STIMULATED RAMAN MOLECULE FORMATION IN COLD ALKALI GASES.

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Photoassociation is a process by which two cold, trapped atoms can be optically excited during a collision to make a vibrational level of an excited electronic state of a molecular dimer. High-resolution photoassociation spectra are now well-known for most alkali dimers. The upper level normally decays by spontaneous emission to a number of final molecular levels, bound and unbound. A laser of a second color can be used to stimulate a transition from the upper level to a particular ground state vibrational level. Such a Raman photoassociation process can be used to form translationally cold molecules in a cold atomic gas or a Bose-Einstein condensate. Coupled channels scattering calculations show that the collisional rate coefficient for coherent production of molecules in specific target states, $> 10^{-10}$ cm^3/s, can greatly exceed the rate coefficient for forming products due to excited state spontaneous decay. This implies the feasibility of rapid coherent conversion of atom pairs in a condensate to molecules on a time scale short compared to the trap oscillation time. The untrapped molecules can form a coherent molecular beam. We will examine the prospects for the experimental realization of photoassociative molecule formation in cold alkali gases or condensates.