2D LAYERED MATERIALS AND THEIR BERRY PHASES

G. Gervais[1] and Thomas Szkopek[2],

[1]McGill University, Department of Physics

[2]McGill University, Department of Computer and Electrical Engineering

The study of the quantum Hall effects in alloyed semiconductors (and elemental carbon) generated intense investigations on the 'Berry phase' properties existing in solid state materials. During a round trip in *k*-space, electrons may acquire a geometric phase that in the simplest case, such as graphene, is determined by the linear dispersion of coupled bands. This geometrical phase manifests itself as an overall shift in the Landau level spectrum and is experimentally observable during Shubnikov-de Haas experiments performed in high magnetic fields. But what are the candidate materials that may have a non-trivial Berry phase, and could we control it?

Based on our recent investigation of Berry phase in hydrogenated graphene [1], cuprate superconductors [2] and black phosphorus (bP) [3], I will present an overview of Berry phase in layered materials with an emphasis on potential new candidates. In particular, I will discuss in detail bP, which is the second known elemental allotrope with a layered crystal structure that can be mechanically exfoliated to atomic layer thickness. Its 'puckered' honeycomb graphene-like structure is believed to be highly sensitive to strain and pressure, and as such it is a candidate for controlling the Berry phase.

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Category: QH
Email: gervais@physics.mcgill.ca