MAR14-2014-020777

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Graphene Spintronics: The Current State of the Art

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Graphene has great potential for spintronics and new spintronics applications. Room temperature spin relaxation lengths of 10 micrometer or more have already been achieved, allowing electron spins to be transported (and manipulated) over large distances. However, the basic spin relaxation mechanisms which control spin transport in graphene are still not understood. In this talk I will give an overview of the experimental state of the art, and discuss the role of the various spin relaxation mechanisms in graphene. I will compare results obtained from different graphene systems, ranging from suspended graphene [1], graphene sandwiched between boron nitride layers [2], and epitaxial graphene [3]. I will discuss recent experiments where the spin relaxation is studied in devices with both top and bottom gate devices, which allow the carrier density as well as the electric field to be controlled independently[4]. Finally, I will address the intriguing observation that localized states present in the buffer layer of epitaxial graphene can dramatically change the spin transport parameters [5]. The possible relation with recently observed room temperature ferromagnetism in these systems may make it possible to make "all-graphene" spintronics devices.

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[2] P.J. Zomer et al., Phys. Rev. B86, 161416 (2012)
[3] T. Maassen et al., Nano Lett. 12 (3), 1498 (2012)
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