

Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

“Current at a distance and resonant transparency in Weyl semi-metals”

Yuval Baum, Weizmann Institute of Science, Israel

Abstract: Topology in various guises plays a central role in modern condensed matter physics. Although the original applications of topological ideas to band structures relied on the existence of a fully gapped bulk spectrum, more recently it has been recognized that protected surface states can arise even in gapless systems. The prototypical example of a gapless topological phase is a Weyl semi-metal.

Surface Fermi arcs are the most prominent manifestation of the topological nature of Weyl semi-metals. In the presence of a static magnetic field oriented perpendicular to the sample surface, their existence leads to unique inter-surface cyclotron orbits. We show how these inter-surface cyclotron orbits affect the electronic properties of Weyl semi-metals already at the semi-classical level. As a result, we are able to propose two experiments which directly probe the Fermi arcs: a magnetic field dependent non-local DC voltage and sharp resonances in the transmission of electromagnetic waves at frequencies controlled by the field. We show that these experiments do not rely on quantum mechanical phase coherence, which renders them far more robust and experimentally accessible than quantum effects. We also comment on the applicability of these ideas to Dirac semimetals.

[1] Y. Baum, E. Berg, S.A. Parameswaran and A. Stern, "Current at a distance and resonant transparency in Weyl semi-metals", cond-mat arXiv:1508.03047 (2015).

12:00noon
Tuesday, September 29, 2015
Duboc Seminar Room (4-331)