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Time-dependent quantum many-body theory of identical bosons in a double well[1] DAVID MASIELLO[2], Department of Chemistry, Northwestern University, WILLIAM REINHARDT, Department of Chemistry, University of Washington — We formulate a time-dependent multiconfigurational self-consistent field theory for identical bosons to explore the combined effects of the condensate's mean field and atomic correlation on the many-body dynamics of a double-well BEC from first principles. Our explicitly time-dependent approach includes the the underlying mean-field orbitals as well as all possible Fock-space amplitudes allowed within a certain model space as time evolving dynamical variables, and applies the time-dependent variational principle to derive well-defined equations of motion that include the full and self-consistent coupling between these variables. Due to its general formulation and rich mathematical structure, this treatment clarifies many of the principles and approximations that are found in other relevant approaches, and proves to be a powerful theoretical tool in the understanding of recent double-well BEC interference experiments performed at MIT and Heidelberg; a novel application to the interference patterns created by ballistic expansion of Schrödinger cat states, the analog of the double slit experiment for whole condensates, is presented.

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