1. Open Dot Experiments

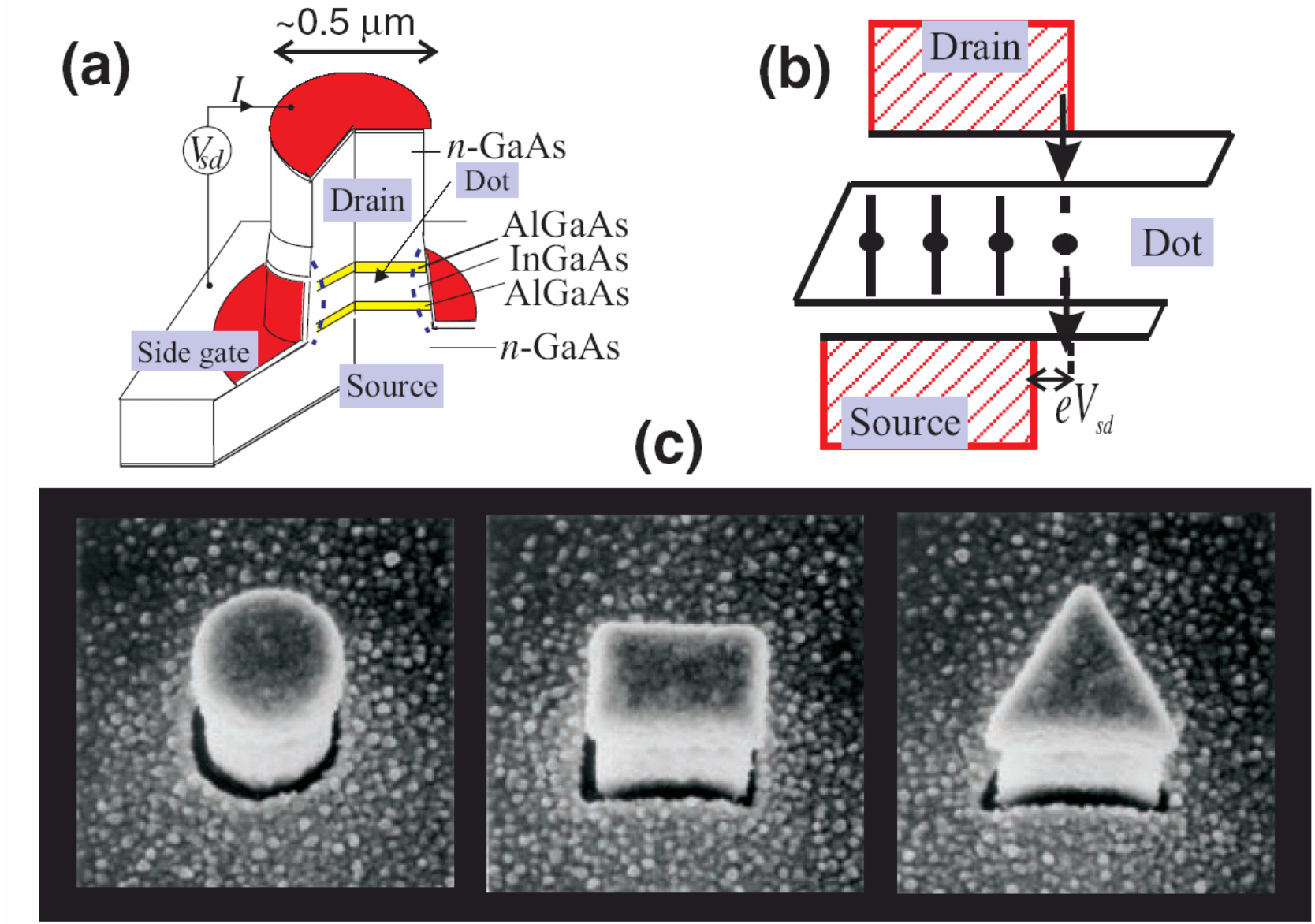
2. Kondo effect

3. Few Electron Dots

4. Double Quantum Dots

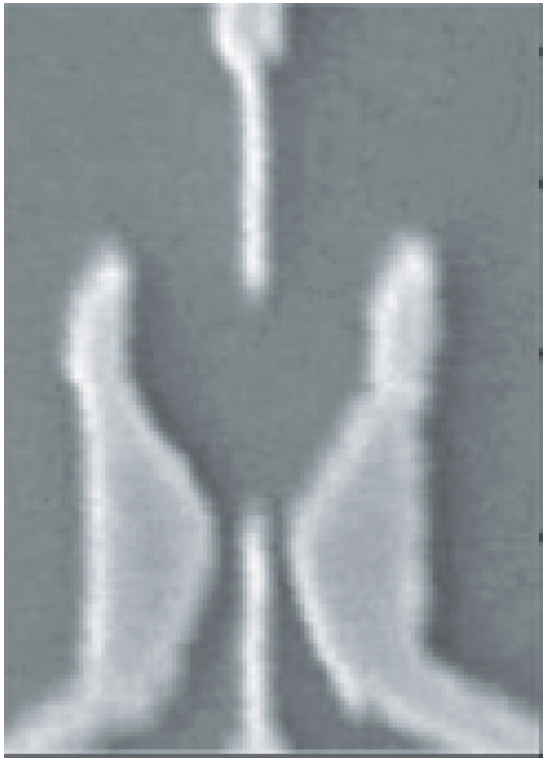
Kouwenhoven, Austing and Tarucha, RPP 64, 701 (2002)
Tarucha et al., PRL77, 3613 (1996)
Kouwenhoven et al., Science 278, 1788 (1997)

Few Electron Quantum Dots: Vertical

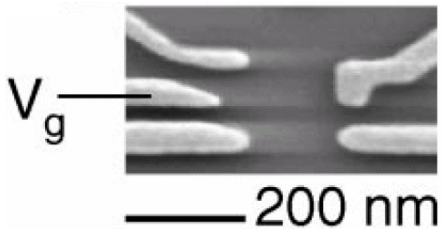


Kouwenhoven, Austing and Tarucha, RPP 64, 701 (2001)

