

The Dirac Equation

Contribution ID: 3

Type: **not specified**

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Wednesday, July 6, 2022 2:30 PM (1 hour)

In this talk, I will explain how the Dirac equation can be used to describe the physics of materials like graphene and topological insulators. I will present briefly the topological band theory for Bloch electrons in crystalline materials. Specific examples of tight-binding models giving rise to lattice versions of the Dirac equation in various space dimension will be discussed in various space dimensions : 1D (Su–Schrieffer–Heeger and Rice–Mele models), 2D (graphene, boron nitride, Haldane model) and 3D (Weyl semi-metals). I will show how the Dirac equation provides a description of the physics near specific points in reciprocal space, and also allows to predict edge/surface states between various Dirac materials.

J. Cayssol and J.N. Fuchs, “Topological and geometrical aspects of band theory”, *J. Phys. Mater.* 4, 034007 (2021).