



CONDENSED MATTER THEORY SEMINAR

Topological electronic properties of silicon

Prof. Claudio Chamon, Boston University

Tuesday, Mar 6, 2018, 11:00-12:00

WBGB/020 (PSI-West)

Abstract:

The central role that materials play in human history is exemplified by the three-age division of prehistory into the stone, bronze, and iron ages. References to our present time as the information age or silicon age epitomizes the important role that this semiconducting material came to play in the development of computers and devices that permeate our daily lives. Remarkably, silicon has been left out of the explosion of research activity on topological materials. On the surface, this omission is the result of a boundary-centric classification of undoped silicon as a trivial insulator. Here we show that the electronic states in silicon have nontrivial topological structures that are captured by a network of Berry flux lines that link at points of high symmetry in the Brillouin zone. This complex network has ice-nodal points where fluxes satisfy ice rules. Fixing the longitudinal momentum parallel to such flux lines yields a two-dimensional Dirac Hamiltonian for the transverse degrees of freedom. This complex Berry-flux network implies a topologically stable two-fold degeneracy along the X-W direction in all of silicon bands, a fact that is supported by crystal symmetry arguments as well as direct inspection of the vast literature on silicon band structures.

Contact: Markus Müller, WHGA/136, Markus.Mueller@psi.ch, tel: 056 310 44 30