Probing Autler–Townes spectra of strongly coupled lithium $2S_{1/2}$ and $2P_{1/2}$ levels by Rydberg excitation

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Strong long-range interaction between Rydberg atoms modifies the properties and behavior of a dense ensemble of Rydberg atoms. Nonlinear optical effects such as Autler–Townes (AT) splitting [1] and electromagnetically induced transparency (EIT) have been studied in strongly interacting cold and hot atomic samples. In [2, 3], the ground level and the first excited level of cesium are coupled by a strong field and are probed via excitation into a Rydberg level. Interaction between Rydberg atoms leads to sufficient broadening of AT spectra.

In the present work, the effects of the strong long-range interaction of Rydberg atoms on the AT splitting spectrum are investigated. Lithium D1 line transitions are strongly coupled and they are probed by excitation into $70S$ Rydberg states. Interactions between Rydberg atoms excited by the probe beam lead to broadening of the AT spectra. At high concentrations of Rydberg atoms, significant suppression of the excitation of the AT peak at red detuning is observed.

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