Spin-electronics

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Spin transport in solid-state environment differs dramatically from textbook discussions of electronic charge flows, fostering the idea of "Spin-electronics." The quantum nature of spin and the robust geometric Berry-phase effects due to its interaction with the crystalline surroundings open venues for coherent manipulation of individual spins and collective spin flows with no or little dissipation. By reciprocity, spin flows can be utilized to excite magnetic and mechanical dynamics in tiny solid-state devices, up to nonlinear turbulent behavior. I will review the recent progress in the field, focusing on spin transport and magnetic dynamics in textured ferromagnets and spin-orbit-coupled systems. The specific topics will include spin-transfer torque and pumping effects in magnetic systems and spin Hall physics in two-dimensional semiconductor heterostructures.