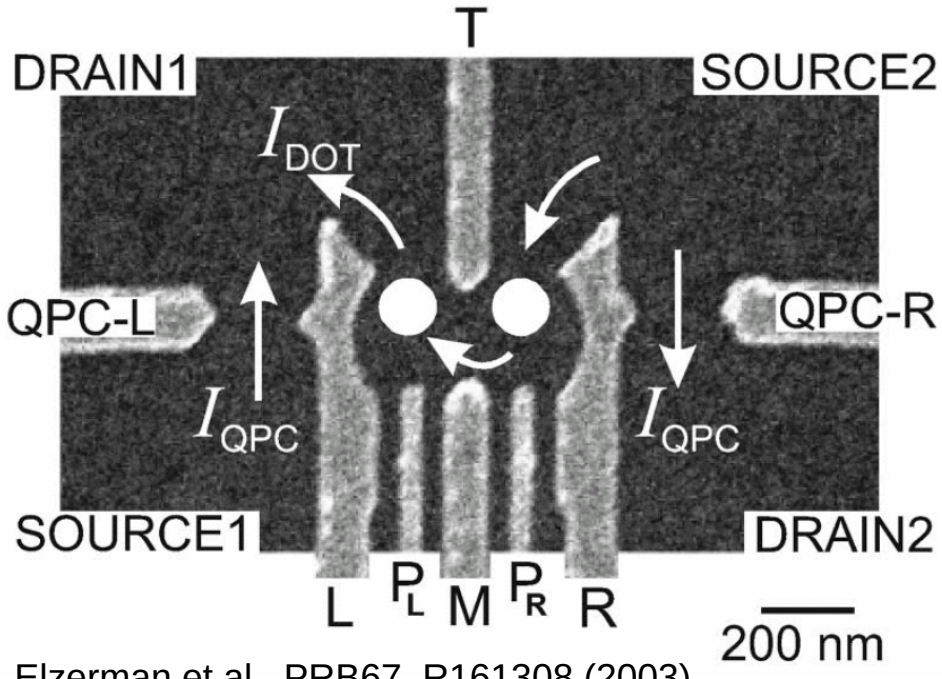
Few Electron Quantum Dots: Lateral



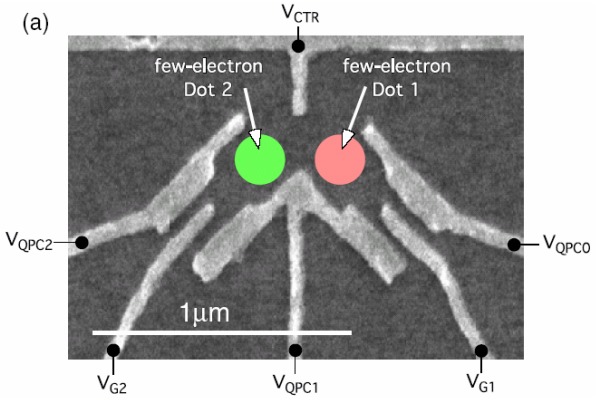
Ciorga et al., PRB61, R16315 (2000)



