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Optical control and spectroscopic studies of collisional population transfer in molecular electronic states ERGIN AHMED, XINHUA PAN, Temple University, JOHN HUENNEKENS, Lehigh University, MARJATTA LYYRA, Temple University — Understanding the basic physics of collision processes between atoms and molecules is of fundamental importance for large number of areas of research including chemical reactivity, ultra cold atoms and molecules, and astrophysics of the interstellar medium. We have experimentally demonstrated [1] optical control of the singlet/triplet probability distribution in the outcome of collisions involving lithium dimer molecules and argon atoms. The control is achieved using the Autler-Townes (AT) effect to manipulate the spin character of a spin-orbit coupled pair of levels serving as a "gateway" between the singlet and triplet electronic state manifolds. As a result we show that the rate coefficient of a collisional process between excited molecules ($^7Li_2$) and atoms (Ar) leading to internal quantum state changes in the molecules can be effectively manipulated with a laser. In addition, as an extension of these results new gateway levels can be created from singlet and triplet levels that hardly interact to begin with.

[1] E. H. Ahmed et al., *Physical Review A* **89**, 061401(R) (2014).

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