Interplay between Ferroelectricity and Rashba effects

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Abstract

The discovery of novel properties, effects or microscopic mechanisms in modern materials science is often driven by the quest for the coexistence and/or coupling of several functional properties into a single compound. Within this framework, by exploiting the interplay between spin and dipolar degrees of freedom via spin-orbit coupling in ferroelectric semiconductors, I will focus on the tight link between k-dependent spin-splitting in the electronic structure, spin-texture and electric polarization. Based on density functional simulations, I will show our theoretical predictions of a giant Rashba spin-splitting in "bulk" GeTe[1], prototype of novel multifunctional materials - labeled as Ferro-Electric Rashba Semi-Conductors (FERSC)[2] - where the chirality of the spin texture is one-to-one linked to polarization. As the latter can be induced/controlled/switched via an electric field in a non-volatile way, the integration of semiconductor spintronics with ferroelectricity is envisaged. In the second part of the talk, the connection between ferroelectricity and spin-degrees of freedom will be discussed by providing examples from different materials classes (oxides heterostructures,[3] halides perovskites,[4] chalcogenides, etc), all of them showing strong relativistic effects.

References

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