Zumbuhl et al., PRL93, 256801 (2004)



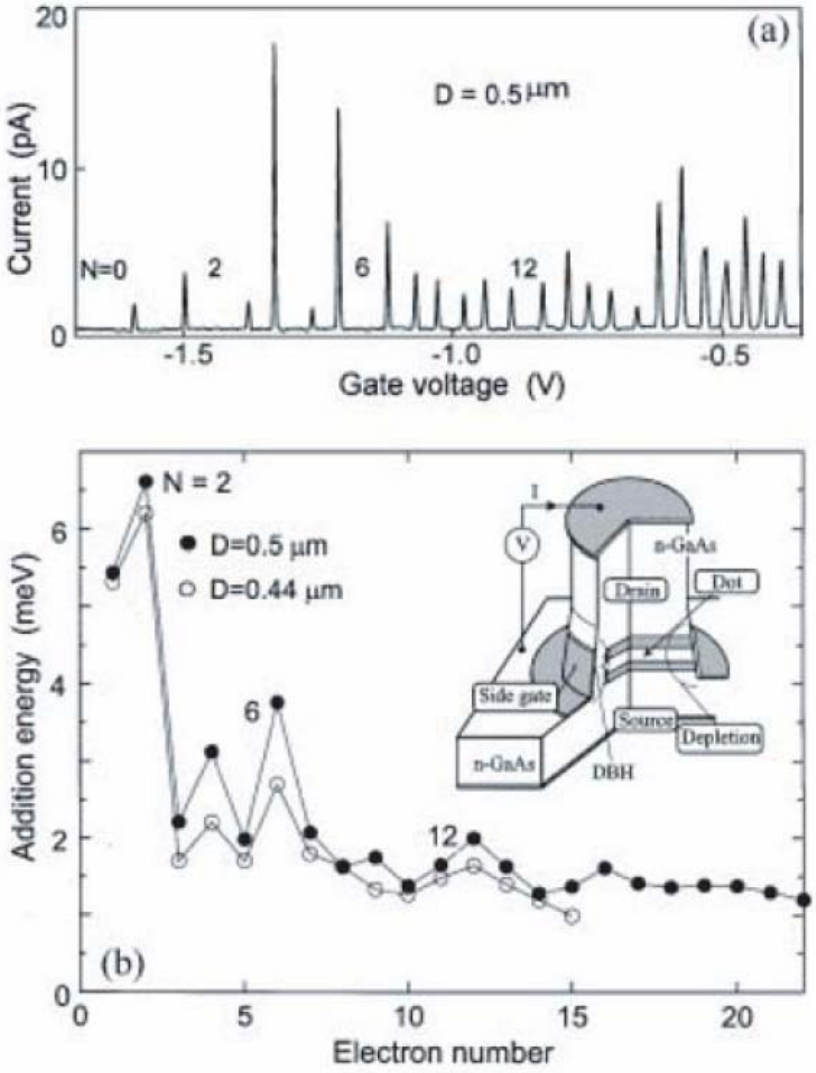
Elzerman et al., PRB67, R161308 (2003)
similar design: Marcuslab



Chan et al., Nanotech. 15, 609 (2004)

