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Coherent and adiabatic photoassociation in a Bose-Einstein condensate PASCAL NAIDON, EITE TIESINGA, National Institute of Standards and Technology, FRANCOISE MASNOU-SEEUWS, Laboratoire Aimé Cotton, PAUL JULIENNE, National Institute of Standards and Technology — Photoassociation is a process by which two colliding atoms associate into an excited bound state by absorbing a resonant photon. This excited state subsequently decays by spontaneous emission. The atom loss rate in a gas photoassociated by a laser can be calculated from the two-body theory. It is linear with the laser intensity for small intensities, then saturates and decreases at higher intensities, in accordance with the two-body unitary limit. Many-body models have predicted that the rate of photoassociation in a Bose-Einstein condensate may saturate before the unitary limit. However this rate limit has not been observed. We revisit the many-body theory of photoassociation in a condensate and explain why the rate limit has not been seen. In particular we identify two different regimes, the coherent and the adiabatic regimes. All photoassociation experiments up to now have been performed in the adiabatic regime, for which the limitation on the rate occurs at larger intensities than initially predicted by many-body models. We also find that this limitation on the rate is essentially a two-body effect rather than a many-body effect. Finally we investigate the possibility to explore the coherent regime using Bose-Einstein condensate of alkaline-earth metals.

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