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Optical Generation of Ballistic and Diffusive Spin Currents in Organic-Inorganic Lead Halide Perovskites JUNWEN LI, PAUL HANEY, National Institute of Standards and Technology — Organic-inorganic halide perovskite solar cells have attracted enormous attention in recent years due to their remarkable photovoltaic power conversion efficiency. These materials should exhibit interesting spin-dependent properties as well, owing to the strong spin-orbit coupling and the broken inversion symmetry present at room temperature. In this work, we consider the spin-dependent optical response of $\text{CH}_3\text{NH}_3\text{PbI}_3$ on two distinct time scales. We first use density functional theory to compute the ballistic spin current injected by absorption of linearly polarized light. This spin current persists on a time scale of the momentum relaxation time. We then consider diffusive transport of photogenerated charge and spin for a thin perovskite layer with a passivated surface and an Ohmic, non-selective back contact. The spin densities and spin currents are evaluated by solving the drift-diffusion equations for a 3-dimensional Rashba model. We comment on the applications of optically excited spin densities and spin currents in these materials.

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