

# Atom-like Structures with Interesting Electronic Properties

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Quantum dots (QDs) are zero dimensional nanostructures that are made from semiconductor or metallic materials. QDs display optical and electrical properties that are different from those of their bulk materials due to quantum confinement effects. These properties have proven to be useful in applications ranging from solar cells, light emitting diodes as well as biological fluorescent tagging. Researching the electronic properties of QDs will lead us to a fundamental understanding of their behaviors and could also lead to the design of more efficient devices that incorporate QDs.

We probe the electronic properties of different sized cadmium selenide (CdSe) QDs. There are energies where electrons can and cannot exist in a QD. The region where electrons cannot exist is known as the band gap. Fig. 1 demonstrates that the band gap width (flat regions in the data) increases with decreasing QD diameter. By tuning the width of the bandgap, we can control the colors that a QD emits. QDs with bigger diameters possess narrower bandgaps and thus emit red light when stimulated while those with smaller diameters have a wider bandgap and therefore emit blue light as seen in Fig. 2. The size tunable electronic properties of a QD are important when designing LEDs.

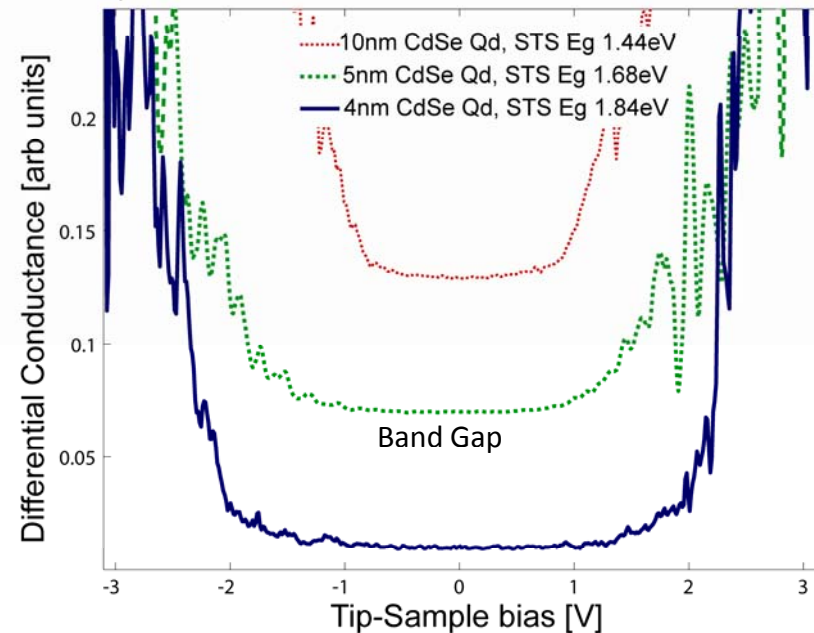


Figure 1: Density of states measurements showing an increase in the width of the band gap with decreasing QD diameter in CdSe QDs of 4nm, 5nm and 10nm diameter.

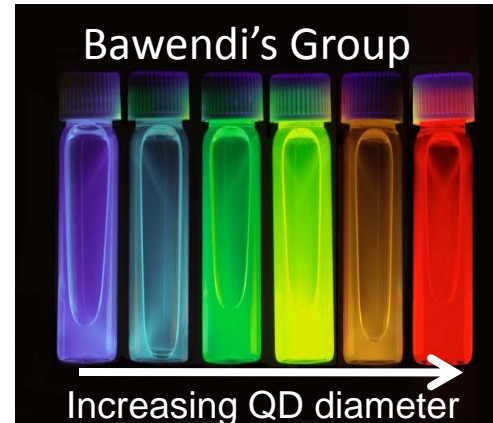


Figure 2: Solutions of QDs of different sizes. QDs with the least diameter emit blue light while QDs with the greatest diameter emit red light

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