Spins in Low-dimensional Materials Systems: Transport, Gate-control and Conversion

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Transport, control and conversion of spins in condensed matters have been pivotal concepts in spintronics. Spin transport is the most fundamental concept to realize spin-dependent phenomena, spin control mainly by gating enables information switching using a spin degree of freedom, and spin conversion allows detection of spins, a dissipative physical quantity. Whilst bulk metallic and semiconducting systems have been to date major material stages to realize the aforementioned concepts, low-dimensional materials systems such as atomically-flat two-dimensional materials [1-3], two-dimensional electron gases formed at an interface of a heterostructure [4,5], topologically-protected Dirac surface states in topological insulators [6,7] and ultrathin films [8] are becoming attractive materials stages to pursue novel spintronic concepts and phenomena. I will introduce the attractiveness of these new materials systems, cover an overview of the central achievements, and focus on recent investigation to pioneer novel spintronic physics in the low-dimensional materials systems.

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