THE HUMBOLDT STATE UNIVERSITY MATHEMATICS DEPARTMENT PRESENTS

BSS 166
NOV. 04, 2021
4PM

THE (POSSIBLE) SHAPES OF SPACE: 3-DIMENSIONAL TOPOLOGY AND GEOMETRIZATION

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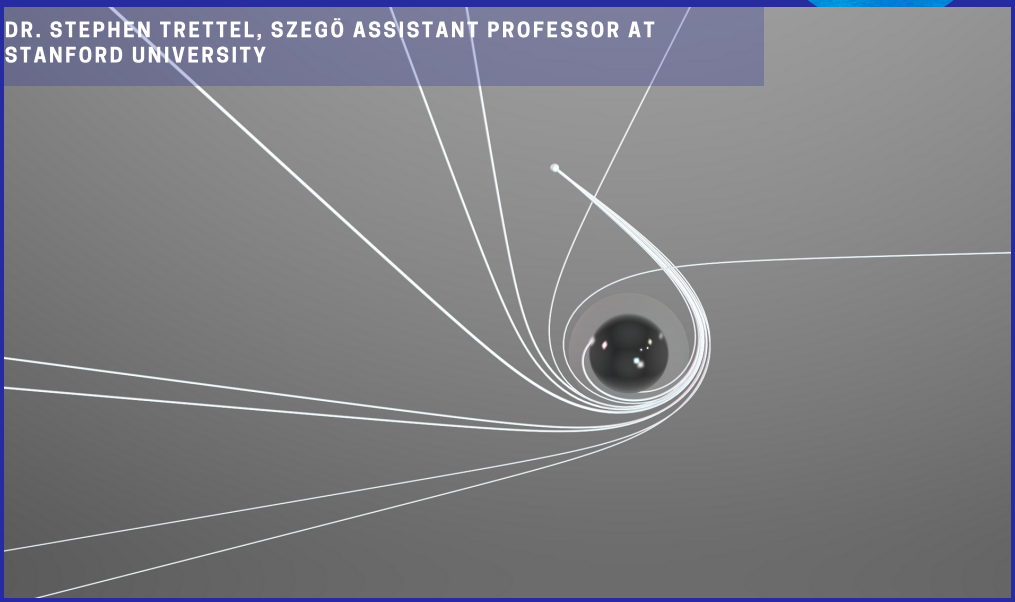

The world of our day to day experience has been well understood mathematically since the time of the Greeks as Euclidean 3-space, or R^3. And if we are to believe Copernicus, the same should hold at every point in space. This leads to a very interesting mathematical question: what are the possible spaces which look like R^3 at every point? One obvious possibility is R^3 itself, and throughout much of history this was (either implicitly or explicitly) assumed to be the only logical option. But during the 19th and 20th centuries not only did mathematicians come to realize this is not true, but rather they discovered an infinite collection of such spaces of arbitrary complexity!

In this talk we will attempt to understand this zoo of possible worlds from a 21st century perspective, where geometry plays a central role. As a beautiful and motivating example we begin with the classification of 2-dimensional worlds and the uniformization theorem of the 19th century. We then turn to our main focus, understanding the statement of the Geometrization Theorem (the first, and to date only Millennium Prize problem resolved), which tells us how to understand all three dimensional worlds as made of certain fundamental geometric 'building blocks'. Pairing an understanding of this theorem with some computational Riemannian geometry, we will explore some of these building blocks via computer simulations.

The public is welcome to this free lecture, which is geared toward a general audience. Masks are required, regardless of vaccination status.