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Narrow Feshbach Dance of Two Trapped Atoms NICOLAS LOPEZ VALDEZ, University of California Riverside, EDDY TIMMERMANS, Los Alamos National Laboratory, SHAN-WEN TSAI, University of California Riverside — Near a narrow Feshbach resonance (with magnetic field width 10 mG or smaller) the ultra-cold atom interactions acquire an effective range that can be comparable to the average inter-particle distance. Although requiring a more accurate magnetic field control than their broad counterparts, the narrow Feshbach resonances can free cold atom physics from its straightjacket of the contact interaction paradigm. The finite-range effects can give rise to roton features in the phonon dispersion of dilute Bose-Einstein condensates (BEC's) and BEC's can support a ground state with modulated density patterns that breaks translational symmetry. We show that the finite range interaction is the consequence of the time-delay in atom-atom collisions. The narrow regime is also the parameter region in which the interacting atoms can spend a significant fraction of their time in the spin-rearranged (also called "closed") channel. To study the interaction physics we describe two atoms in a harmonic trap, interacting near a narrow resonance. We find the fraction of time that the atoms spend in the closed channel at fixed magnetic field and we study the time evolution of this system under conditions of a time-varying magnetic field.

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