WAM 2017 Yearbook
Geometry and Randomness in Group Theory

Objectives: This is a compilation of activities and resources contributed by participants during the Women and Mathematics Program May 15 – 26, 2017. We hope this can serve as a mathematical and professional reference guide for women mathematicians around the country.

1 Mathematical Content and References

1.1 Olga Kharlampovich on *Free and Hyperbolic Groups*

- Lecture Notes:
  Day 1, Day 2, Day 3, Day 4.

- Lecture Videos:
  Day 1, Day 2, Day 3, Day 4.

- References:

  a) *Combinatorial Group Theory* by Roger C. Lyndon and Paul E. Schupp, 2001.

  b) *Metric Spaces of Non-Positive Curvature* by Martin R. Bridson and André Häfliger, 1999.

1.2 Goulnara Arzhantseva on *Random Groups*

- Lecture Notes:
  Emailed to all program participants. Please use for your own reference only, do not publicize or distribute.

- Lecture Videos:
  Day 1, Day 2, Day 3, Day4.

- References:

  a) *Combinatorial Group Theory* by Roger C. Lyndon and Paul E. Schupp, 2001.

  b) *A January 2005 Invitation to Random Groups* by Yann Ollivier, in Ensaios Matemáticos **10**, Sociedade Brasileira de Matemática, Rio de Janeiro, 2005.

1.3 Kim Ruane on *Examples of Non-Positively Curved Groups*

- Lecture Notes: taken by Aurora Marks
  Day 1, Day 2, Day 3, Day 4.

- Lecture Videos:
  Day 1, Day 2, Day 3, Day 4.
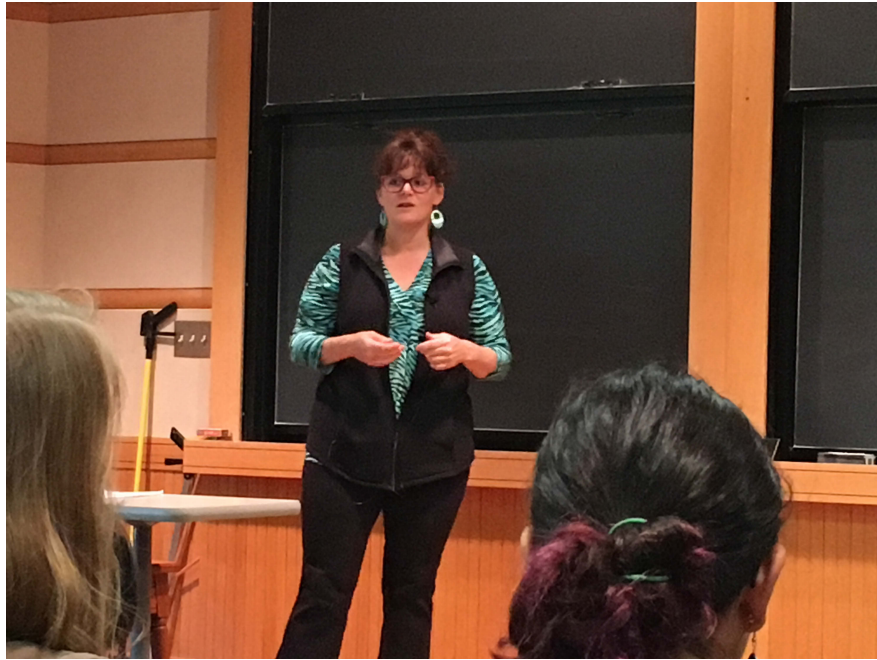
- References:

  a) *Metric Spaces of Non-Positive Curvature* by Martin R. Bridson and André Häfliger, 1999.

  b) *Groups, Graphs and Trees* by John Meier, 2012.

1.4 Tatiana Nagnibeda on *Amenability*

- Lecture Notes: taken by Aurora Marks
  Day 1, Day 2, Day 3, Day 4.

- Exercises: Day 1, Day 2, Day 3.

- References:

  a) [The Banach-Tarski Paradox (Encyclopedia of Mathematics and its Applications)](#) by Stan Wagon, 1993.

  b) [Topics in Geometric Group Theory](#) by Pierre de la Harpe, 2000.

1.5   Research Seminars

- [Walking on Groups: a Distance Formula for Outer Automorphism Group of the Free Group](#) by Funda Gultepe, University of Illinois at Urbana-Champaign.

