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Magnetic Moment Formation in Graphene Detected by Scattering of Pure Spin Currents ADRIAN SWARTZ, KATHY MCCREARY, JEN-RU CHEN, WEI HAN, University of California, Riverside, JAROSLAV FABIAN, University of Regensburg, ROLAND KAWAKAMI, University of California, Riverside

— Graphene's 2D nature and high surface sensitivity have led to fascinating predictions for induced spin-based phenomena through careful control of adsorbates, including the extrinsic spin Hall effect, band gap opening, and induced magnetism. By taking advantage of atomic scale control provided by MBE, we have investigated deposition of adsorbates and their interactions with graphene. Spin transport measurements performed in-situ during systematic introduction of atomic hydrogen demonstrated that hydrogen adsorbed on graphene forms magnetic moments that couple via exchange to the injected spin current. The observed behavior is quantitatively explained utilizing a phenomenological theory for scattering of pure spin currents by localized magnetic moments. Lattice vacancies show similar behavior, indicating that the moments originate from so called pz-orbital defects. On the other hand, experiments with charge impurity scatterers such as Mg and Au, are noticeably absent of features related to magnetic moment formation. Furthermore, we observe gate dependent effective exchange fields due to the spin-spin coupling between conduction electrons and magnetic moments, which are of interest for novel phenomena and spintronic functionality but have not been seen previously in graphene.

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