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Talk Title: Quantum Gases — Integrable Systems — Quantum Nonequilibrium

Abstract: In a typical attractive cold-bosonic medium, the ground state and the continuum excitation band are separated by a gap, which makes the surface fluctuations quantum-cold. These fluctuations usually cannot be used to create macroscopic quantum coherence. However, in one-dimensional Bose gases, nontrivial conservation laws governing such systems ensure that a four-fold quench of the coupling constant generates two macroscopic solitons whose relative motion is close to a Heisenberg-minimal uncertainty state. This macroscopic degree of freedom occupies an area of $\hbar$ in the phase space, and we wish to use this property to create quantum advantage in precision measurement. Our preliminary estimate show that the accuracy with which the angle phase of a phase-space rotation in a harmonic potential can be measured increases by a factor of N, if macroscopic quantum coherence of the inter-soliton motion is employed; here, N is the number of atoms in the solitons. The projects will be run in a tight collaboration with Randall Hulet's experimental group at Rice University.