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Influence of Rashba effect on carrier kinetics in hybrid perovskites

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Owing to their large spin-orbit coupling [1], the lead halide hybrid perovskites are of interest for applications in semiconductor spintronics and spin-optoelectronics. While the photophysical properties of these materials have been studied extensively in recent years due to their potential for solution-processed, high-efficiency photovoltaic applications [2], much less is known about their spin-related properties [3-6]. Our studies of the spin-dependent carrier kinetics in butylammonium methylammonium lead iodide perovskite [7] indicate dominant precessional spin relaxation tied to the Rashba effect. Our recent measurements of the coherent carrier kinetics in 3D CH₃NH₃PbI₃also suggest a role played by the Rashba splitting on the rate of interband dephasing. These findings point to the need for further studies of the influence of the strong spin-orbit coupling on the charge and spin dynamics in this family of materials.

[1] M. Kepenekian and J. Even, J. Phys. Chem. Lett. 8, 3362 (2017).
[2] https://www.nrel.gov/pv/assets/images/efficiency_chart.jpg.
[3] D. Giovanni et al. Nano Lett. 15, 1553 (2015).
[4] C. Zhang et al. Nat. Phys. 11, 427 (2015).
[5] P. Odenthal et al. Nat. Phys. 13, 894 (2017).
[6] D. Niesner et al. Phys. Rev. Lett. 117, 126401 (2016).
[7] S. B. Todd et al. arXiv:1807.10803 (2018).

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