- [Approximation of the Entries of a Random Orthogonal Matrix by Independent Standard Normal](#) by Kathryn Lockwood, Case Western Reserve University.

- *Measures Defined by Random Groups* by Yuan Liu, University of Wisconsin Madison.

- [Graph Coloring Problem and Fibering Right Angled Coxeter Groups](#) by Kasia Jankiewicz, McGill University.

- [Acylindrically Hyperbolic Structures on Groups](#) by Sahana Hassan Balasubramanya, Vanderbilt University.

- *Quantitative Mostow Rigidity: Relating Volume to Topology for Hyperbolic 3-manifolds* by Rosemary Guzman, University of Illinois at Urbana-Champaign.

- *Morse Boundaries for Finitely Generated Groups* by Heejoung Kim, University of Illinois at Urbana-Champaign.

- *Random Coxeter Groups* by Angelica Deibel, Brandeis University.

1.6   Colloquium

- *Free Groups from Free Lie Algebras* by Lisa Carbone, Rutgers University.

- *Algorithms for Groups of Homeomorphisms* by Susan Hermiller, University of Nebraska Lincoln.

1.7   Princeton University Day Activities

- *Cut-off for a Class of Hyperplane Arrangement Walks* by Evita Nestoridi.

- *Interlacing Polynomials and Ramanujian Graphs* by Adam Marcus.

- *Embeddings of Groups, Poincaré Inequality, and Random Walks* by Assaf Naor.

- *Computations with Finitely Presented Groups with GAP* by Susan Hermiller.
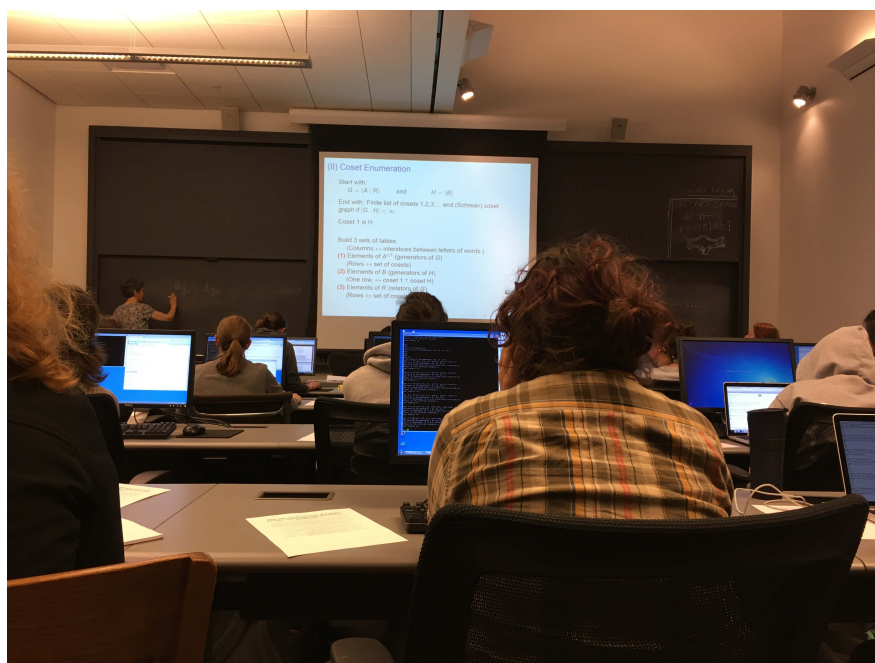
2 Women in Science Seminar

2.1 Chats

- Evening Chat on Diversity and Identity in Mathematics with Rosemary Guzman (University of Illinois at Urbana-Champaign) and Yen Duong (University of Illinois at Chicago).

2.2 WAM Ambassador Program: Brainstorm Session

We encourage you to become WAM Ambassadors to initiate and organize activities at your own university to encourage the participation in mathematics of women and members of underrepresented minority at all levels.

Thanks to a generous grant from Charles and Lisa Simonyi, the IAS Women and Mathematics Program will be able to fund annually up to three postdoctoral or advanced graduate ambassadorships and up to six graduate ambassadors to build support and outreach networks across the country, thus making the annual May WAM program a springboard to catalyze a wide ranging outreach program. Some possible activities for ambassadors to organize include:

- Satellite weekend or day-long meetings with both research and mentoring components, organized on regional basis, and with outreach to local WAM alum. WAM would help the organizers reach former WAM participants, so that the meeting could also serve to sustain friendships and collaborations started at the annual meeting.

