Dynamics of Dirac Electrons in a Photon Cavity

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We consider low energy excitations of monolayer graphene embedded in an optical cavity and exposed to an perpendicular constant magnetic field. The influence of an additional radiation field can yield resonant cyclotron transitions of the Dirac fermions of graphene which can be studied within techniques known from cavity quantum electrodynamics. The coupling of cavity photons with condensed matter has been realized in the context of electron gases[1, 2] and very recently also proposed for graphene[3, 4] and opens a new field of interesting issues concerning fundamental and applied aspects. We consider for realistic tight-binding models of graphene the influence of edge effects, such as inter-valley scattering, in this context. In addition to that we plan to extend the theory describing light-matter coupling in closed graphene cavity systems to graphene nanoribbons coupled to such a photon cavity in order to investigate transport properties.

[1] D. Hagenmüller, S. De Liberato and C. Ciuti, Phys. Rev. B **81**, 235303 (2010).
[2] G. Scalari, C. Maissen, D. Turčinková, D. Hagenmüller, S. De Liberato, C. Ciuti, C. Reichl, D. Schuh, W. Wegscheider, M. Beck, and J. Faist, Science **335**, 1323 (2012).
[3] D. Hagenmüller and C. Ciuti, Phys. Rev. Lett. **109**, 267403 (2012).
[4] L. Chirolli, Marco Polini, V. Giovannetti and A. H. MacDonald, Phys. Rev. Lett. **109**, 267404 (2012).