UNIVERSITY OF IOWA MATHEMATICS DEPARTMENT NEWSLETTER

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IN THIS ISSUE

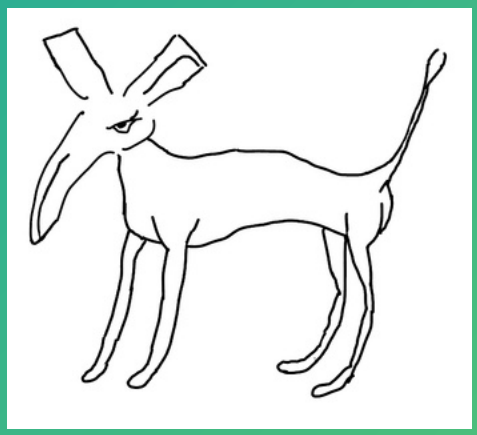
COVER CAPTURED BY SHASHANK SINGH

UNIVERSITY OF IOWA MATHEMATICS DEPARTMENT NEWSLETTER

GRADUATE LIFE AND SUBMISSIONS

GRADUATE STUDENTS CONVENING FOR GAUSS SEMINAR

THE MGB AT ITS FIRST MEETING OF THE YEAR



ZACHARY'S SELF-PROCLAIMED FAVOURITE TOPOLOGICAL SPACE

MISTY IOWA CITY CAPTURED BY SHASHANK

FATEMEH AND PARIA CELEBRATING NOWRUZ(PERSIAN NEW YEAR)

INTERVIEW

WITH ROBERT DEYESO, RTG–POSTDOCTORAL RESEARCH SCHOLAR

Paria: Can you describe your current research and the problems you're working on?

Robert: My research focuses on low-dimensional topology, and typically concerns three-dimensional manifolds (3-manifolds). I use Heegaard Floer homology, a suite of topological invariants useful for studying 3-manifolds. I deploy them on spaces arising from a construction called Dehn surgery, which involves modifying the 3-sphere by excising a knot's neighborhood and reattaching it in interesting ways. This procedure only depends on where the neighborhood's meridional curve is attached, which is captured by a rational 'slope'. There are three major open problems concerning this construction:

1. The Berge Conjecture: Only knots arising from Berge's construction admit surgery to a lens space.
2. The Cosmetic Surgery Conjecture: Different surgery slopes on the same knot cannot produce the same 3-manifold (preserving orientation).
3. The Cabling Conjecture: Only 'cabled' knots admit Dehn surgery to a decomposable 3-manifold.

I've used recent advancements in Heegaard Floer homology to study this last conjecture. In particular, new 'immersed curves' techniques for working with bordered versions of these invariants have made these problems more approachable.

Paria: You've worked on proving the cabling conjecture for certain knots, correct?

Robert: Yes, I used Heegaard Floer homology to prove the Conjecture for 'thin' knots, a class of knots that contains 'alternating' knots. In my thesis work, I couldn't fully handle thin, L-space knots with immersed curves as they are very simple for such knots. However, Holt Bodish and I were able to successfully use aspects of stronger types of Heegaard Floer invariants to handle the L-space knots case, and thereby showed that all thin knots satisfy the Cabling Conjecture.

Paria: That sounds like a major breakthrough! Could you explain the role of Heegaard Floer homology in this?

Robert: Heegaard Floer homology is a combinatorial tool for studying three-manifolds. It connects mathematics and physics and has been refined in recent years. This has allowed me to approach classical problems in low-dimensional topology, like the Cabling Conjecture, in new ways.

Paria: What's next for your research?

Robert: I'll continue exploring the Cabling Conjecture, focusing on L-space knots, and using immersed curve techniques in Heegaard Floer homology to approach more open problems concerning Dehn surgery in low-dimensional topology.

Paria: Great, let's dive in. What skills do you think are essential for a successful researcher, both independently and in collaboration?

Robert: That's a great question. I was fortunate to have fantastic advisors during my undergraduate and graduate school years, so a lot of what I learned about collaboration came through observation. I think the key is ensuring everyone's interests are aligned with the tasks they're working on - no one should be stuck on a problem they dislike. For me, I love visualizing math. I spend a lot of time creating figures, sometimes just for clarity, which can lead to breakthroughs. For example, while working with immersed curves I found it easier to represent them in figures by connecting vertical strips. That gave me significant insight that simplified homology computations later on.

Paria: That's fascinating. Are you currently mentoring anyone?

