α-GeTe and (GeMn)Te Semiconductors: a New Paradigm for Spintronics

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Abstract: GeTe is the simplest known binary ferroelectric semiconductor with a narrow band gap. Below 700 K it assumes a non-centrosymmetric rhombohedral structure in which an electric dipole is formed due to a relative Ge/Te sublattice displacement along the [111] direction. Ferroelectric polarization results from asymmetric positions of Ge and Te atoms along that direction and ensures that the system possess a well-defined axis for symmetry breaking. Resulting in a giant Rashba-type spin splitting of the bulk band structure. We report on first-principle calculations which indicate that the large lattice distortion responsible for the ferroelectric order is also the most significant ingredient for the giant Rashba-type spin-splitting. We review the experimental verification of this giant Rashba-type splitting and show the main results proving that (GeMn)Te is a new paradigm multiferroic semiconductor with magnetoelectic properties, offering broad opportunities for spintronics materials design.