

# Colloquium 2020-2021

Unless stated otherwise, colloquia are scheduled for Thursdays 4:15-5:15pm in WH-100E with refreshments served from 4:00-4:15 pm in WH-102.

Organizers: [Vladislav Kargin](#), [Cary Malkiewich](#), [Anton Schick](#), and [Adrian Vasiu](#)

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## Spring 2021

**A Special Event:** Professor Ken Ono (University of Virginia), who is a Phi Beta Kappa Visiting Scholar this year, is virtually visiting our department on March 11-12. He will present three lectures via zoom, a Math Club Talk for undergraduate and graduate students with interest in mathematics, a Colloquium Talk for our faculty and graduate students, and a Public Lecture intended for a general audience. Details of these talk are given below. The talks are sponsored by our local Phi Beta Kappa Chapter. Many thanks to Professor Alex Feingold for organizing this.

### Thursday March 11, 2:50-3:50pm, THIS IS THE MATH CLUB TALK [Zoom Link](#)

Speaker: [Ken Ono](#) (University of Virginia)

Topic: What is the Riemann Hypothesis, and why does it matter?

*Abstract:* The Riemann hypothesis provides insights into the distribution of prime numbers, stating that the nontrivial zeros of the Riemann zeta function have a “real part” of one-half. A proof of the hypothesis would be world news and fetch a \$1 million Millennium Prize. In this lecture, Ken Ono will discuss the mathematical meaning of the Riemann hypothesis and why it matters. Along the way, he will tell tales of mysteries about prime numbers and highlight new advances.

### Thursday March 11, 4:30-5:30pm, THIS IS THE COLLOQUIUM TALK [Zoom Link](#)

Speaker: [Ken Ono](#) (University of Virginia)

Topic: Gauss' Class Number Problem

*Abstract:* In 1798 Gauss wrote *Disquisitiones Arithmeticae*, the first rigorous text in number theory. This book laid the groundwork for modern algebraic number theory and arithmetic geometry. Perhaps the most important contribution in the work is Gauss's theory of integral quadratic forms, which appears prominently in modern number theory (sums of squares, Galois theory, rational points on elliptic curves, L-functions, the Riemann Hypothesis, to name a few). Despite the plethora of modern developments in the field, Gauss's first problem about quadratic forms has not been optimally resolved. Gauss's class number problem asks for the complete list of quadratic form discriminants with class number  $h$ . The difficulty is in effective

computation, which arises from the fact that the Riemann Hypothesis remains open. To emphasize the subtlety of this problem, we note that the first case, where  $h=1$ , remained open until the 1970s. Its solution required deep work of Heegner and Stark, and the Fields medal theory of Baker on linear forms in logarithms. Unfortunately, these methods do not generalize to the cases where  $h>1$ . In the 1980s, Goldfeld, and Gross and Zagier famously obtained the first effective class number bounds by making use of deep results on the Birch and Swinnerton-Dyer Conjecture. This lecture will tell the story of Gauss's class number problem, and will highlight new work by the speaker and Michael Griffin that offers new effective results by different (and also more elementary) means.

### Friday March 12, 4:00-5:00pm, THIS IS THE PUBLIC LECTURE

Speaker: **Ken Ono** (University of Virginia)

Topic: Why does Ramanujan, "The Man Who Knew Infinity", matter?

**Since this talk is open to the general public, we require registration in advance for this meeting: [Use this link to preregister](#). After registering, you will receive a confirmation email containing information about joining the meeting.**

*Abstract:* This lecture is about Srinivasa Ramanujan, "The Man Who Knew Infinity." Ramanujan was a self-trained two-time college dropout who left behind 3 notebooks filled with equations that mathematicians are still trying to figure out today. He claimed that his ideas came to him as visions from an Indian goddess. This lecture gives many reasons why Ramanujan matters today. The answers extend far beyond his legacy in science and mathematics. The speaker was an Associate Producer of the film "The Man Who Knew Infinity" (starring Dev Patel and Jeremy Irons) about Ramanujan. He will share several clips from the film in the lecture, and will also tell stories about the production and promotion of the film.

Archive:

- [2014-2015](#)
- [2015-2016](#)
- [2016-2017](#)
- [2017-2018](#)
- [2018-2019](#)
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