

Mapping Electronic States in Semiconductor Nanostructures

D. Goldhaber-Gordon, Stanford University, PHY-0425897

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For fifteen years, researchers have studied electrons confined in tiny boxes known as “quantum dots” or “artificial atoms”. Electric fields from fine metal wires (bright lines in top figure inset) confine electrons within a semiconductor to a space smaller than the wavelength of visible light. Electrons can be added to the artificial atom one at a time, by changing the voltage on one of the nearby wires. Detecting these additions (peaks in top figure), indirectly helps us understand how electrons arrange themselves in these structures.

To measure more directly how electrons arrange themselves, we have built a Scanning Gate Microscope (schematic, bottom figure) which can locally perturb the electrons in a box. Measuring the effect of that perturbation as a function of its location should reveal the trapped electrons’ spatial arrangement or “wavefunction”.

