

# Theory of Condensed Matter: Hard Condensed Matter

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## **Spin Transport Phenomena in Graphene with Adatoms**

Graphene has proven to be a perfect platform for electronic applications (long mean free paths and electrons moving as massless Dirac fermions). However, its potential use in the field of spintronics has been under debate during the last five years. The spin-orbit coupling induced by substrates and specific adatoms can reduce the spin relaxation time to the order of picoseconds making it useless for most spintronic applications.

In this talk, I will give a brief overview of spin dynamics in two different cases, gold-decorated and magnetic hydrogenated graphene. In the last part, the possibility to induce a spin Hall type effect by Thallium/Indium adatom segregation in graphene ribbons will be also discussed.

Pseudospin-driven spin relaxation mechanism in graphene. D. Van Tuan, F. Ortmann, D. Soriano, S. O. Valenzuela and S. Roche. *Nature Physics* 10, 857-863 (2014)

Multiple quantum phases in graphene with enhance spin-orbit coupling: from quantum spin Hall regime to spin Hall effect and robust metallic state. A. Cresti, D. Van Tuan, D. Soriano, A. W. Cummings and S. Roche. *Phys. Rev. Lett.* 113, 246603 (2014) Spin transport in hydrogenated graphene. D. Soriano, D. Van Tuan, S. M.-M. Dubois, M. Gmitra, A. W. Cummings, D. Kochan, F. Ortmann, J.-Ch. Charlier, J. Fabian and S. Roche. *2D Materials* 2, 022002 (2015) Spin dynamics and relaxation in graphene dictated by electron-hole puddles. D. Van Tuan, F. Ortmann, A. W. Cummings, D. Soriano and S. Roche. *Scientific Reports* 6, 21046 (2016)

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