

Fall 2016 Joint Colloquium

Materials Department & Materials Research Laboratory

Professor Mark Sherwin

Physics Dept. and Institute for Terahertz
Science and Technology
University of California, Santa Barbara

Friday, October 7th, 2016

11:00 am, ESB 1001

Pizza served at noon.



Probing electronic structure by colliding electrons and holes at terahertz frequencies

I will discuss recent experiments that suggest a new method of probing the complete electronic structure of bulk materials and heterostructures near the center of the Brillouin zone. In these experiments, strong monochromatic terahertz fields coherently accelerate and collide electrons and holes that have been resonantly injected by a near-ir laser tuned near the band edge of a semiconductor or semiconductor quantum wells. The signature of electron-hole collisions is a near-ir frequency comb that decorates the near-ir laser line with dozens of teeth, or sidebands, that are separated from each other by twice the terahertz frequency. Careful study of the dependence of the sidebands on the polarizations of the near-ir and terahertz fields with respect to each other and the lattice show that band structure alone (i. e., the dispersion relations $E_n(\mathbf{k})$) is insufficient to explain observations. It is necessary to also account for the so-called Berry curvature, which is related to the Bloch wave functions of the bands.

Bio

Prof. Mark Sherwin has been a member of the Physics Department at UCSB since he received his Ph. D. in Physics from U. C. Berkeley in 1988. He is director of UCSB's Institute for Terahertz Science and Technology, home of the UCSB Free-Electron Lasers, and a Fellow of the American Physical Society. He is very grateful for his wonderful collaborations with members of UCSB's Materials Department.

<http://sherwingroup.itst.ucsb.edu/index.html>

Hosted by Stephen Wilson.