HL 10 Invited Talk Santos

Time: Tuesday 09:30–10:15 Room: HSZ 01

Invited Talk HL 10.1 Tue 09:30 HSZ 01

Coherent spin transport by acoustic fields in GaAs quantum wells — •Paulo Santos, James Stotz, Odilon Couto, Fernando Iikawa, Rudolph Hey, and Klaus Ploog — Paul-Drude-Institut, Berlin

Spintronic applications require processes for the storage, manipulation, and coherent transport of spins. Here, we show that these tasks can be realized in undoped GaAs quantum wells (QWs) by mobile potential dots (dynamic quantum dots, DQDs) induced by surface acoustic waves (SAWs). The type-II piezoelectric potential induces spatially separated negative and positive DQDs, which store and transport photogenerated electrons and holes. The spatial separation prevents recombination and quenches excitonic spin relaxation mechanisms. Measurements of the spin transport length ℓ_s on QWs grown along different orientations demonstrate that ℓ_s is limited by the Dyakonov-Perel mechanism. Here, the carriers experience an effective magnetic field B_{int} associated with spin-orbit coupling, which leads to spin precession angles that depend on the individual carrier trajectory and velocity. Variations in B_{int} can be minimized by confining all spins within a small DQD during transport. In fact, we demonstrate ℓ_s approaching 100 μm when the DQD dimensions are reduced below 1 μm. The spins precess coherently around B_{int} during transport. The spin precession frequency can be controlled by an external magnetic field, thus opening the way for the realization of spin control gates based on SAWs.(Work supported by the NanoQuit/BMBF, Germany.)