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Driving the persistent spin helix and electron-hole density waves with an electric field in n-GaAs quantum wells LU-YI YANG, JAKE KORALEK, J. ORENSTEIN, Lawrence Berkeley National Laboratory and University of California Berkeley, D. TIBBETTS, J. RENO, M. LILLY, Center for Integrated Nanotechnologies, Sandia National Laboratory, S. MACK, D.D. AWSCHALOM, Center for Spintronics and Quantum Computation, University of California Santa Barbara — We use transient spin grating spectroscopy to study the persistent spin helix (PSH) state of a 2D electron gas in the presence of an in-plane electric field parallel to the wavevector of the spin helix. By directly measuring its phase, we can measure the PSH displacement with 10 nm spatial and sub-picosecond time resolution. We demonstrate that the phase velocity of the PSH crosses zero at a nonzero wavevector. The data indicate that spin Coulomb drag may play a role in the spin wave drifting process. We also study the displacement of electron-hole density waves (EHDW's) as a function of electric field. Although charge neutral, the EHDW is found to drift, but with with a velocity that is much smaller than that of the surrounding electrons. We speculate that the drift is caused by a Coulomb drag interaction between the Fermi sea and the EHDW.

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