Chirality, spin and orbital in DNA-type chiral materials

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In chemistry and biochemistry, chirality represents the structural asymmetry characterized by non-superimposable mirror images for a material like DNA. In physics, however, chirality commonly refers to the spin-momentum locking of a particle or quasiparticle in the momentum space. While seemingly unrelated characters in different fields, the structural chirality leads to the electronic chirality featured by the orbital-momentum locking encoded in the wavefunction of chiral molecules or solids, i.e. the chirality information transfers from the atomic geometry to the electronic orbital. The electronic chirality provides deep insights into the chirality-induced spin selectivity (CISS), in which electrons exhibit salient spin polarization after going through a chiral material. I will introduce the most recent experimental progress and understanding on chirality-driven spintronics, optoelectronics, and their implications in biochemistry.

References:

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