researchers to make significant progress in this field. More details on their group activities will be available on the PIMS CRG page here.

Principal Investigators
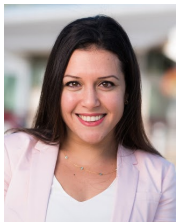
Alia Hamieh (UNBC)

Habiba Kadiri (Lethbridge)

Greg Martin (UBC)

Nathan Ng (Lethbridge)
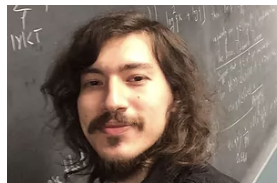
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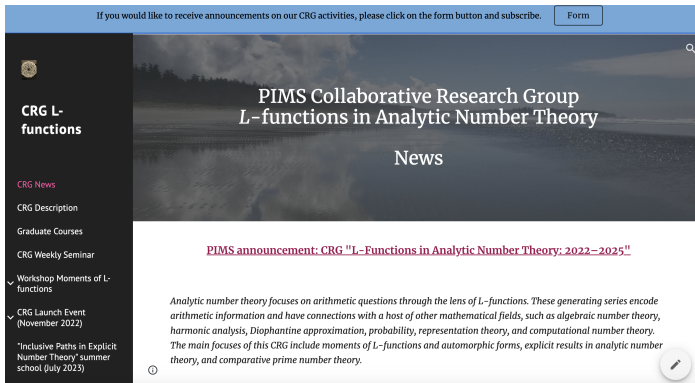

Fatma Cicek
PIMS CRG pdf
UNBC

Ertan Elma
ULeth pdf
Lethbridge

CRG website and mailing list

- `https://sites.google.com/view/crgl-functions/crg-description`
- To subscribe to mailing list fill form.

- L-functions and Automorphic Forms
  - moments and zeros of L-functions, mean values of long Dirichlet polynomials, MDS, spectral theory of automorphic forms, random matrix theory
- Explicit Results about L-functions and Primes
  - bounds for primes and primes in number fields, zero-free regions, zero-repulsion, zero-density results, bounds for the least prime in arithmetic progressions and Chebotarev's density theorem, online calculator, TME-EMT project, applications (Diophantine approx. and cryptography).
- Comparative Prime Number Theory
  - Chebyshev's bias and its generalizations to number fields/function fields, sign changes of prime counting functions, size of error terms in prime number theory (Montgomery's conjecture), quantitative LI conjecture

Overview of CRG events

	F21	W22	S22	F22	W23	S23	F23	W24	S24	F24	W25
Scientific events											
L-functions workshop (UNBC)			✓								
Summer School IPENT (UofL)						✓					
CPNT workshop (UBC)									✓		
Two-day workshops (BIRS)											
Launch event		✓									
Multiple Dirichlet series etc					✓						
Connections etc									✓		
FRG's (BIRS)											
LI conjecture			✓								
Primes between cubes						✓					
Large values etc									✓		
Showcase events											
CMS meeting (Vancouver)							✓				
CNTA conference (UBC)									✓		
Distinguished Visitors											
DV 1 (UNBC)			✓								
DV 2 (UofL)						✓					
DV 3 (UBC)									✓		
Postdocs											
PDF 1 (UNBC)			✓	✓	✓	✓	✓	✓			
PDF 2 (UofL/UBC)						✓	✓	✓	✓	✓	✓
Digital Grad Courses											
Analytic Number Theory 1 (UofL)				✓							
Analytic Number Theory 2 (UBC)					✓						
Moments of L-functions (UNBC)							✓				
CRG seminar (online)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

CRG pdf at UBC, 2023-2025

Pacific Institute for the Mathematical Sciences, PIMS

Position ID: PIMS-PIMSPDFLFUNCTIONS [#21073]
Position Title: L-functions in Analytic Number Theory: PIMS PDF Position
Position Type: Postdoctoral
Position Location: Vancouver, British Columbia, Canada [map]
Subject Area: Analytic Number Theory
Application Deadline: 2022/12/05 11:59PM ⓘ * (posted 2022/10/13, updated 2022/10/11, listed until 2023/04/22)
Position Description: Apply

We are happy to announce an opening for a PIMS Postdoctoral Fellowship, with an intended starting date of August 1, 2023, at the University of British Columbia (UBC) in Vancouver. This is a one-year position that is typically renewable for a second year. If selected, you will conduct research in analytic number theory as part of the exciting new PIMS-funded Collaborative Research Group (CRG) "**L-functions in Analytic Number Theory**". The main focuses of this CRG include comparative prime number theory, explicit results in number theory, and moments of L-functions and automorphic forms. We encourage you to apply if you have experience and familiarity with the analytic theory of L-functions.

You will work with Dr. Greg Martin at UBC, and will have the opportunity to visit and collaborate with the other CRG leaders: Dr. Habiba Kadiri and Dr. Nathan Ng at the University of Lethbridge, and Dr. Alia Hamieh at UNBC. You will be actively involved in various research projects covered by this CRG and will also be invited to have various important roles in our planned activities (guest lectures, co-organization of events, mentorship of graduate students).