- Ongoing collaborative study groups to help undergraduate students through particularly challenging courses, particularly at the early stages of their study.

- One-on-one mentoring between undergraduates and graduate students and postdocs.

- Undergraduate research opportunities, to be directed by WAM alum at their home institutions to encourage female undergraduates and members of underrepresented minority to undertake independent projects of various sizes and scopes.

- Undergraduate or graduate research seminar, based on a set of WAM lectures.

- Math outreach activities at local schools and communities.

Each postdoctoral or advanced graduate ambassadorship will receive a $1000 award to organize a weekend conference, and a grant of up to $2000 towards the cost of a conference which includes honorarium and travel costs for invited speaker(s), lunch and refreshment for conference participants. The $1000 ambassadorship award can be shared among up to four organizers. The conference grant ($2000 maximum) will be disbursed to the lead organizer's home institution (e.g., mathematics department, grants office, or finance office) to reimburse conference costs. It is expected that the lead organizer's home department will provide matching funds and administrative support.

Each graduate ambassador will receive a $500 award to build a support structure for undergraduate math majors in her university. Ambassador can apply for additional funds from a $3000 pool to organize outreach activities in their local communities.

WAM ambassador selection criterion include mathematical expertise and enthusiasm. Each lead conference organizer and graduate ambassador should have a faculty sponsor (male or female) at their home institution. WAM ambassadors will be invited back to WAM annual meeting the following May to share best practices and new outreach ideas, and help to train new WAM ambassadors.

To apply to become a 2018 WAM ambassador, you need to provide the following information by July 31, 2017:

1. A current CV of the lead applicant (and co-applicants if applicable).

2. A detailed plan of proposed activity, including

   (a) A reference letter from a faculty member at your institution and his/her consent to be an advisor of the proposed activity;

(b) Written consent from lead applicant?s home department to accept conference or activity grants from IAS and to administer reimbursement of conference or activity expenses from the grant.

3. A detailed budget of the proposed activity, including dates and time frame.

4. Information on additional funding you will receive or apply for to support the proposed activity. For example, copy of application for matching funds submitted to your department, university graduate council, diversity committees, AWM, or faculty NSF grants.

Please email the application material in pdf format to womensprogram@ias.edu by July 31, 2017.

After the completion of your proposed activity, you must submit a summary report. Please acknowledge IAS Women and Mathematics as well as Charles and Lisa Simonyi in your activity announcement (print or online) and any publication that result from the activity.

See also `https://www.math.ias.edu/wam/about/ambassador`.

During the Brainstorm Session on May 19, WAM participants collectively came up with many tips and advice:

- How to organize a weekend conference:

  (a) Main idea: field of math, region/location, intended audience
  (b) Get a faculty member onboard, assemble a team
  (c) Decide dates and solicit keynote speaker, be careful to avoid conflict with other key events (e.g. sporting games)
  (d) Create a budget and get funding from IAS WAM, department, graduate council, faculty grants (for NSF Broader Impact), diversity committees, AWM, other STEM organizations.
  (e) Expenses: keynote speaker, food (lunch and tea break), transportation, lodging (ask students to host out of town student attendees), social hour/wrapup, childcare allowance.
  (f) ASK for administrative and financial support – if you don't ask, you will never know what could have been available.
  (g) Create an event website: consult existing event sites of Southern California Women in Mathematical Symposium, Midwest Women in Mathematics Symposium, Texas Women in Mathematics Symposium.
  (h) Check out a sample plan and proposal by Yen Duong.

- How to start a Directed Reading Program (DRP): DRP is an experiential learning program that matches undergraduate and graduate students or

postcos in mathematics for projects that deepen students' understanding of high-level mathematical concept originated from The University of Chicago. Further examples of successful DRP programs are hosted by: University of California Berkeley, University of Connecticut, University of Maryland College Par, University of Texas Austin, University of Wisconsin Madison, Yale University. Advice on how to start a DRP program can be found on AMS Blog site.

- How to start an AWM Chapter or Women in Math Group:

  (a) Host events: wine and cheese, board game nights, guest lectures, brownbag lunch, tea/coffee with faculty.

  (b) Display gender/diversity fact sheet to initiate dialogue with male and female math department members.

