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Quantum Control of the Spin-Orbit Interaction Using the Autler-Townes Effect ERGIN AHMED, SONIA INGRAM, TEODORA KIROVA, OMER SALIHOGLU, Temple University, JOHN HUENNEKENS, Lehigh University, JIANBING QI, Penn State University, Berks Campus, YAFEI QUAN, MARJATTA LYYRA, Temple University — The interaction between the spin and the orbital angular momenta (spin-orbit interaction) of the electron in an atom or a molecule often can be neglected or treated as a perturbation. However, when relativistic effects are not negligible, the spin-orbit interaction must be taken into account. It can cause mixing of electronic states of different spin multiplicity, with the degree of mixing dependent on the strength of the spin-orbit interaction as well as the energy separation between the interacting states. It is also well known that, in the presence of strong electromagnetic fields, the energy levels in atoms or molecules experience shifts in their positions due to the Autler-Townes (AT) effect. Thus control of the spin-orbit interaction can be realized by using resonant or nonresonant laser fields as an external control mechanism. We have demonstrated [1] experimentally such control of the spin-orbit interaction using resonant cw optical field. We show that the enhancement of the spin-orbit interaction between a pair of weakly interacting singlet-triplet rovibrational levels, $1^3\Sigma_g^-$(v=1, N =21, f) − $G^1\Pi_g$(v=12, J =21, f), depends on the Rabi frequency (laser power) of the control laser. The increase in the spin-orbit interaction due to the control field is observed as a change in the spin character of the individual components of the perturbed pair.
[1] E. H. Ahmed, S. Ingram, T. V. Kirova, O. Salihoglu, J. Huennekens, and A. M. Lyyra, PRL, **107**, 163601 (2011).

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