Abstract:
The growth of the research activity and interest in Condensed Matter has been fostered by a continuous string of new discoveries. One of such discoveries has been the realization, in 2004, of graphene. Graphene is a one-atom-thick layer of carbon atoms arranged in a honeycomb structure. Graphene has extraordinary electronic properties: in graphene, at low energies, the electrons behave as massless Dirac fermions, i.e. like neutrinos (if neutrinos had no mass). We now know that there are other materials in which the electrons behave like in graphene. We call such materials Dirac materials. In this talk I will first introduce some of the most studied, recently discovered, Dirac materials such as graphene, topological insulators, and Weyl semimetals. I will then motivate and present the essential model that describes the behavior of the electrons in these materials. Finally I will discuss some of the surprising experimental consequences arising from the Dirac-like nature of the electrons in these materials.