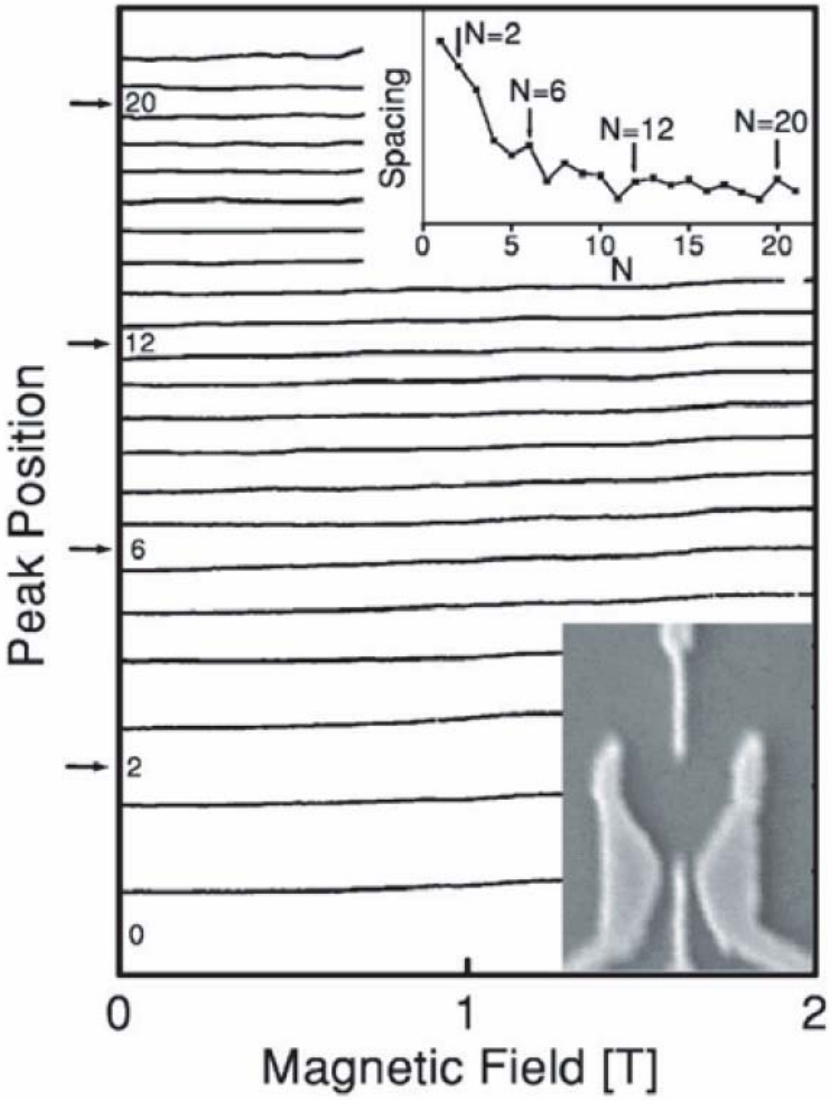
Rotation Symmetry and Angular Momentum

circular symmetry: 