# 22 Photoluminescence from a dilute electron system in GaAs quantum wells

## - Observation of an electron puddle state -

### Motivation

We performed photoluminescence measurement of a dilute electron system induced in undoped GaAs quantum wells grown by an MBE technique. These samples are suitable for studying the properties of dilute electrons since they have atomically flat hetero-interfaces and contain very few impurities.

### Originality

In our sample, where the short-range potential modulation due to the impurities near the quantum well is greatly suppressed, we observed an electron puddle state, which is formed by the long-range potential fluctuation. We also observed a clear transition to a two-dimensional electron system when the puddles are connected with each other.

### Impact

Micro/nano-fabrication on undoped GaAs quantum wells makes it possible to realize “artificial crystals” by biasing the gate with a lattice pattern. This device will lead to wide variety of tunable spin-based devices like semiconductor ferromagnets.


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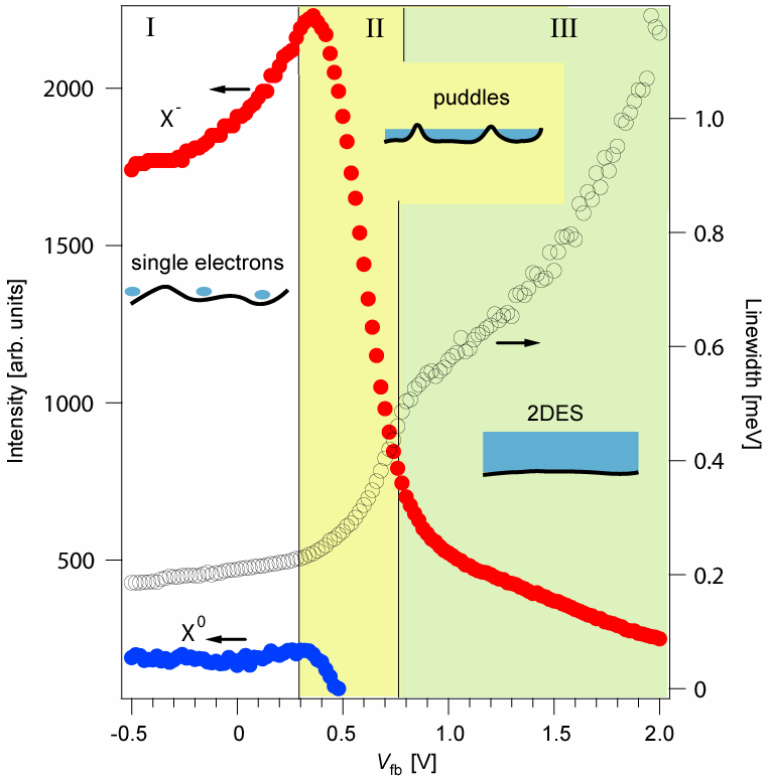
### Photoluminescence intensity and linewidth




Electrons are induced as $V_{fb}$ increases. The “electron puddle state” (regime II) is observed in between the single electron localized state (I) and the two-dimensional electron system (III)