You should hold a PhD or equivalent degree (from any country) or expect to receive one before July 1, 2023. The position typically requires a PhD obtained in 2020 or later; however, if your PhD was obtained before 2020, we invite you to describe your career trajectory including any unusual circumstances in your cover letter.

We take our commitment to equity, diversity, and inclusion (EDI) very seriously, and we strive to offer a productive and inclusive space to train junior researchers. We strongly encourage applications from people from historically underrepresented groups in the Mathematical Sciences. We particularly welcome applications from women, Indigenous persons, persons with disabilities, members of visible minority/racialized groups, and members of 2SLGBTQIA+ communities. In your cover letter, we invite you to describe your personal or professional experience with the interactions between EDI and mathematics, as well as your ideas for how we can improve EDI outcomes.

Applications should include:

- a cover letter;
- a research statement;
- a teaching statement;
- a curriculum vitae, including a list of publications;
- at least three confidential letters of reference, including one that addresses your teaching experience.

Your annual salary will be $60,000 (CAD) for duties including research and teaching two mathematics courses per year. There may be the possibility of additional teaching (with a corresponding increase in salary). You will also receive an additional stipend for travel and other professional development expenses during the course of the tenure.

If you are interested or have any questions, please contact Dr. Greg Martin at **gerg@math.ubc.ca**. We will begin reviewing applications after *December 5, 2022*.

- Main supervisor: Greg Martin (UBC). opportunity to work with all CRG leaders.
- Dec. 5 deadline.

CRG L-functions conference at UNBC (July 2022)
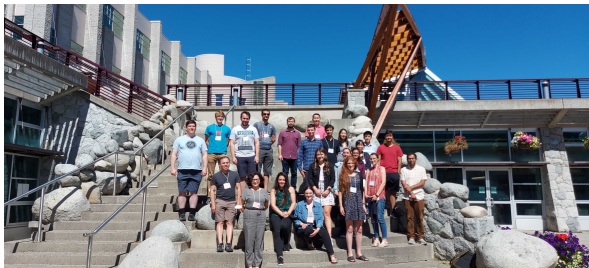
- hybrid format (23 in person, 73 online),
- 9 longer talks, 19 shorter talks, 25 mathtube videos, list of open problems,
- Themes: approximate functional equation techniques, multiple Dirichlet series, shifted convolution sums, random matrix theory, spectral theory of automorphic forms.
- 2 Icebreaker sessions, 2 EDI sessions, 1 networking session, daily Gather meetings.

L-functions in Analytic Number Theory
Weekly Seminar Series

- Fall 2022-Spring 2025
  Schedule for Fall 2022: Thursdays, 11am-noon (Mountain time)
- Coming next: Sanoli Gun (Nov. 24), Anurag Sahay (Dec. 1)
- Slides and recordings of some lectures available on Mathtube.

PIMS network Graduate Courses

- Fall 2022: Analytic Number Theory 1 (Kadiri, Lethbridge) introduction to analytic number theory with proof of the PNT, guest lectures (Martin, Ramaré) 5 UofL and 9 WDA students.
- Spring 2023: Analytic Number Theory 2 (Martin, UBC), (Dirichlet characters, Dirichlet L-functions and their zeros, and the prime number theorem in arithmetic progressions, limiting distributions of error terms and comparative prime number theory ("prime number races").)
- Fall 2023: Moments of L-functions (Hamieh, UNBC).
- students in Western Canada register via Western Dean's Agreement

Summer School at BIRS-UBCO, July 2-15, 2023

Inclusive Paths in Explicit Number Theory (23ss001)

- July 2-15, 2023 in Kelowna, BC at UBC Okanagan.
- Hybrid model, 30 students in person.
- Week 1: Courses on Zero-density, subconvexity, zero-free regions and repulsion, character sums, Chebotarev's Density Theorem.
- Week 2: Working groups on projects in explicit number theory (articles written).
- Instructors: Hamieh, Hiary, Kadiri, Lumley, M.R. Murty, Ramaré, Sinha, Treviño, Zaman.
- Call for applications in Spring 2023.

- FRGs (focussed research groups) on
  - Linear independence conjecture.
  - Primes between cubes.
  - Montgomery's conjecture on the error term in the prime number theorem.
- 2-day workshops
  - Connections between multiple Dirichlet series method and approximate functional equations
  - Connections between explicit number theory, diophantine approximation, and cryptography

EDI, Network, and Community Impact

- Strengthening research networks.
  Facilitating collaborative research.
  Connections between PIMS universities, researchers USA,
  Europe, Australia, and Asia.
- Increasing accessibility at lower cost.
  Online components to expand the audience. Hybrid events,
  online seminar, and online grad courses.
- Showcasing and accelerating diversity in mathematics.
  Committed to increased representation and participation from
  equity deserving groups, EDI sessions on career building and
  advancement.