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Dynamics of association in ultra-cold Fermi gases in spherically symmetric harmonic traps TAKAHIKO MIYAKAWA, PIERRE MEYSTRE, Optical Sciences Center, The University of Arizona — We consider the photoassociation of a low-density gas of quantum-degenerate trapped fermionic atoms into bosonic molecules in a spherically symmetric harmonic potential. For a dilute system and the photoassociation coupling energy small compared to the level separation of the trap, only those fermions in the single shell with Fermi energy are coupled to the bosonic molecular field. Introducing a collective pseudo-spin operator formalism we show that this system can then be mapped onto the Tavis-Cummings Hamiltonian of quantum optics, with an additional pairing interaction. We first show that the filling factor - fraction of total number of pairs to the degeneracy in the Fermi level - has strong impact on coherent dynamics of the Bose-Fermi system. In a semiclassical description of the system, the pairing interaction between fermions is shown to result in a self-trapping transition in the photoassociation, with a sudden suppression of the coherent oscillations between atoms and molecules. We also show that the full quantum dynamics of the system is dominated by quantum fluctuations in the vicinity of the self-trapping solution.

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