DAMOP07-2007-020049

Abstract for an Invited Paper
for the DAMOP07 Meeting of
the American Physical Society

Two Weakly-Coupled Condensates

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The recent realization of a single weak link for an atomic Bose-Einstein condensate in an optical double-well potential allows for the first time observation of coherent Josephson oscillations directly on the level of populations on either side of the junction. Furthermore it opens up the way to fully characterize the tunneling dynamics since not only the dynamics of the population difference can be measured but even the time evolution of the relative phase is detectable. How the residual interaction of the atoms can lead to a new dynamical regime, which is characterized by an inhibition of tunneling, will be discussed in detail. The well controlled experimental setup of the atomic system allows for a quantitative study of thermally induced fluctuations of the relative phase between the weakly linked condensates. The experimentally observed fluctuations are in quantitative agreement with the theoretical predictions and give insight into the coherence of two weakly coupled condensates. Since the thermal fluctuations exist for any non-zero temperature their measurement can be employed as a new type of primary thermometer for atomic Bose-Einstein condensates working in a regime were standard methods such as time of flight fail. Our recent results on the heat capacity of a quantum gas at ultra low temperatures using this new noise-thermometer will be presented.