2D shell filling



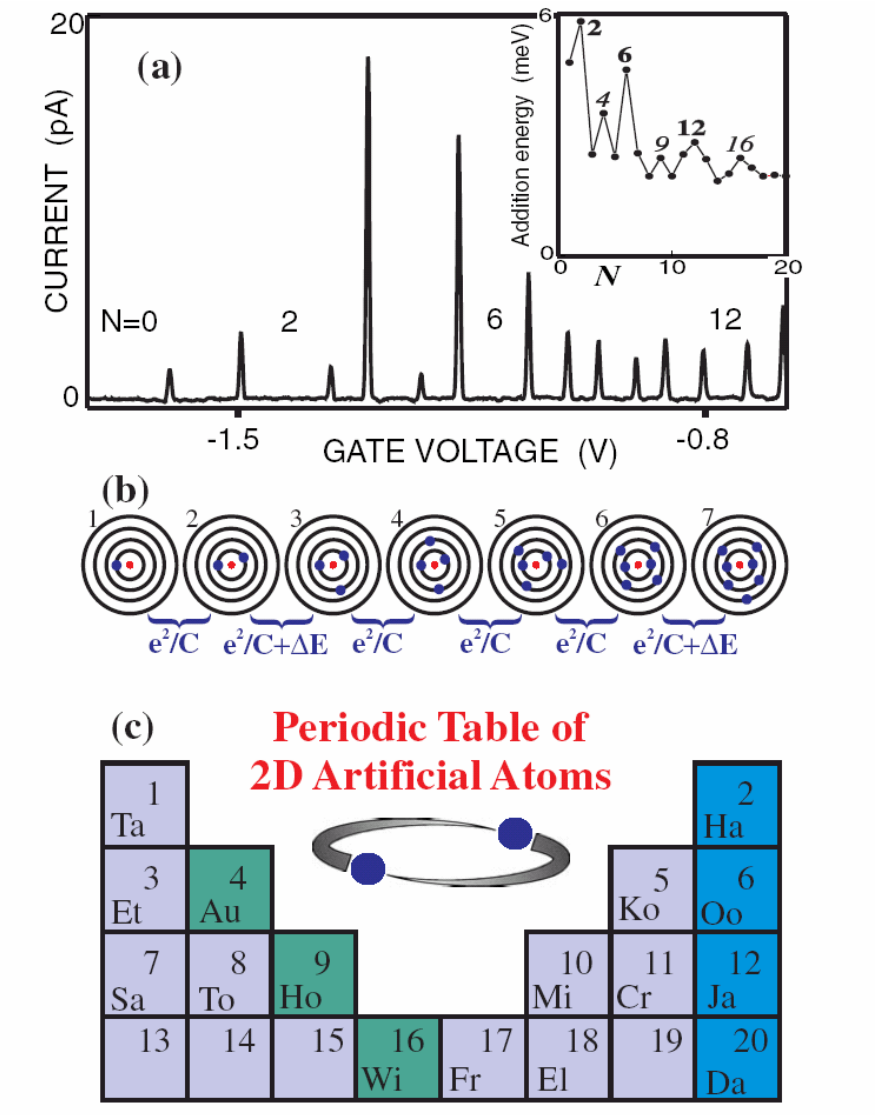
Tarucha et al., PRL77, 3613 (1996)

