

# Short-range scattering in quantum dots

October 20 2010

---

Chinese researchers, reporting in the *Journal of Applied Physics*, published by the American Institute of Physics, have described a new breakthrough in understanding the way electrons travel around quantum dots. This might lead to promising new fabrication methods of novel quantum devices.

Guodong Li and colleagues at the National Center for Nanoscience and Technology in Beijing carried out an experiment using self-assembled [quantum dots](#) and a two-dimensional electron gas, and then fit the data to a model to find out the type of [scattering](#) exhibited.

Much recent work has examined the internal structure of electron states of these 10-nm-scale quantum dots, which are tiny, very efficient energy absorbers that can release energy at custom frequencies depending on their size. Self-assembled quantum dots hold great promise for inexpensive fabrication of all kinds of novel applications such as lasers, detectors, and [optical data storage](#), as well as in nanotechnology research. What is missing, says the team, is an understanding of the scattering effects of the electrons. Optimizing scattering may be useful as a way of efficiently transporting electrons and thereby maximizing the performance of quantum dot-based devices.

To study these effects, the researchers placed an AlGaAs/GaAs two-dimensional electron gas (2DEG) near embedded GaSb/GaAs type-II quantum dots at a temperature of 4.2 K.

"The type-II GaSb quantum dots only confine the holes and not the

[electrons](#)," says coauthor Chao Jiang, "so they are free to interact with the 2DEG."

Measurements at various voltages in the coupled system showed that the scattering mechanism is short-range, an idea verified by a simple model with a constant scattering potential.

"For the first time, we have clarified that the mechanism of electron scattering in this type of quantum dot system is short-range," says Chao. "The result is particularly significant for the future designing of very efficient quantum-dot-based devices."

**More information:** The article, "Short Range Scattering Mechanism of Type-II GaSb/GaAs Quantum Dots on the Transport Properties of Two-dimensional Electron Gas" by Chao Jiang, Guodong Li, Hong Yin (National Center for Nanoscience and Technology, China), Qinsheng Zhu (Chinese Academy of Science) and Hiroyuki Sakaki (Toyota Technological Institute) appears in the *Journal of Applied Physics*. [link.aip.org/link/japiau/v108/i4/p043702/s1](http://link.aip.org/link/japiau/v108/i4/p043702/s1)

Provided by American Institute of Physics

Citation: Short-range scattering in quantum dots (2010, October 20) retrieved 25 April 2024 from <https://phys.org/news/2010-10-short-range-quantum-dots.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.