Theory of Magnetic Circular Dichroism in Resonant Photoemission of Altermagnets

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Altermagnetism is a special case of antiferromagnetism which is believed to have great potential for spintronics technology. In an altermagnet, there are two magnetic sublattices (A,B) which have opposite spin moments. The sublattices are equivalent under some rotation operation, rather than under a lattice translation as in a conventional antiferromagnet. As a consequence, time-reversal symmetry is broken in an altermagnet, which leads to properties that altermagnism shares with ferromagnetism, in particular the existence of spin-polarized bands. While many materials have been predicted to have an altermagnetic phase by theoretical calculations, the experimental evidence is scarce and only a few materials have been unambiguously been proven to be altermagnets. In this context, it is important to devise new experimental methods for detecting altermagnetism. I propose a new type of experiment, namely circular dichroism (CD) in angle resolved, resonant photoelectron (or Auger electron) emission spectroscopy (RPES or RAES) [1]. I have developed a theory for this new experiment, which shows that the angular distribution of RPES has a strong magnetic CD signal. The angular intensity variation is the same as that of the difference in photoelectron diffraction of sublattices A and B, while the amplitude is directly proportional to the XMCD of one sublattice [1]. I shall present numerical results on MnTe and discuss the relation of the present technique with XMCD of altermagnets [2].

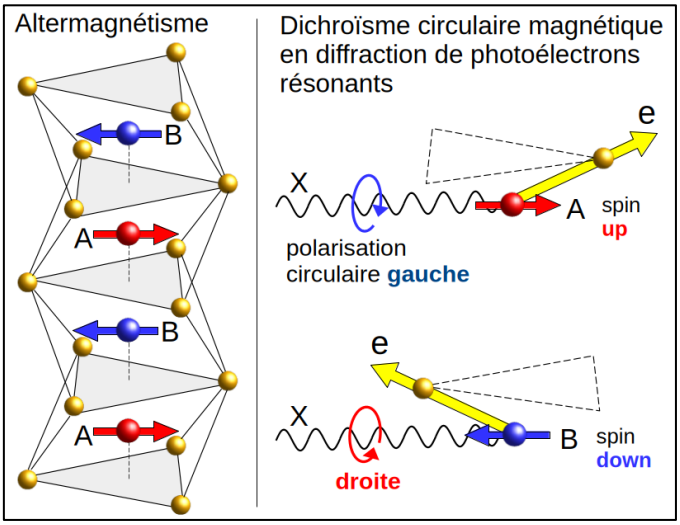

Figure. Left: Spin structure of altermagnetic MnTe (Te in yellow) Right: principle of magnetic CD in angle-resolved, resonant photoemission.

References

[1] P. Krüger, Phys. Rev. Lett. **135**, 196703 (2025).

[2] A. Hariki et al, Phy s. Rev. Lett. **132**, 176701 (2024).