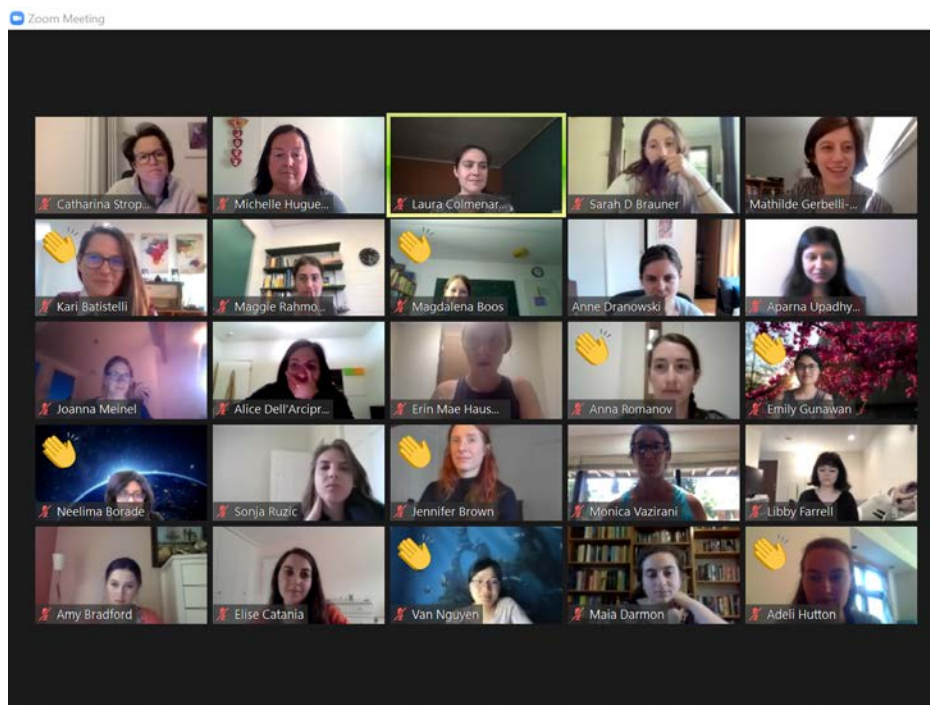


WAM 2021 Yearbook

Representation Theory: Categories and Combinatorics (virtual)



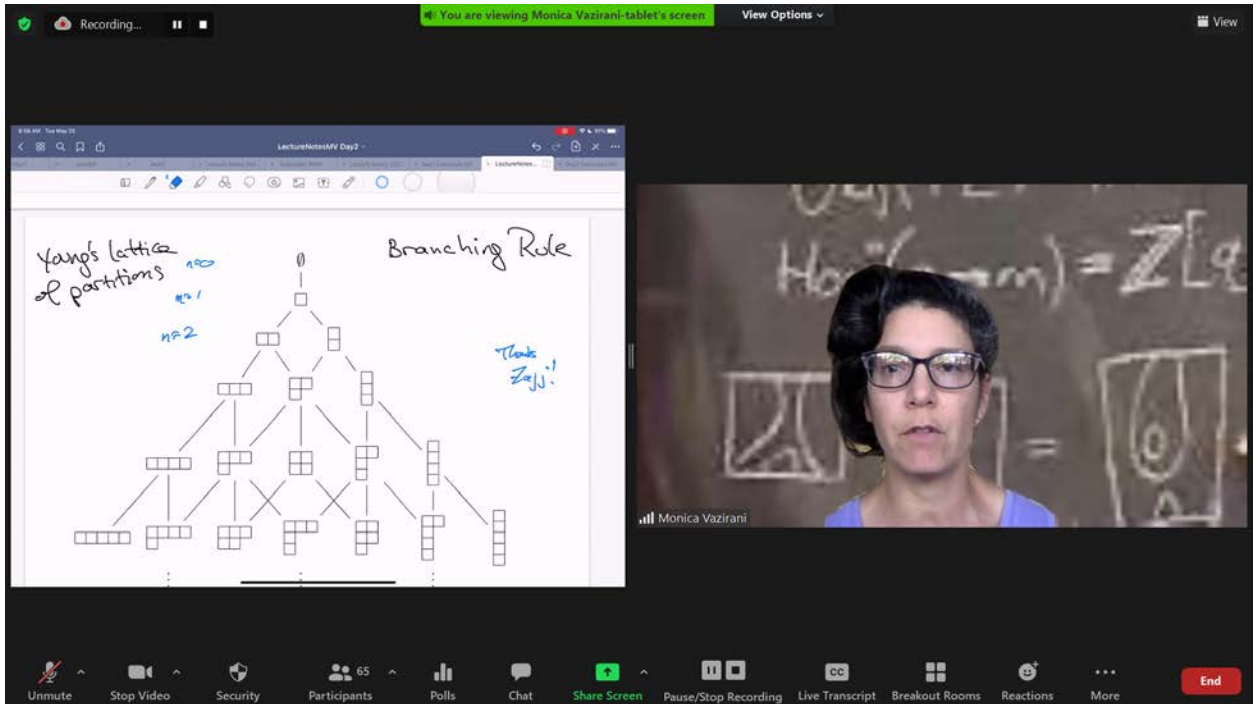
Institute for Advanced Study, Princeton
May 22-28, 2021

