Course Objective: This course teaches the theory and methods used to model quantum electron transport in ultra-scaled traditional semiconductor devices such as MOSFETs and HEMTs, nano-scaled research semiconductor devices such as nanowires, and novel electronic material systems such as carbon nanotubes, molecular wires, graphene, topological insulators, etc.

Prerequisites: EE 208 or equivalent or consent of instructor or 2nd year physics graduate student.

Instructor: Roger Lake (WCH 437; phone: 827-2122; e-mail: rlake@ee.ucr.edu).

Office Hours: M: 1-2pm

Class Meeting: M: 2:10 – 5pm, LFSC 2418

Discussion: F: 12:10 – 1pm, LFSC 2418

References: See ‘Course Materials’ on i-learn.
Also:
Supriyo Datta, Quantum Transport Atom to Transistor, Cambridge, 2005.

Topics Covered:


- **Second Quantization:** Hamiltonian, electron density, and current operators.

- **Non-Equilibrium Green Functions:** S-matrix, Wicke’s theorem, self-consistent Born approximation.

- **Incoherent Scattering:** Self-energies for electron-acoustic phonon, electron-polar-optical phonon, alloy, interface roughness, and ionized impurity scattering.

- **Quantum Transport with Incoherent Scattering:** Self-consistent Born approximation. Current conservation.

Grading:

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<tr>
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