Double Quantum Dots Control Kondo Effect

September 15 2006

Two quantum dots connected by wires could help scientists better control the Kondo effect in experiments, according to a study by Ohio University and University of Florida physicists published in a recent issue of Physical Review Letters.

The Kondo effect occurs when electrons become trapped around the magnetic impurities in semiconductor materials, which prompts the electrons to change their spin. This phenomenon has intrigued scientists, as electronic correlations can create interesting and complex behavior in materials.

In the new work, scientists demonstrate how the two quantum dot system can behave in two different and interesting ways: As a simile for a Kondo-effect system where one quantum dot is used to "filter" the effect of the current leads, and as a way to study "pseudo-gapped" systems and correlations in them, which can help scientists understand structures such as superconductors.

“This last part is of great current interest to theorists and experimentalists who are exploring what are called quantum phase transitions, which are changes in systems that alter their behavior dramatically as a function of some parameter while remaining at zero (or very low) temperature,” said Sergio Ulloa, a professor of physics and astronomy at Ohio University.

The study, funded by the National Science Foundation, was conducted by Luis Dias da Silva, Nancy Sandler and Ulloa, all members of the Ohio

University's Nanoscale and Quantum Phenomena Institute, and Kevin Ingersent of the University of Florida.

Source: Ohio University