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Optically tunable Feshbach resonances for control of ultracold alkaline earth atomic gases ROMAN CIURYLO, University of Torun, Poland, EITE TIESINGA, NIST, PAUL JULIENNE, NIST — Optical Feshbach resonances due to photoassociation of two colliding ground state atoms using laser frequencies to the red of the atomic intercombination line may provide a way to control the scattering length of ultracold alkaline earth atomic collisions, such as Ca or Sr, and the related species Yb. Since the line width of the intercombination line is very small due to the long lifetime of the excited state, it is possible to use large detuning from the photoassociation resonance to control loss processes due to excited state decay. The small linewidth also allows the detuning from atomic resonance to be small enough while molecular Franck-Condon factors are large enough to allow significant changes in scattering length. Our model calculations for cold Ca collisions use standard expressions from photoassociation theory to calculate the real and imaginary parts of the scattering length and develop criteria for changing the scattering length without excessive losses. Unlike alkali atom systems where rapid loss processes accompany optical Feshbach control of the scattering length, losses can remain acceptably small for the Group II atoms, while retaining the ability to change the magnitude and sign of the scattering length.

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