This is a compilation of activities and resources contributed by participants during the 2021 Women and Mathematics Program. We hope this can serve as a mathematical and professional reference guide for women mathematicians around the country.

I. Mathematical Talks

A. Terng Lectures:

Monica Vazirani, University of California, Davis, “Representation theory & Combinatorics of the symmetric group and related structures”



The screenshot shows a Zoom meeting interface. On the left, a presentation slide titled "Young's lattice of partitions" and "Branching Rule" is displayed. The slide features a tree diagram of Young diagrams (partitions) starting from the empty partition at the top. The nodes are labeled with Young diagrams, and the edges represent the branching rule. Handwritten notes in blue ink include "n=1" and "n=2" next to the first two levels, and "Thanks Saji!" on the right side. On the right, a video feed shows Monica Vazirani, a woman with dark hair and glasses, speaking. The background of her video feed shows a chalkboard with mathematical equations, including $\text{Hom}(V^{\otimes n}, V^{\otimes m}) = \mathbb{Z}[q]$. The Zoom interface at the bottom shows various controls like Unmute, Stop Video, Security, Participants (65), Polls, Chat, Share Screen, Pause/Stop Recording, Live Transcript, Breakout Rooms, Reactions, and More. A red "End" button is visible in the bottom right corner.

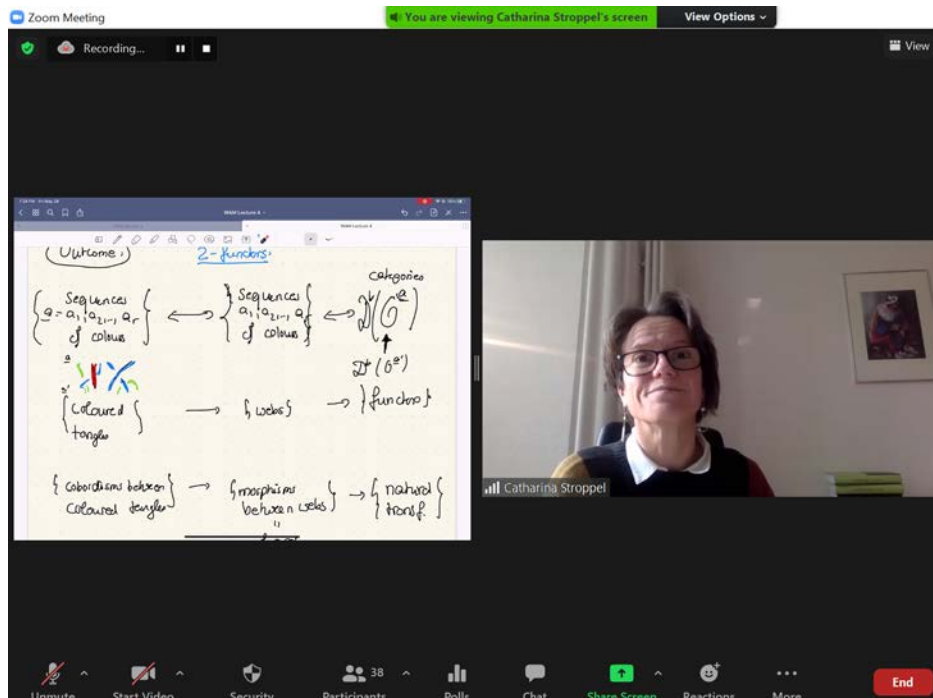
Abstract: With an eye toward coordinating with the advanced course, we will start with the representation theory of the symmetric group and related combinatorics. We will focus on the functors of induction and restriction. We will then consider related algebraic structures such as Hecke algebras. We can use diagrammatics to depict various elements, objects, morphisms, and so on, even in the setting of de-categorification.