circular symmetry broken

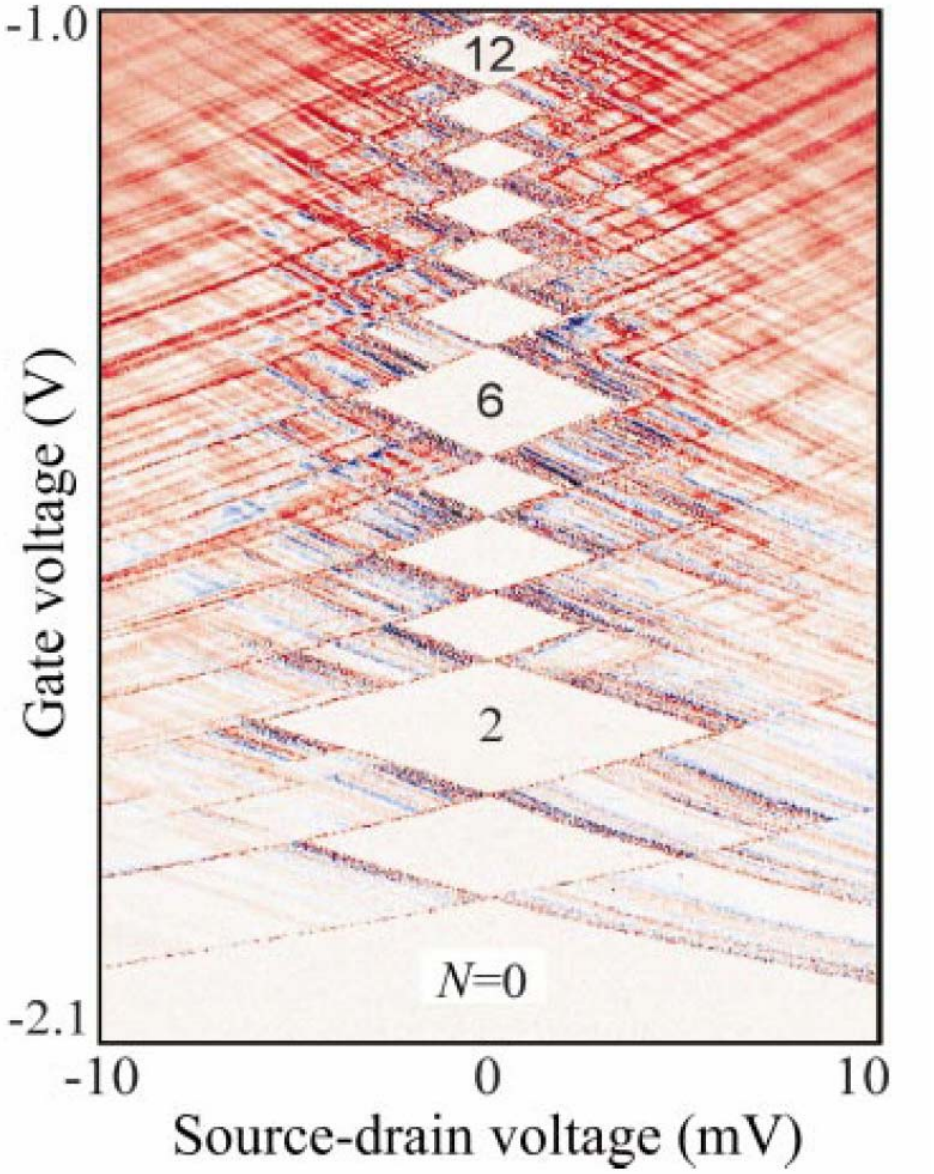


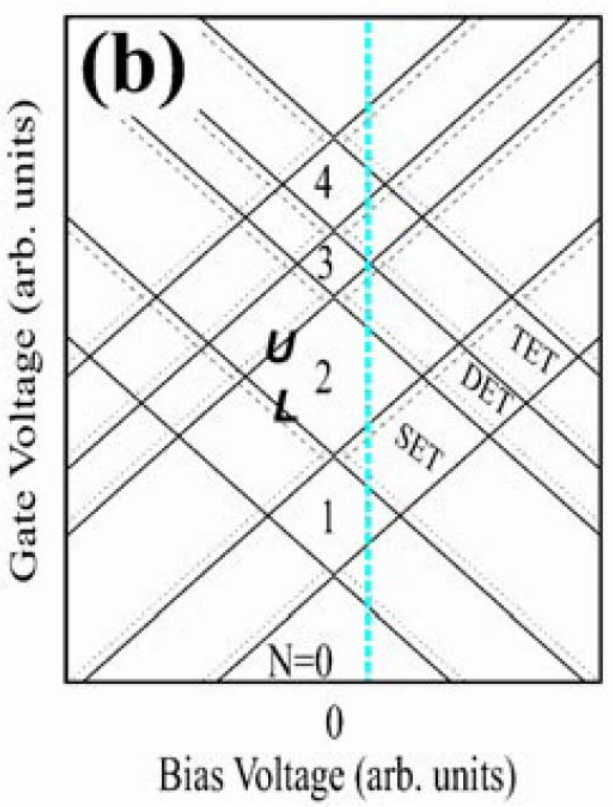
Ciorga et al., PRB61, R16315 (2000)

