UCLA Mani L. Bhaumik Institute for Theoretical Physics

Bhaumik Luncheon Young Scientists Seminar (BLYSS)

Friday, March 13th @ 12PM in Physics & Astronomy Building (PAB) 4-330

The Mani L. Bhaumik Institute of Theoretical Physics is pleased to present the **Winter 2020** Bhaumik Luncheon Young Scientist Seminar (BLYSS). The goal of this Seminar series is to learn about exciting new ideas from young scientists in the department and around the world through short talks and discussions.

Krishna Choudhary

Sleep: A Dynamical Systems Approach

During sleep, the brain remains active, even in the absence of sensory stimulus. Borrowing principles from statistical and dynamical systems physics, we construct simple biophysically-inspired mean-field neural network models to study how neural systems maintain spontaneous activity in the absence of external input. We are concerned specifically with non-REM sleep, during which EEG activity shows slow oscillations (~1Hz) of high voltage, and during which neurons in the neocortex organize and synchronously transition between periods of tonic firing and periods of quiescence. This oscillation between two dynamic network states is observed across mammalian species, and has been implicated in long-term memory consolidation and learning. The three-parameter minimalist model we explore both replicates the observed network state oscillation and predicts new phenomena that have been confirmed with experiment.

Shu Zhang

Vortices and hedgehogs in ferromagnets—a field-theoretic approach

Topological defects are ubiquitous in physics. Condensed matter systems, especially magnetic systems, provide a nice playground, where topological defects can be observed, tuned and driven. In ferromagnets, the precessional nature of spins can be captured by a gauge field term, often referred to as the Wess-Zumino action. This field-theoretic approach has helped us in finding some interesting aspects of topological defects in ferromagnets. In this talk, I will give two specific examples: (1) a vortex as a charge-flux composite in the dual theory of a (2+1)-dimensional XY ferromagnet [1], (2) a hedgehog as a Dirac monopole in a (3+1)-dimensional Heisenberg ferromagnet [2].

[1] S. Dasgupta, S. Zhang, I. Bah, O. Tchernyshyov, arXiv:1909.05248[2] J. Zou, S. Zhang, Y. Tserkovnyak, in preparation