Outcome

March 28, 2008

Big Ideas

- Size-dependent properties
- Manipulation of properties with size-tuning

Outcomes

- Describe quantization
- Contrast/compare conductance of bulk and nano-wires
- Predict or speculate the conductance, and relate to other systems

Relevant Phenomena

- Atomic structure
- Quantum dots
- Quantum point contacts
- SET
- Phonon counter
- 1D Josephson

Prerequisite

- Wave mechanics
- Differential equations
- Modern/quantum physics
- E&M (with circuits)

Evidence-1

learning outcome-1: Describe quantization:

Task: Write-up that illustrates (through words/pictures) the understanding of the quantization:

- Schematics of discreteness vs. continuum
- Examples of quantization: energy levels of a particle in a 1D box, including size-dependence.

(Expression of Eigen-energy and energy diagrams)

Evidence-2

- Contrast/compare: conductance of bulk and nano-wires:

- Task: Students' experimental demonstration /lab of the difference between a 1D wire and a typical resistor.
- Evidence: Lab report that includes graphs that show both quantized conductance and continuously varied conductance of a resistor.

Evidence-3

- Predict or speculate the conductance, and relate to other systems

Learning Activities-1

1. Describe quantization

- Assigned reading along with questions to think about.
- Ask students to send in questions.
- Group presentations (1-2 slides)
- Class discussion.
- With credit awarded.

Learning Activities-2

2. Contrast/compare conductance of bulk and nano-wires

- Literature reading.
- Group presentations (1-2 slides)
- Class discussion.
- In class demo: Simulations and analysis