

- 3) [20 pts.] For those systems that do show resistance quantization, what is the resistance if the wire is wide enough to support one mode? (Be sure to take into account the fact that electrons have spin.) Express your answer in ohms!

$$\frac{h}{2e^2} = 12.5 \text{ k}\Omega$$

- 4) [10 pts.] Two different quantum dots are connected to leads with small tunnel barriers. The conductance of the leads vs. gate voltage for one quantum dot (quantum dot A) shows clear peaks at temperatures below 100 K. The conductance vs. gate voltage for the other quantum dot (quantum dot B) shows clear peaks at temperature below 10 K. Which dot is smaller, A or B?

A

- 5) [10 pts.] In class we had a demonstration tunnel junction with two Al electrodes separated by a thin oxide tunnel barrier. The Al electrodes were about 1 cm x 1 mm x 100 nm. Are the electrodes 1d, 2d, or 3d in the quantum mechanical sense?

3D

- 6) [10 pts.] A ballistic wire has a long length, but the height is one Fermi wavelength tall, and the width is 10 Fermi wavelengths wide. What is the resistance?

$\frac{h}{2e^2} \frac{1}{10} = 1.25 \text{ k}\Omega$ using class formula.

Correction from class: Should be $\frac{h}{2e^2} \frac{1}{10} \frac{1}{2} = 625\Omega$