2D Periodic Table of Elements

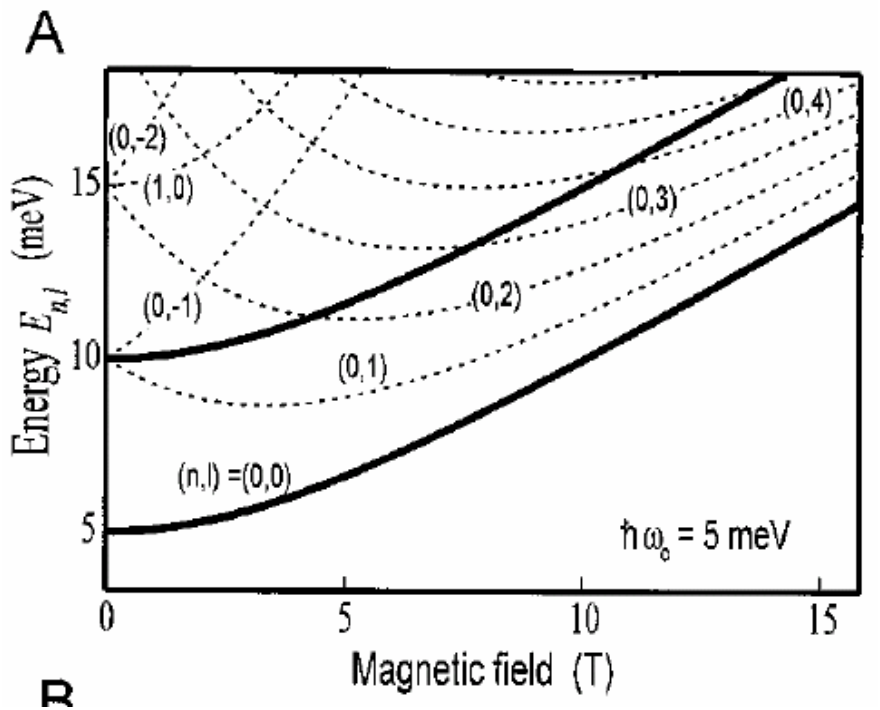


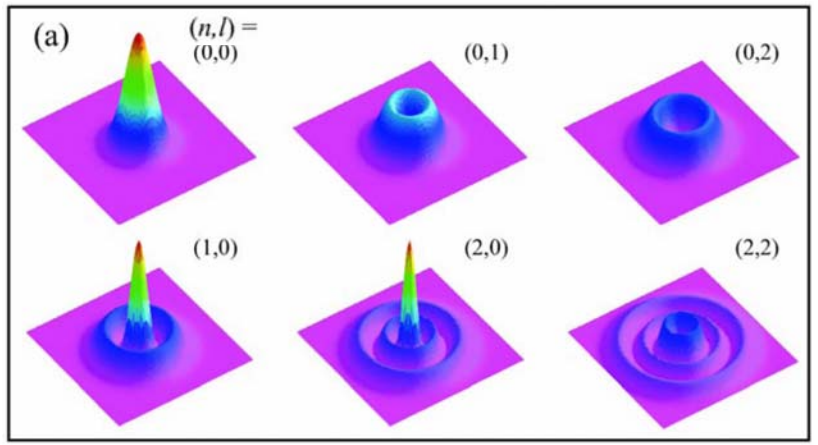
Excitation Spectra of Circular, Few Electron Dots





Fock-Darwin States: Single Particle Levels





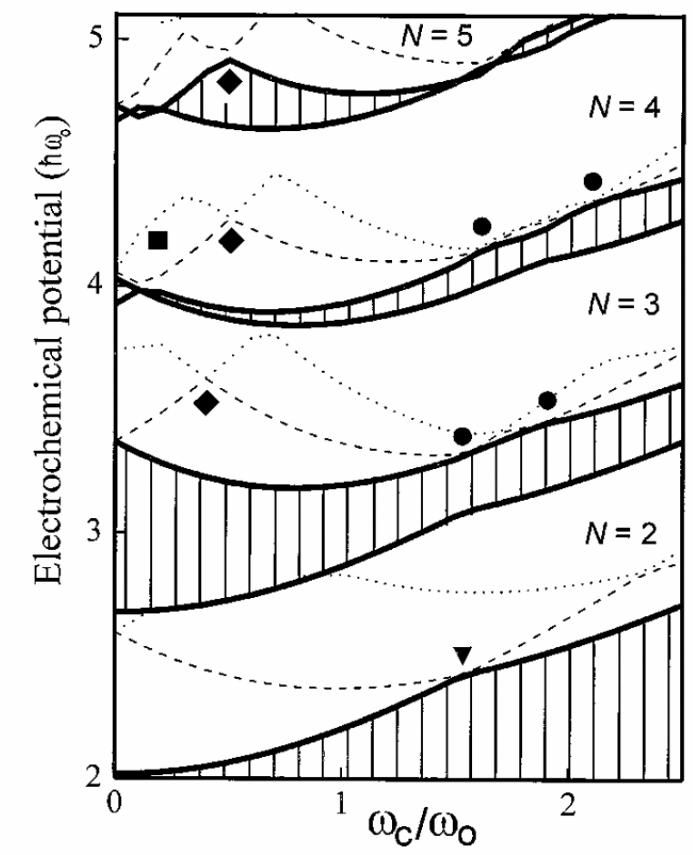
Fock-Darwin Energies

$$E_{n,\ell} = (2n + |\ell| + 1)\hbar\sqrt{\left(\frac{1}{4}\omega_c^2 + \omega_o^2\right)} - \frac{1}{2}\ell\hbar\omega_c$$

