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Device Applications of Spin-Orbit Interaction in Semiconductor Heterostructures[1] DAVID Z.-Y. TING, Jet Propulsion Laboratory, California Institute of Technology, XAVIER CARTOIXÀ[2], Dept. of Physics, U. Illinois at Urbana-Champaign, YIA-CHUNG CHANG, Dept. of Physics, U. Illinois at Urbana-Champaign — We report recent progress in theoretical development of two classes of non-magnetic semiconductor heterostructure spin devices that exploit spin-orbit interaction in the presence of structural inversion asymmetry (SIA) or bulk inversion asymmetry (BIA). The first uses resonant tunneling to filter spins, and can be used to create a source of spin polarized current. We will provide an analysis on the origin of spin-dependent tunneling in these structures and discuss their applications. The second exploits the interplay between BIA and SIA to control spin lifetimes for device applications. We show that the D'yakonov-Perel' spin relaxation can be suppressed to first order in k for one out three spin components in [001] and [011] heterostructures, and for all three spin components in [111] heterostructures. Our results suggest the use of [111] heterostructures as preferred channels for spin transport, as active regions in spin-LEDs, for spin lifetime transistor, and for spin storage.

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