Department of Mathematics

April 13, 2026

UNDERGRADUATE MATH SEMINAR

Professor Kim Plofker

The next seminar of the winter term will be

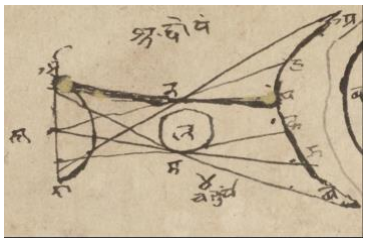
DATE: **THURSDAY, April 16**

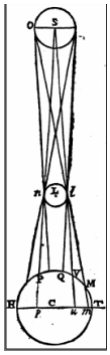
Time & **12:30 –** Refreshments in **Bailey 204**

Location: **12:50 – 1:45** Seminar in **Bailey 207**

In this seminar, Union College's Professor Kim Plofker, the math department's Historian of Mathematics, will present the following talk.

Title: Going Around in Ellipses: Debating the Shape of the Solar System in Mughal, India (or, Why you should ALWAYS cite your sources!)





Abstract: This interdisciplinary talk explores an early 18th-century international scientific project at the court of Jai Singh II in Jaipur. As the Maharaja's court astronomers and some visiting European Jesuit mathematicians undertook to reconcile their different ideas of mathematical astronomy, they argued about models. We will look at some of the Latin, Sanskrit and Persian works that their discussions produced.

Pieces from Thesis: Ryder Mollo

Ryder wrote his senior thesis this past fall and winter under the guidance of ***Professor Phanuel Mariano****.*

For my thesis, I examined four questions in probability theory that are each commonly referred to as paradoxes. Some of these are veridical paradoxes, which have an actual solution but appear false or unintuitive, while other paradoxes arise from an ambiguity in how the question is posed.

The first paradox is called the Birthday Paradox, which Prof. Mariano discusses in his Probability Theory course here at Union. The original question is, if there are 23 people in a room, what is the probability that at least two of them will share the same birthday (assuming that all birthdays are equally likely)? The calculation for the question is fairly straightforward; however, the equation becomes more complicated when you remove the assumption of equally likely birthdays. In my thesis I prove that the probability of two people sharing a birthday is always the least when each birthday is equally likely. To emphasize this result, I calculated the estimated probability of two people sharing a birthday using 19 years of U.S. birthdate data.

The second paradox is the Monty Hall Problem, where a game show contestant chooses one of three doors, with one door containing a prize. After the host reveals a door without the prize, the contestant must decide whether to stick with their original choice or switch. Beyond the original problem, I examined several variations which utilized Bayesian probability. Additionally, I ran simulations in Wolfram Mathematica to illustrate the results.

The third paradox is the 100 Prisoners Problem. In this problem, 100 numbered prisoners must each find their own numbered card, hidden in one of 100 boxes. The prisoners can open at most 50 boxes, and if any prisoner doesn't find their card, they all lose. The problem asks for the best strategy for

Continued on the next page.

prisoners to escape the proposed dilemma. This strategy, known as the cycle strategy, has each prisoner follow a chain of cards starting from the box matching their own number. Building on a proof from Eugene Curtin and Max Warshauer, I show that the cycle strategy is the optimal solution. After extending the results for arbitrary parameters, I used Wolfram Mathematica simulator for the 100 Prisoner Problem and confirmed the results.

The fourth paradox is the St. Petersburg Paradox. This paradox involves a game where you flip a coin repeatedly until tails appears and win 2^n dollars where n is the number of flips. Daniel Bernoulli questioned what a fair price to play would be, as the expected value is infinite but noticed that this does not reflect what people are willing to pay in price. Daniel Bernoulli and Gabriel Cramer proposed different utility functions that represent a person's value of money which make the expected value finite. Additionally, William Feller created a definition of fair for a set number of games and had a proof that the function $n\log_2(n)$ is fair for n games. I expand Feller's proof in my thesis and compare the result to simulated outcomes.

Overall, I enjoyed this thesis because I was able to study questions that I thought had interesting results while expanding upon ideas that were previously presented by mathematicians. Creating and graphing simulations was also a fun exercise for these theoretical results.

Pi Mu Epsilon – Math Honors Society Accepting Applications

Pi Mu Epsilon (PME) is a national undergraduate math honors society. In Spring 2013, a chapter of PME was established at Union College. Now we are looking to induct new members who have demonstrated an ability and interest in mathematics consistent with PME's purpose and goals.

To be considered for membership into Union's chapter of PME, a student must have

- taken at least two math courses at the 200-level or above;
- a minimum campus-wide GPA of 3.0 and a minimum GPA of 3.0 in all math courses that can be used to fulfill a math major;
- a demonstrated engagement and involvement, while at Union College, in the promotion of mathematics at Union College and/or broader community, (examples include, active involvement in the Union College Math Club, in the Association of Women in Mathematics, in the Hudson River Undergraduate Mathematics Conference, in the Calculus Help Center, in math tutoring through the Kenney Center, in math problem solving training sessions and/or competitions, regular attendance at the Union College Math Department Seminar);
- an interest in joining PME, demonstrated by writing a few paragraphs/mini-essay in an email to **Professor Paul Friedman** (friedmap@union.edu) explaining your interest, your qualifications, and how you have supported and will continue to support the purpose and goals of PME. This email must be received by **noon on Thursday, April 23.**

The national initiation fee for PME is $30. This covers the cost of membership and a one-year (two issue) subscription to the MPE Journal. Members of MPE can also purchase other PME items such as tassels for graduation, t-shirts, etc. For more information, go to the website **pme-math.org.**

HRUMC

HRUMC: Saturday, April 25 at Vassar College.

Register online to attend this daylong conference AND let **Professor Paul Friedman** (friedmap) know that you will be attending. Do so by April 17!