Terng Problem sessions were run by Jennifer Brown (University of California, Davis) and Anne Dranowski (IAS).

Lectures were recorded and can be found here: (scroll for dates and lectures) <https://www.ias.edu/video?tags=15496>

B. Uhlenbeck Lectures:

Catharina Stroppel, University of Bonn, “Representation theory & Categorification”



Abstract: In modern representation theory we often study the category of modules over an algebra, in particular its intrinsic and combinatorial structures. Vice versa one can ask the question: which categories have a given combinatorics? This is the basic insight into the concept of categorification. Categorification is a recent development which often provides finer invariants and is used in different areas of mathematics (such as knot theory). We will explain a crucial ingredient in categorification: diagrammatics of tensor categories. We will focus on a few examples that arise in current research, such as Deligne categories. This course provides a categorical framework for the structures studied in the elementary course.

Uhlenbeck Problem Sessions were run by Joanna Meinel (University of Bonn) and Nicolle Sandoval Gonzalez (UCLA).

Lectures were recorded and can be found here: (scroll for dates and lectures) <https://www.ias.edu/video?tags=15496>

References for both courses

- Etingof's lecture notes :
 - Link : <http://www-math.mit.edu/~etingof/reprbook.pdf> ;
- Gruson and Serganova: **A Journey Through Representation Theory**:
 - Link: <https://link.springer.com/book/10.1007%2F978-3-319-98271-7>
- Chapters 1, 2, 3 (particularly 3.1, 3.2, 3.3) of Benson's book **D. J. Benson: Representations and Cohomology I: Basic Representation Theory of Finite Groups and Associative Algebras**;
 - <https://www.cambridge.org/core/books/representations-and-cohomology/9EE67E1280D8DB01AAC662530799AA8E>)
- J.P. Serre: **Linear Representations of Finite Groups**:
 - Link: <https://link.springer.com/book/10.1007%2F978-1-4684-9458-7>
- James and Liebeck : **Representations and Characters of Groups**:
 - <https://www.cambridge.org/core/books/representations-and-characters-of-groups/9F525E6ACAC7FFADFDDBDECE98C115F40>)
- Fulton and Harris: **Representation Theory**:
 - Link: <https://link.springer.com/book/10.1007%2F978-1-4612-0979-9>

C. Colloquium

Laura Rider, University of Georgia, " Geometric Categorifications of the Hecke Algebra " Recording of talk can be found here: (scroll for dates and lectures)
<https://www.ias.edu/video?tags=15496>

D. Special Talk Chelsea Walton, "Beyond Algebra"

The image shows a Zoom meeting interface. The main content is a presentation slide titled "Beyond Abstract Algebra-IAS 2021" dated "May 23, 2021 at 1:34 PM". The slide features handwritten text in blue ink: "BEYOND ABSTRACT ALGEBRA" in large letters, followed by "REFLECTIONS 10 YEARS POST PH.D." and "CHELSEA WALTON RICE UNIVERSITY" at the bottom. The Zoom window includes a top bar with "You are viewing Chelsea Walton's screen" and "View Options", a top status bar with "9:41 AM Tue Jan 9", and a bottom toolbar with icons for Mute, Stop Video, Security, Participants, Polls, Chat, Share Screen, Record, Live Transcript, Breakout Rooms, Reactions, More, and End. On the right side, there is a vertical stack of video thumbnails for Chelsea Walton, Michelle Huguenin, Liz Milićević, Laura Colmenar..., and Anne Dranowski.

