Topological electronic structures and spintronic applications for silicone

Prof. Wei-Feng Tsai
Department of Physics, NSYSU

Silicene is a two-dimensional crystal of silicon with a hexagonal lattice structure that is related to that of graphene but with atomic bonds that are buckled rather than flat. This buckling confers advantages on silicene over graphene, because it should, in principle, generate both a band gap and polarized spin-states that can be controlled with a perpendicular electric field. Recently we have shown that in the absence of any external field its ground state is topological and, furthermore, a field-gated silicene can possess two gapped Dirac cones exhibiting nearly 100% spin-polarization, situated at the corners of the Brillouin zone. Using this fact, we propose a design for a silicene-based spin-filter that should enable the spin-polarization of an output current to be switched electrically, without switching external magnetic fields. Our quantum transport calculations indicate that the proposed designs will be highly efficient and robust against weak disorder and edge imperfections. In this talk, some of recent progress will also be mentioned.