Robert: Yes! This semster, I'm mentoring an undergraduate student, Eric Lucas. We have been working on the other half of my thesis problem that concerned when Dehn surgeries contain a Klein bottle. We dove into homological algebra and manifold topology, and I've noticed his enthusiasm grow as we explore the finer details of the math. He's also interested in visualizing the concepts, so he created a pegboard to model the immersed curves which has been incredibly helpful for speeding up our computations.

Paria: That's really creative! What about when you're not doing math—what would you do if you weren't in this field?

Robert: Hmm, that's a tough one. Growing up, I was really into video games, and I think that sparked my interest in optimization, which later led me to math. If I weren't in math, I might have gone into engineering—probably aerospace. I'm fascinated by things like the design of turbofan engines and the challenges of optimizing performance in varying atmospheric conditions.

Paria: That makes sense. If you could collaborate with any mathematician, living or dead, who would it be and why?

Robert: That's a hard question! If I could time travel, I'd love to collaborate with Newton. Imagine bringing modern knowledge to someone like him, who achieved so much at such a young age. But I think for a more grounded answer, I'd choose my past advisor, Jason DeVitoor Tye Lidman. They're both calm and thoughtful people, and I think working together would open up exciting opportunities, especially with their broad range of collaborations.

Paria: Those all sound like great choices. Looking ahead, where do you see yourself in ten years?

Robert: I am happy to share that I have accepted a tenure-track position at my alma mater – the University of Tennessee at Martin. It is a primarily undergraduate institution that emphasizes teaching and undergraduate research; two things that I am very passionate about. They are particularly interested in innovations in teaching, like the animations I have developed using a Python library called Manim to animate math concepts. My students have responded really well to that. Teaching in this way has been a huge motivator for me, and makes it possible to convey difficult theoretical concepts to undergraduates in ways that they learn best.

Paria: That's great news, congratulations. As someone who has taken your class, I should say they are very lucky to have you as a faculty. Do you have any advice for us grad students?

Robert: Grad school can be overwhelming, especially during the second and third years when you're preparing for quals, selecting an advisor, and juggling coursework. It's important not to withdraw socially during these times, even though it can feel like a lot. I faced health issues during my second year, which added extra stress, but having a strong support system helped me push through. I think maintaining social connections is critical for both mental health and for your research collaborations down the line.

Paria: Excellent advice. Any final thoughts?

Robert: Just to add, I think it's important to recognize the strength of the math community in your department. I've noticed a strong camaraderie among the grad students here, which really helps everyone thrive. It's something I value deeply, and I encourage everyone to contribute to that positive culture. In the end, good collaborations aren't just about math; they're about strong, productive social relationships.

Paria: Thank you so much for your time and insights!

Robert: It was my pleasure. Thanks for the thoughtful questions!

COMPS AND DEFENSES!

CONGRATULATIONS ON COMPING

BLAKE MATTSON - DECEMBER 4TH

MARC MOORE -FEBRUARY 12TH

IAN RAMSEY- FEBRUARY 20TH

UPCOMING DEFENSES

JINYANG WU-MARCH 25TH

ADRIANA FERNANDEZ QUERO - MARCH 25TH

MARGERITA BUSTOS GONZALEZ- MARCH 26TH

ELISE ASKELSEN- MARCH 26TH

CASEY STONE- MARCH 27TH

MATH PETS!

ZACHARY'S PETS FROM BACK HOME, OLLIE AND AZULA

MEET CHUNK, JACOB MILLER'S DOG

FATEMEH'S LITTLE FLOWER GUARDIAN, GINGER

JOSE'S CATS FROM HOME: TIMMY(IN BOX) AND AKIRA (IN TRASHBAG)

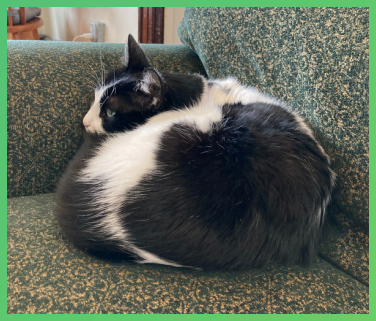
LIZ AND NANDITA'S CAT GRAMMY WITH HIS STUFFED ELEPHANT

LIZ'S DOG FROM HOME, ADORABLE ALEX

SAM'S DOG CHARLIE

MARC'S NEIGHBORHOOD WATCHERS,DETECTIVE LENTIL AND DETECTIVE BEAN

BLAKE'S CAT, BUSTER, SHOWING GOOD TASTE IN GAME CONSOLES



PARIA'S BABY, DELBAR NICE AND COZY

RECIPES!

