GRAPHENE EDGE MAGNETISM FOR SPINTRONICS APPLICATIONS: DREAM OR REALITY?

Jens Kunstmann[1], Cem Özdo?an[2], Alexander Quandt[3,4], Holger Fehske[3], Hâldun Sevinçli[1], Gianaurelio Cuniberti[1]

[1]Institute for Materials Science, TU Dresden, 01062 Dresden, Germany
[2]Department of Materials Science and Engineering, Cankaya University, Ankara, Turkey
[3]Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, Germany
[4]School of Physics and DST/NRF Centre of Excellence In Strong Materials, University of the Witwatersrand, South Africa
jens.kunstmann@tu-dresden.de

We critically discuss the stability of edge states and edge magnetism in zigzag edge graphene nanoribbons (ZGNRs). We point out that magnetic edge states might not exist in real systems, and show that there are at least three very natural mechanisms - edge reconstruction, edge passivation, and edge closure - which dramatically reduce the effect of edge states in ZGNRs or even totally eliminate them. Even if systems with magnetic edge states could be made, the intrinsic magnetism would not be stable at room temperature. Charge doping and the presence of edge defects further destabilize the intrinsic magnetism of such systems. We conclude that edge magnetism within graphenes ZGNRs is much too weak to be of practical significance, in particular for spintronics applications. We further discuss the influence of nonmagnetic edges on the electron transport through ZGNRs.

References:

[1] J. Kunstmann, C. Özdo?an , A. Quandt, H. Fehske, arXiv:1007.2602 (2010).