Abstract Submitted
for the DAMOP08 Meeting of
The American Physical Society

Two-body transients in coupled atomic-molecular Bose-Einstein Condentates EITE TIESINGA, Joint Quantum Institute/NIST, PASCAL NAIDON, NIST, PAUL JULIENNE, Joint Quantum Institute/NIST — The conversion of atom pairs into molecules, using either Feshbach resonances or photoassociation can serve as a tool to probe the many-body properties of ultracold gases. In particular, photoassociation, the process of associating atoms with a resonant laser light, was recently used to observe pair correlation in a 1D Bose gas and in the BEC-BCS crossover. Conversely, it can be used to reach new collective regimes. Theories have suggested the coherent conversion of an atomic Bose-Einstein condensate into a condensate of molecules, the possibility of macroscopic superposition, and production of correlated atom pairs (or rogue dissociation) at high laser intensity. Several experiments have made the first steps in these directions. We discuss the dynamics of an atomic Bose-Einstein condensate when pairs of atoms are converted into molecules by photoassociation. Three regimes are found and it is shown that they can be understood on the basis of time-dependent two-body theory. In particular, the rogue dissociation regime, which has a density-dependent limit on the photoassociation rate, is identified with a transient in the two-atom dynamics exhibiting universal properties. We illustrate how these regimes can be explored by photoassociating condensates of alkaline-earth atoms.

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Date submitted: 22 Jan 2008 Electronic form version 1.4