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Unusual hole Rashba spin splitting in one-dimensional semiconductor nanowires[1] JUN-WEI LUO, SHU-SHEN LI, Institute of Semiconductors, Chinese Academy of Sciences, ALEX ZUNGER, University of Colorado, Boulder — By means of atomistic pseudopotential calculations we explore the evolution of the hole Rashba effect in semiconductor nanowires across the wide range of external electric fields and nanowire sizes. We uncover an abrupt transition from the steep rise, with a slope 300 times larger than the electron counterpart, to the saturation in the hole Rashba effect (α_R) as increasing the electric field in nanowires. We reveal that the origin underlying the transition arises from the competition between quantum confinement and quantum confine stark effects on the energy separation between hole subbands. The abrupt transition to saturation gives rise to otherwise giant hole Rashba effect a moderate field-independent α_R for a nanowire once the electric field exceeding the transition point. In particularly, the saturated hole α_R in Si nanowires, which is about 100 meVÅ and even stronger than InAs electron Rashba effect, is almost independent on nanowire size, making Si nanowires compelling for the realization of scalable integration of Si CMOS compatible spintronic devices.

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