LENS/Condensed Matter Seminar

November 21, 2019

Speaker: Chen-Lung Hung, Purdue University

Title: “Quench dynamics and Townes soliton formation in two-dimensional Bose gases”

Abstract: Predicting the evolution of many-body systems under attractive interactions is a challenging task, owing to the instability to collapse. Bright solitons are remarkable stationary states, established when the self-focusing effect responsible for collapse is exactly compensated by wave dispersion. In two-dimensional (2D) Bose gases, however, such intricate balance cannot be fulfilled except at a critical norm known as the Townes threshold – only at which matter-wave bright solitons can form. In this talk, I will discuss our recent study on the collapse dynamics in a homogeneous 2D Bose gas (formed by atomic cesium), when its interaction is quenched from repulsive to attractive via a Feshbach resonance [1]. We observe the formation of Townes solitons through the manifestation of modulational instability that results in the amplification of density wave disturbances and fragmentation of a 2D sample. Our high-resolution density measurements in space and time domain reveal detailed information about the formation process, from the amplified growth of density waves, the formation of 2D solitons, to the subsequent collision and collapse dynamics, demonstrating multiple universal behaviors in association with the formation of a stationary state. Towards the end of the talk, I will discuss our on-going plan for exploring non-equilibrium dynamics such as quantum critical transport, entanglement generation and distribution in a strongly-coupled 2D gas loaded in an optical lattice and with spatiotemporal control of atomic interactions.