E. Postdoc Seminar and Short Postdoc Introductions

F. Organized by Ana Balibanu (Harvard) and Charlotte Chan (MIT)

Laura Colmenarejo
(she/her/hers)

PHD @ Univ. of Sevilla (Spain) 2016
Postdoc @ UMass Amherst 2019-Now
Assistant Prof @ NCSU August 2021

Structure constants

Schubert polynomials

Representation theory

Algebraic geometry

Algebraic combinatorics

Mathematical physics

Stochastic analysis

DISCLAIMER: This diagram does not reflect the intersection between all the areas.

Participant thumbnails: Catharina Strop, Michelle Hugue, Laura Colmenarejo, Sarah D. Brauner, Mathilde Gerbel.

Zoom Meeting

Emily Gunawan, postdoc @ University of Oklahoma

Current research with undergraduate students

Box-ball system $\pi = 452361$

Steady state starting at $t=3$

Soliton decomposition

RSK algorithm:

permutations $\pi \leftrightarrow$ pairs $P(\pi), Q(\pi)$ of standard tableaux

$\pi = 452361$

$P(\pi) = \begin{matrix} 1 & 3 & 6 \\ 2 & 5 & 4 \\ 4 \end{matrix}, Q(\pi) = \begin{matrix} 1 & 2 & 5 \\ 3 & 4 & 6 \\ 6 \end{matrix}$

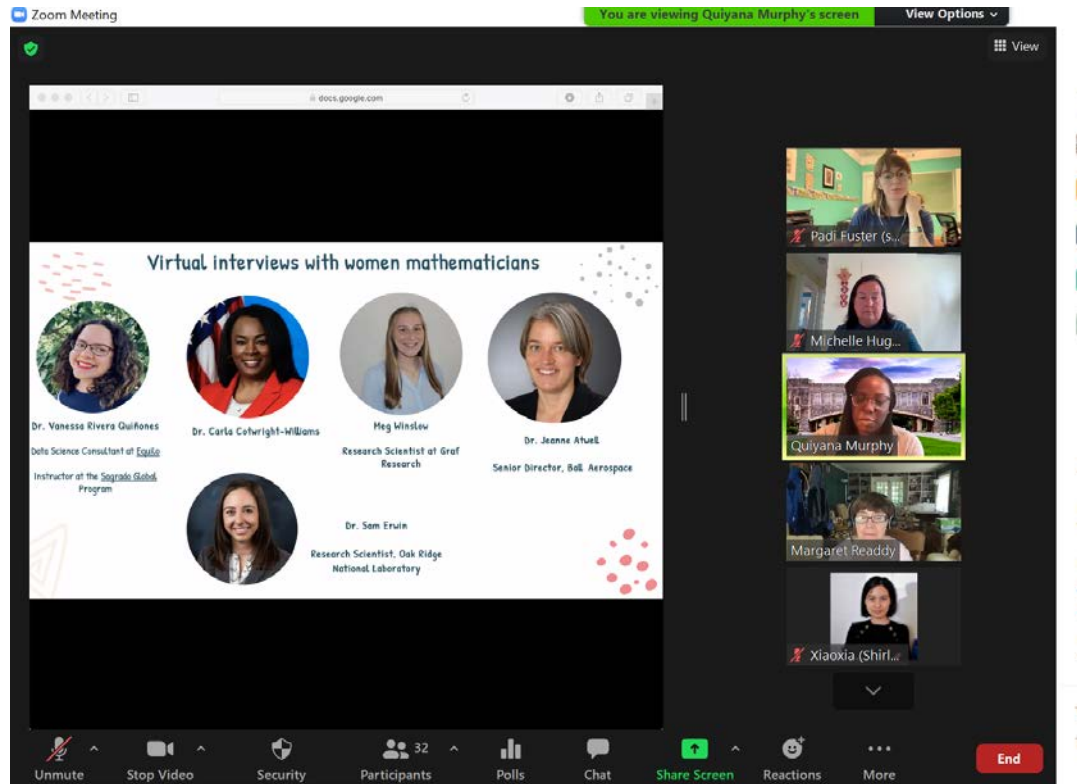
Participant thumbnails: Anne Dranow, Michelle Hugue, Laura Colmenarejo, Emily Gunawan, Mathilde Ger...

