IS IT POSSIBLE TO CREATE GROUND STATE Sr_2 MOLECULES WITH OPTICAL FESHBACH RESONANCES?

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Ultracold alkaline earth metal atoms are attracting interest as candidates for the next generation optical frequency clocks. But they offer many more exciting perspectives. For example, the extremely narrow linewidth of their intercombination lines implies optical Feshbach resonances involving very small losses[1] and thus hold the promise of easy optical control. These optical Feshbach resonances may be used to change the atomic ground state scattering length or to associate molecules from atoms.

The prospects for forming ground state strontium dimers by optical transitions near an intercombination line are investigated. First, the concept of ramping the intensity and possibly frequency of a cw laser over an optical Feshbach resonance[2] is studied. The involved excited states show a crossover from dipole-dipole to van der Waals interaction which determines the sign of the light shift and thus whether molecules are associated or dissociated. Second, the concept of a two-colour pump-dump process with short laser pulses [3] is applied to the formation of ground state Sr_2 molecules.

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[3]C. P. Koch, E. Luc-Koenig, and F. Masnou-Seeuws. *Phys. Rev. A* 73**,** 033408 (2006), and C. P. Koch, R. Kosloff, and F. Masnou-Seeuws. *Phys. Rev. A* 73, 043409 (2006)