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Spin-polarized semiconductor induced by magnetic impurities in graphene[1]

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Magnetic impurities adsorbed on graphene sheets are coupled antiferromangetically via the itinerant electrons in the graphene. We study this interaction and its impact on the electrons' spectral density by use of unbiased Monte-Carlo simulations. The antiferromagnetic order breaks the symmetry between the sublattices, and a gap for the itinerant electrons opens. Our simulations show that the itinerant states below and above the gap are not dispersionless states trapped by the impurities, but are instead mobile states with a large dispersion. We compare various scenarios for the impurity distribution and find that random doping produces a standard semiconductor. If, on the other hand, all or most of the impurities are localized in the same sublattice, the spin degeneracy is lifted and the conduction band becomes spin-polarized. We also discuss the properties of edge states at edges or magnetic domain boundaries.

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