

Charge-to-spin conversion and spin lifetime in crystals with reduced symmetry

Materials with low crystal symmetry enable a broader range of physical phenomena, including unusual spin textures, unconventional charge-to-spin conversion, or extended spin lifetimes. Chiral crystals, in particular, stand out due to their unique properties and behavior, making them excellent candidates for both fundamental and applied spintronics research. In this talk, I will discuss chirality-dependent charge-to-spin conversion in a variety of systems, focusing on chiral tellurium. In this material, electric currents induce spin and orbital accumulation either parallel or anti-parallel to the current direction, resembling the chirality-induced spin selectivity effect known from molecular systems. The charge-to-spin conversion efficiency in chiral tellurium reaches 50%, and the generated spin accumulation is carried by slow relaxons leading to an enhanced spin lifetime. Generally, slow relaxons, associated with the parallel spin-momentum locking typical of chiral crystals, can lead to extended spin relaxation times, offering a promising perspective for long-distance spin signal transport.

References

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