Perturbative Frictional Jamming and its relation to electron transport in disordered media

By
Dr Mahesh Bandi
OIST Graduate University

Abstract
It is well known that external perturbations evolve a frictional granular pack jammed in an initial metastable configuration to an eventual stable one. Beneficial in achieving efficient packing, athermal perturbations can also cause failure. Understanding pack response to perturbations naturally carries both fundamental and applied significance. In a related context, the power law pressure $P$ increase against packing fraction $\phi$ is considered a signature of the frictionless jamming transition. In contrast, independent studies reveal frictional jamming exhibits an initial exponential pressure rise before deviating towards the putative power law. The range of $\phi$ over which pressure rises exponentially is marked by a marginally stable solid (fragile state) sensitive to perturbations. In this talk, I report experiments on frictional granular pack pressure response to controlled perturbations in this fragile state. In particular, I will deduce an empirical result from the experimental data which establishes a close correspondence between this classical (frictional jamming) problem and a quantum effect, viz. Hopping conduction mechanism for electron transport in amorphous semiconductors.

Short Biography
Mahesh grew up in India where he received his Bachelors' in Computer Engineering from the University of Madras in 1998. Following a two year stint in the Indian software industry, he returned to academia and earned his MS Electrical Engineering (2002), MS Physics (2004) and PhD Physics (2006), all from the University of Pittsburgh. Following postdoctoral terms at Los Alamos National Laboratory (2006 - 2009) and Harvard University (2009 - 2011), he commenced his appointment as an Assistant Professor at OIST Graduate University, Japan starting Summer 2012 and was promoted to the rank of Associate Professor with tenure in summer 2018. Since 2018, he holds an adjunct appointment with the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy. Mahesh's primary research interests lie in Experimental Nonlinear, Non-equilibrium, and Soft Matter Physics with supporting contributions in theory and numerics. His research portfolio is organized along four overlapping themes: Statistical Physics of Renewable & Sustainable Energy, Quantitative Life Sciences, Hydrodynamics, and Amorphous Media. His serious non-scientific interests include art, hiking, and as a foodie.