Non-resonant light control of ultracold collisions

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Non-resonant light universally couples to any polarizable object, independent of the particular energy level structure, frequency of the light (as long as it is non-resonant), or presence of a permanent dipole moment. For molecules, this coupling shifts rotational and vibrational levels, induces molecular alignment, and alters, in conjunction with spin-orbit interaction, the spin character of wavefunctions. It also modifies intermolecular interactions and can thus be used to control atomic and molecular collisions.

I will show that non-resonant light control becomes particularly useful at low temperature when the scattering is dominated by tunneling and resonances. In particular, it can be employed to shift the position of shape resonances, induce Feshbach resonances and engineer them in their position and width. Non-resonant light control thus facilitates photo- and magneto-association of molecules that would otherwise be very hard to produce.