Astronomy Special Seminar

李政道研究所
TSUNG-DAO LEE INSTITUTE

Starduster: Statistical Physics Models for Understanding Life's Critical Transitions

Time: 15:00-16:00, 5 July (Friday), Shanghai time

Venue：N600（TDLI）

Host: Fabo Feng

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Meeting ID: 601318852

Dr. Ivan Sudakow
the Open University

Abstract:

Exploring life on other planets and Earth's cold environments or studying extinct life on Earth often highlights the limitations of incomplete and low-resolution records across space and time. Modeling offers a promising solution to address these gaps, bridging different scales of processes, revealing critical transitions, enhancing our understanding of mass extinctions, and aiding in the identification of potential biosignatures.

In this talk, I will demonstrate how statistical physics can address these challenges. For instance, I will discuss using the Ising model to detect critical phenomena in phytoplankton dynamics in cold environments, employing nonlinear dynamics to understand how microbial biomes can delay climate catastrophe, and leveraging stochastic models to extend the Gaia paradigm.

Biography:

Dr. Ivan Sudakow was appointed to a Lectureship in Applied Mathematics at the School of Mathematics and Statistics at the Open University in 2022. He holds an M.S. in Statistical Physics and a Ph.D. in Applied Mathematics from Russia. From 2012 to 2015, he was the Edward Lorenz Postdoctoral Fellow in the Department of Mathematics at the University of Utah. He then worked as an Assistant Professor in the Department of Physics at the University of Dayton, OH, USA, from 2015 to 2022. Dr. Sudakow was a Kavli Institute for Theoretical Physics Scholar from 2020 to 2022. In 2024, he became a SETI Institute Affiliate and is also the leader of the Mathematics of Mass Extinction network at the Newton Institute in Cambridge. His main expertise includes mathematical biology, statistical physics, and applied dynamical systems. Recently, he has started working in the field of Artificial Intelligence for Earth. He has received grants from various organizations such as the NSF, LMS, RSF, RFBR, and Microsoft. Dr. Sudakow has published over 35 papers in leading international journals on different topics in mathematics, physics, and interdisciplinary studies.

Astronomy and Astrophysics Division
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