Highlights

Innovative materials with strong interplay of spin orbital charge and topological degrees of freedom - 2018

Ferroelectric Control of the Spin Texture in GeTe

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The electric and nonvolatile control of the spin texture in semiconductors would represent a fundamental step toward novel electronic devices combining memory and computing functionalities. Recently, GeTe has been theoretically proposed as the father compound of a new class of materials, namely ferroelectric Rashba semiconductors. They display bulk bands with giant Rashba-like splitting due to the inversion symmetry breaking arising from the ferroelectric polarization, thus allowing for the ferroelectric control of the spin. Here, we provide the experimental demonstration of the correlation between ferroelectricity and spin texture. A surface engineering strategy is used to set two opposite predefined uniform ferroelectric polarizations, inward and outward, as monitored by piezoresponse force microscopy. Spin and angular resolved photoemission experiments show that these GeTe(111) surfaces display opposite sense of circulation of spin in bulk Rashba bands. Furthermore, we demonstrate the crafting of nonvolatile ferroelectric patterns in GeTe films at the nanoscale by using the conductive tip of an atomic force microscope. Based on the intimate link between ferroelectric polarization and spin in GeTe, ferroelectric patterning paves the way to the investigation of devices with engineered spin configurations.

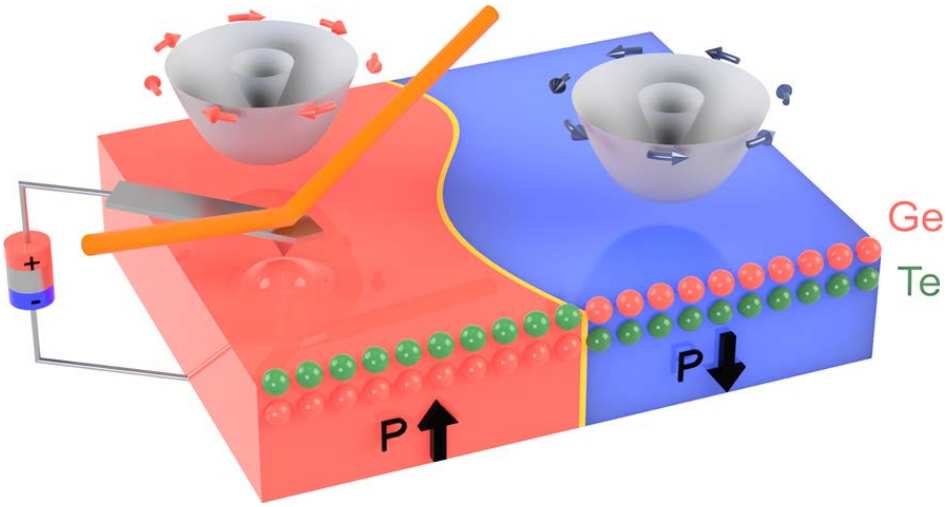

Fig. 1: Switching of GeTe spin texture of Rashba-type for two different orientations of the ferroelectric polarization. On the left (right) region, the polarization is pointing out of (towards) the surface (see vertical black thick arrow denoting P) and the spin expectation values at a specific constant energy map, denoted as red (blue) arrows, circulate clock-wise (counterclockwise).