- Esther Banaian, Univ Minnesota, Frieze patterns from orbifolds
- Maiko Serizawa, Univ Ottawa, Foldings of root systems and liftings of Schubert classes
- Jennifer Brown, UC Davis, Color structures and quantum invariants
- Karina Batistelli, Univ Chile, Kazhdan-Lusztig polynomials for \tilde{B}_2
- Yusra Naqvi, Univ College London, Positivity of interpolation polynomials

- Sarah Brauner, Univ Minnesota, Eulerian representations for real reflection groups
- Aparna Upadhyay, Univ at Buffalo, The Benson - Symonds invariant for signed permutation modules and trivial source modules
- Alice Dell'Arciprete, Univ of East Anglia, Blocks of Ariki-Koike algebras
- Darlayne Addabbo, Univ Arizona, Higher Level Zhu Algebras
- Flor Oroz Hunziker, Univ Colorado Boulder, Tensor categories for non-rational Virasoro vertex algebras
- Magdalena Boos, Ruhr-Univ Bochum, Classical Lie-theoretic questions via Representation Theory
- Emily Norton, University of Clermont Auvergne, Calibrated representations of cyclotomic Hecke algebras at roots of unity
- Laura Colmenajero Hernando, UMass Amherst, An insertion algorithm for diagram algebras

G. Lunchtime Talks

- Discussion: Maggie Rahmoeller - Get to know you – things I wish I knew getting into grad school
- Discussion: Cynthia Vinzant - Get to know you – things I wish I knew finishing grad school
- Ambassador Program: introductions and summaries from 2021 recipients. Summary videos found here:
<https://www.ias.edu/math/wam/2021/21-ambassador-video-reports>
 - Catherine Berrouet, Florida Atlantic University
 - Rosa Fuster, Tulane University
 - Quiyana Murphy, Virginia Tech
 - Xiaoxia Wu, Univ Chicago/TTIC
- Discussion: Emily Peters – Applying for jobs with a teaching component
- Discussion: Anastasiia Tsvietkova - Computations and programming in mathematics research, and broader career options
- Discussion: Lisa Schneider – Grad School
- Princeton University virtual lunch
- Discussion: Lisa Sauermann – Work-life Balance
- Discussion: Nathalie Wahl – Publishing



III. Outreach

A. “Math E-Carnival” with Princeton Public Library.

Organized by Margaret Readdy with help from Elise Catania, Shanna Dobson, Libby Farrell, Adeli Hutton, Mee Seong Im, Emily Norton, Bhargavi Parthasarathy

B. Introduction to Ambassador Program (see lunch time talks)

Thanks to a generous grant from Lisa Simonyi, the IAS Women and Mathematics Program will fund annually up to three (3) postdoctoral or advanced graduate ambassadors and up to six (6) graduate ambassadors to build support and outreach networks across the country.

WAM Ambassador selection criteria include previous participation in the Women and Mathematics summer program, mathematical expertise, and enthusiasm. Each lead conference organizer and graduate ambassador should

have a faculty sponsor (male or female) at their home institution. They must also have matching funds committed to the project.

WAM Ambassadors must also fulfill these requirements:

1. Submit a summary report within 30 days of the completion of the proposed activity.
2. Acknowledge IAS Women and Mathematics and Lisa Simonyi in activity announcements (print and online) and in any publication that results from the activity.
3. Participate in the WAM annual meeting the following May to share best practices and new outreach ideas, and to help train new WAM Ambassadors.

See <https://www.ias.edu/math/wam/2021/21-ambassador-video-reports> for details.

