



# Mathematics Colloquium

## Discrete or continuous?

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Host: Tim Browning

From Zeno's paradoxes to quantum physics, the question of the continuous nature of our world has been prominent and remains unanswered. Does space-time really exist, or is it just a good model for an enormous, but finite number of elementary particles? Discrete structures behave quite differently from continuous ones. The great success story of mathematics in the 18-th and 19-th centuries was the development of analysis, with extremely powerful tools such as differential equations or Fourier series, and with by now very standard methods like the famous (infamous?) epsilon-delta technique. Discrete mathematics had a later start, but for importance of its applications it is catching up. Its proof techniques are different, such as enumeration or induction. In the continuous world, algorithms are mostly computations, with numerical analysis at the center. In the discrete world, algorithmic ideas are more diverse, including searching, recurrence, and (yes!) pulling in methods from continuous mathematics. I will argue that these worlds are not as far apart as they seem. The use of computers forces us to approximate continuous structures by finite ones; but perhaps more surprisingly, very large finite structures can be very well approximated by continuous structures, and this approximation gets rid of inconvenient and unnecessary details. Many fundamental questions of mathematics, probability, or physics can be asked in both settings, and their approaches cross-fertilize each other.

**Wednesday, April 10, 2024 03:30pm - 04:30pm**

Raiffeisen Lecture Hall



This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station. Please find a schedule of the ISTA Shuttle on our webpage: <https://ista.ac.at/en/campus/how-to-get-here/> The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.