Physics Seminar

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Marconi Building, N115, 13:30

Title: Doping and local probing of 2D and 3D Dirac materials

Abstract

Phenomena associated with Dirac electrons in solids have become one of the main topical subjects in condensed matter physics. Hosting these intriguing new phenomena, several classes of materials have emerged, including 2D Dirac materials (e.g. graphene), 3D topological insulators (e.g. Bi_2Se_3) and 3D Dirac semimetals (e.g. Cd_3As_2). Although the physics underlying these new materials and phenomena is fundamentally different from that of previously studied materials (e.g. conventional semiconductors and insulators), the electronic phenomena can be tuned using similar approaches. One such approach is doping, i.e. to introduce atoms of a foreign element (e.g. for n-type doping of conventional semiconductors). While it is known that the electronic phenomena induced by a dopant strongly depends on the local structure of the dopant atom (the lattice site that it occupies, if it couples with other point defects such as vacancies, etc.), such effects are still poorly understood in these new classes of materials. In particular, numerous doping-driven effects have been theoretically predicted but still lack experimental verification, in many cases due to the difficulty in locally probing structural and electronic properties.
This seminar gives an overview of our research activities addressing some of these open questions, within an international network of research groups and facilities. This work builds on our previous experience on doping and local probing of more conventional materials, and is based on unique experimental approaches that combine radioactive ion beams (at the ISOLDE facility at CERN) and high-brilliance X-ray radiation (at synchrotron facilities).