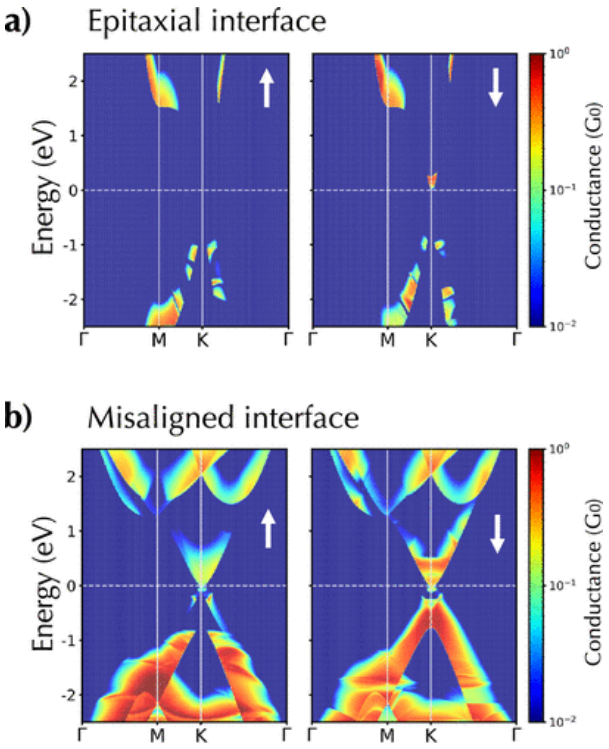
Spin-filtering in 2D based magnetic tunnel junctions

Simon M.-M. Dubois[1]
V. Zatko[2], M. Galbiati[2], M.-B. Martin[2], B. Dlubak[2], P. Seneor[2], J.-C. Charlier[1]
[1] Institute of Condensed Matter and Nanosciences (IMCN), Université Catholique de Louvain (UCLouvain), B-1348 Louvain-la-Neuve, Belgium
[2] Unité Mixte de Physique, CNRS, Thales, Université Paris-Saclay, 91767 Palaiseau, France
simon.dubois@uclouvain.be

In this talk we first discuss an emerging physical picture of spin-filtering in multilayered graphene-ferromagnet systems supported by *ab initio* calculations and we compare it with experimental data. This picture involves spin filtering effects of arising from (i) graphene-FM hybridization, (ii) graphene k-point selection at the interface and (iii) "graphite" bulk band structure purification. These effects are shown to be either cooperating or competing. These results on graphene-FM systems are then compared predictions regarding other 2D based magnetic tunnel junctions (MTJs). Overall this study unveils paths to better harness the potential of 2D based MTJs.

References

[1] V. Zatko, et al., *Almost Perfect Spin Filtering in Graphene-Based Magnetic Tunnel Junctions*, ACS Nano, 16 (2022) 14007-14016.
[2] M. Piquemal-Banci, et al., *Spin filtering by proximity effects at hybridized interfaces in spin-valves with 2D graphene barriers,* Nature Communications 11, (2020) 5670.
[3] V. Zatko, et al., *Band-Structure Spin-Filtering in Vertical Spin Valves Based on Chemical Vapor Deposited WS2*, ACS nano 13 (2019), 14468-14476.



Electronic transmission across (a) the epitaxial and (b) the misaligned Ni/MLGr interfaces. Transmission coefficients are depicted in units of the quantum of conductance (G_0) along the conventional high symmetry k-path in the plane parallel to the interface. Left and right panels correspond respectively to majority and minority spin carriers. It is observed that the epitaxial case provides a highly asymmetrical spin-dependent transport channel, while a more balanced (but hence less spin polarized) spin transport is achieved in the misaligned case.