Blake's Chicken Bacon Ranch Hotdish

3 CUPS CHOPPED, COOKED CHICKEN
1 CUP CHOPPED, COOKED BACON
1 CAN CREAM OF CHICKEN SOUP
1 1-OZ. PACKET DRIED RANCH DRESSING
16 OZ. SOUR CREAM
2 CUPS CHEDDAR CHEESE
32 OZ. TATER TOTS

PREHEAT THE OVEN TO 375. MIX EVERYTHING EXCEPT THE TATER TOTS IN A LARGE BOWL. SPRAY A 9X13 BAKING PAN WITH COOKING SPRAY. SPREAD ABOUT HALF THE MIX EVENLY IN THE PAN, THEN PLACE HALF (16 OZ) OF THE TATER TOTS. PUT THE REMAINING HALF OF THE MIX ON TOP OF THE TATER TOTS AND PLACE THE REMAINING HALF OF THE TATER TOTS ON TOP OF THIS. BAKE 45-50 MINUTES, OR UNTIL BUBBLY.

Petros' Mac n' Cheese Monolith

4 G BUTTER
4 G FLOUR
2 JALAPENOS
1 BOX CHICKEN BROTH (OR 1QT MILK, CREAM, OR WATER)
1 LB PROCESSED AMERICAN CHEESE SLICES
2LB CHEDDAR CHEESE, SHREDDED
1LB MOTZARELLA CHEESE, SHREDDED
1 TBSP ONION POWDER
1 TBSP GARLIC POWDER
SALT AND PEPPER(TO TASTE)
2 BOXES OF ELBO MACARONI PASTA

SHRED THE CHEEE AND DICE THE JALAPENOS, SET ASIDE. MELT THE BUTTER IN THE BIGGEST POT YOU HAVE, AND STIR IN THE FLOUR. KEEP STIRRING CONSTANTLY FOR 5-7 MINUTES THEN ADD THE CHICKEN STOCK AND SEASONINGS. ADD THE JALAPENOS AND AMERICAN CHEESE, STIRRING GENTLY. CUT THE HEAT ENTIRELY AFTER ALL THE AMERICAN CHEESE HAS MELTED AND INCORPORATED INTO THE SAUCE, AND ADD HALF OF THE SHREDDED CHEESE, STIR UNTIL MELTED IN. BOIL YOUR PASTA AND COMBINE WITH THE SAUCE IN YOUR LARGEST (OR SEVERAL) OVEN SAFE COOKING VESSELS. SPREAD THE REMAINING HALF OF THE SHREDDED CHEESE ON TOP AND BAKE IN THE OVEN UNTIL THE CHEESE IS MELTED AND BROWNED.

PUZZLE TIME WITH NANDITA

-NANDITA NAIR

EDGES OUT

YOUNG MAN, IN MATHEMATICS, YOU DON'T UNDERSTAND THINGS-YOU JUST ANAGRAM THEM

THE CUTE RECON STATED THAT A GROUP G IS NON-AMENABLE IF AND ONLY IF G CONTAINS A SUBGROUP THAT IS A FREE GROUP ON TWO GENERATIONS.

THE ANTIQUE DESCRIBES HOW A DENSITY OPERATOR EVOLVES IN TIME.

IN CELLULAR AUTOMATA, THE BROODING HOE IS CLASSICALLY DEFINED ON A TWO-DIMENSIONAL SQUARE LATTICE AND IS COMPOSED OF A CENTRAL CELL AND ITS FOUR ADJACENT CELLS.

POETRY IS A MEASURE OF THE STATISTICAL UNCERTAINTY WITHIN A DESCRIPTION OF A QUANTUM SYSTEM.

WITH FOUR PARAMETERS, I CAN FIT A PHAT ELL, AND WITH FIVE, I CAN MAKE HIM WIGGLE HIS TRUNK.

EACH ARNOLD IS THE WELL-ORDERED SET OF ALL SMALLER ARNOLDS.

SURELY, THERE MUST BE A LESS PRIMITIVE WAY OF MAKING BIG CHANGES IN THE STORE THAN BY PUSHING VAST NUMBERS OF WORDS BACK AND FORTH THROUGH THE TENT BLOCK.

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Here Be the Math Memes