

Scanning probe imaging of quantum nanostructures

- Exploring local electronic states at semiconductor surfaces -

Motivation

Future information technologies will be realized by nanometer-scale semiconductor devices. In such devices, electron behavior is dominated by the quantum mechanics. Thus, real-space understanding of the nanometer-scale physics is very important to develop high-performance quantum devices through observing electron behavior directly in the nanostructures.

Originality

Using scanning tunneling microscope (STM) at low-temperature, we succeeded to image coherently coupled electronic states of interacting In adatoms on the InAs surface, two-dimensional states of electrons and holes of InGaAs/InAlAs and InAs/GaSb quantum well structures. Using this technique, various behaviors of electronic states in semiconductor structures can be imaged directly in nanometer scale.

Impact

This technology will contribute to further understanding of quantum mechanical phenomena of electrons and holes in low-dimensional semiconductor structures designed for quantum devices and quantum computers.

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