Physics Colloquium

Prof. Gary Shiu

"The Topology of Data: from String Theory to Cosmology to Phases of Matter"

We are faced with an explosion of data in many areas of physics, but very so often, it is not the size but the complexity of the data that makes extracting physics from big datasets challenging. As I will discuss in this talk, data has shape and the shape of data encodes the underlying physics. Persistent homology is a tool in computational topology developed for quantifying the shape of data. I will discuss three applications of topological data analysis: 1) identifying structure of the string landscape, 2) constraining cosmological parameters from CMB measurements and large scale structures data, and 3) detecting and classifying phases of matter. Persistent homology condenses these datasets into their most relevant (and interpretable) features, so that simple statistical pipelines are sufficient in these contexts. This suggests that TDA can be used in conjunction with machine learning algorithms and improves their architecture.

Dr. Gary Shiu is a professor of physics at the University of Wisconsin-Madison, USA. He was a chair professor of physics at the Hong Kong U. of Science & Technology (HKUST) and Director of the Center for Fundamental Physics, HKUST. He held visiting appointments at the Institute of Advanced Studies in Princeton, at Stanford University and CERN. Gary Shiu is a fellow of the American Physical Society and the American Association for the Advancement of Science and he is the recipient of many awards, among which are an NSF Career Award and the University of Wisconsin Chancellor's Distinguished Teaching Award. Due to his outstanding lecture and teaching skills he has been invited to and given more than 400 lectures, seminars and colloquia around the world.

Thursday February 11th at 4:25 via Zoom
If you are outside the Lehigh Physics Department, please email Marina Long (mal516@lehigh.edu) for a link.