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Talk Title: Spin drag and fast response in a quantum mixture of atomic gases

Abstract: By applying a sudden perturbation to one of the components of a mixture of two quantum fluids, we explore the effect on the motion of the second component on a short time scale. We show that the response is fixed by the energy weighted moment of the crossed dynamic structure factor (crossed f-sum rule). Special focus is given to the case of coherently coupled Bose-Einstein condensates, interacting Bose mixtures exhibiting the Andreev-Bashkin effect, normal Fermi liquids and the polaron problem. The relevant excitations of the system contributing to the spin drag effect are identified and the contribution of the low frequency gapless excitations to the f-sum rule in the density and spin channels is explicitly calculated employing the proper macroscopic dynamic theories. Both spatially periodic and Galilean boost perturbations are considered