TSF16-2016-000029

Abstract for an Invited Paper
for the TSF16 Meeting of
the American Physical Society

Exciton spin dynamics in hybrid organic-inorganic perovskites

YAN (SARAH) LI, University of Utah

The hybrid organic-inorganic perovskites have emerged as a new class of semiconductors which make excellent solar cells with an efficiency over 20%. They are also highly promising semiconductors for the field of spintronics due to their large and tunable spin-orbit coupling, spin dependent optical selection rules, and predicted electrically tunable Rashba spin splitting. I will present our latest study of exciton spin dynamics on the solution processed polycrystalline methylammonium lead iodide films. With time-resolved Faraday rotation (TRFR) and optical Hanle measurements, we demonstrate the optical orientation and quantum beating of excitons in the perovskites, which confirms the spin-dependent optical transitions. The energy dependence of the Faraday rotation follows the exciton absorption band at low temperatures, confirming its excitonic origin. The TRFR in zero field reveals unexpected long spin lifetimes exceeding 1 ns at 4 K, given that Pb and I exhibit large spin-orbit coupling, and usually lead to fast spin relaxation. Application of a transverse magnetic field causes quantum beating at two distinct frequencies, and the approximate linear relationships give two g-factors, which we assign to electrons and holes as $g_e = 2.63$, and $g_h = -0.33$. These results provide a basic picture of the exciton states in the hybrid perovskites, and suggests their great potential in spintronic applications.