  (c) Create joint group meetings with other STEM departments at smaller campuses.

- How to find childcare fund: ask to see if this is available for the workshop/conference/talk you are interested in attending.

- How to create community outreach activities:

  (a) Math Circles

  (b) Michelle Delcourt's Service Record/Resource website

  (c) Girls' Angle

  (d) Local Girls Scout Troups

  (e) College preparation for disadvantaged youth

  (f) Homeless shelters

  (g) After-school program

  (h) Science fair/Science nights

  (i) Math table at community runs and farmers market

  (j) Girls Inc.

  (k) Sonia Kovalevsky Days

  (l) Expanding your horizons network

  (m) Teach at a prison, Inside-Out Program

2.3 Panels

- *Mathematicians in Academia* with Mirela Ciperiani, Ana Rita Pires and Katrin Wehrheim moderated by Rosemary Guzman and Evita Nestoridi.

Some common questions are:

(a) Why did you choose a career in math? What other options were you considering?

(b) How has your background (e.g. family, experiences, interests, personality) influenced the kinds of problems you've chosen to work on?

(c) Could you talk about a difficult time in your career and how you managed it?

(d) What have been your favorite aspects of being a mathematician? What do you love about doing math?

(e) What accomplishment are you most proud of?

(f) Any advice for women beginning grad school, or for women finishing graduate school, or just generally for a career in math?

(g) Who have your role models been?

(h) Have you ever felt imposter syndrome[1]? How do you deal with it?

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[1]There is a very recent informative talk with video/slides on the subject by Margot Gerritsen of Stanford University.

(i) How to write a professional paper. Is there a rule saying the longer the better? How do we "sell" our result, how do we write an attractive introduction.

- *Alternative Careers of Mathematicians* with Sara Ellison, Margaret Holen, and Linda Ness.

- *Work and Life Balance* with Maria Chudnovsky, Nancy Hingston, Liz Milicevic, Kim Ruane, and Lauren Williams, moderated by Rosemary Guzman and Katie McKeon.

There are several levels of caretaking that affect everyone: if your parents are alive and part of your life, then eventually they'll get older and you will start thinking about them. If you have or want to have a partner, there's the two-body problem and general taking care of the relationship. If you have or want kids, they require a lot of work. And there's also, maybe most importantly, your relationship with yourself and taking care of your physical, mental, and emotional health while pursuing your career. Let's dedicate some time to each level of relationship.

(a) Parents: their physical and financial needs, your emotional relationship with them, their support or lack thereof of your career choice, cultural issues, socioeconomic issues)

(b) Partners: spousal hires, the "second shift", articulating what we need from our partners- do they have to change jobs and move for us, stay home with kids, make money while we're in school?

(c) Kids: when to have them, how to handle kids and school/work, childcare funds and funding.

Some wisdom and advice imparted are:

(a) Don't strive to be perfect in everything – you can put in 80% efforts on certain activities you are not most keen on.

(b) Be able to delegate and outsource certain tasks.

(c) Try to do certain tasks (e.g. reply to email, grading, refereeing) in big batches.

(d) Be open with your partner about your career aspirations, and work together to tackle 2-body problem.

(e) Set limits on other duties and carve out time for math.

(f) Have a flexible backup career plan if math research doesn't work out.

(g) Time management tips: have a linear order of tasks to accomplish, don't be perfect in everything, set a schedule for work and play.

(h) Maternity leave in the form of teaching relief is great to stay on top your academic career and establish equal partnership with your spouse.

3 Outreach Efforts

Successful community outreach activities during WAM 2017 that can be replicated elsewhere:

- Attend a local running race and set up a math table to teach local high school students some probability of non-transitive Grime Dice and the 17 wallpaper patterns on a plane.

- Volunteer to showcase some math enrichment activities at an AfterSchool Program:

a) Betsy Ross Star by Jiarui Chu, Linda cook, Kelly Emmrich, and Gill Grindstaff at UrbanPromise Trenton AfterSchool program.

b) Möbius Valentine by Mo Kearns, Aurora Marks, Sarah Peterson, and Rebecca Rohrlich at UrbanPromise Trenton AfterSchool program.

c) Otrio by Sara Edelman-Munoz and Sabrina Enriquez at UrbanPromise Trenton AfterSchool program.

4   Further Resources

Check out WAM2016 Yearbook for more career advice and literature on gender issues in STEM.