A magnetic phase-transition graphene transistor with tunable spin polarization

I. Hagymási,[1] P. Vancsó,[2] and L. Tapasztó[2]

[1] *Institute for Solid State Physics and Optics, MTA-WRCP, P.O. Box 49, H-1525 Budapest, Hungary*

[2] *Institute of Technical Physics and Materials Science, Centre for Energy Research, P.O. Box 49, H-1525 Budapest, Hungary*

Graphene nanoribbons with zigzag edge orientation (zGNRs) have an interaction induced gap and a magnetic insulating ground state with antiferromagnetic (AF) spin orientation between the two edges. We found that doping can alter the AF coupling to ferromagnetic (FM) between opposite edges. AF zGNRs display semiconducting, while FM ones exhibit metallic behavior in excellent agreement with our experimental findings [1]. This result can be exploited for a novel magnetically mediated switching mechanism in GNR based field-effect transistors. Instead of tuning the Fermi level in and out of a static bandgap, here the applied gate voltage can dynamically open and close an interaction gap, with only a minor shift of the Fermi level. The interplay of the band structure and edge spin configuration in zGNRs enables such transistors to carry spin polarized current without employing an external magnetic field [2].

References:

[1] G. Zs. Magda, X. Jin, I. Hagymási, *et al.*, Nature **514**, 608-611 (2014).

[2] P. Vancsó, I. Hagymási and L. Tapasztó, 2D Materials **4**, 024008 (2017).