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Adiabaticity in a Nonlinear Atom-Molecule Condensate System¹ H. LING, Department of Physics and Astronomy, Rowan University, Glassboro, New Jersey, 08028-1700, USA, H. PU, Department of Physics and Astronomy, and Rice Quantum Institute, Rice University, Houston, TX 77251-1892, USA., P. MAENNER, Department of Physics, Bryn Mawr College, Philadelphia, Pennsylvania 19010-2899, USA. — We consider the two-color Raman photo-association model, and study the adiabatic condition under which a free atomic condensate can be converted into a ground molecular condensate by the method of stimulated Raman adiabatic passage (STIRAP), founded on the nonlinear atom-molecule dark state. We attribute nonadiabaticity to the population growth in the collective excitations of the dark state, and derive an adiabatic theorem by comparing the rate change of the Hamiltonian to the level spacing in the Bogoliubov excitation spectrum of the dark state. We apply this theorem to study the powers and durations of the laser pulses that are required for an efficient STIRAP operation with different system parameters including two-body collision coefficients.

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