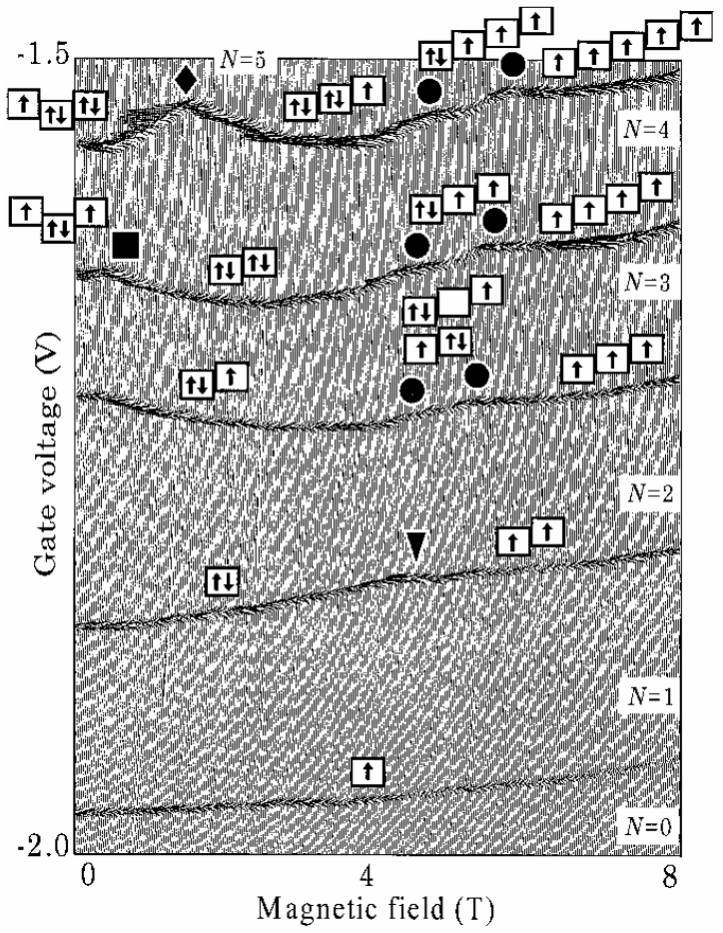
$n = 0, 1, 2, \ldots$ radial

$l = 0, \pm 1, \pm 2, \ldots$ angular momentum

Magnetic Field Transitions



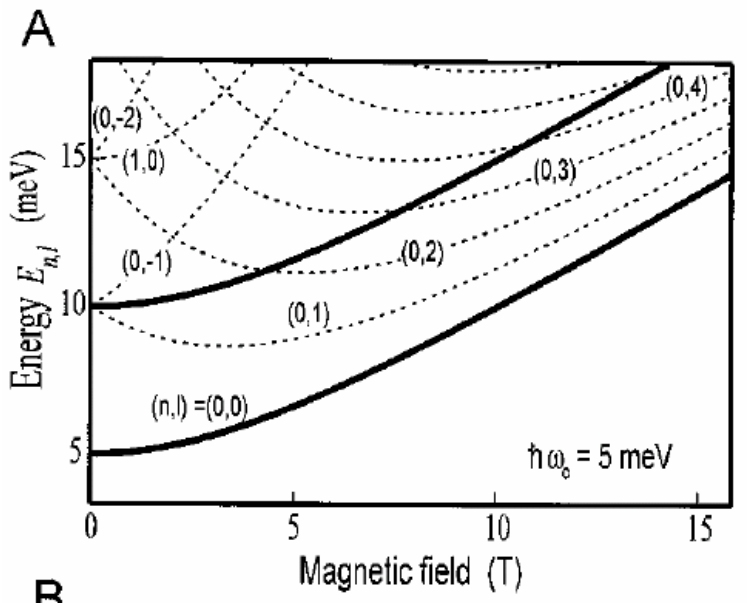
exact calculation

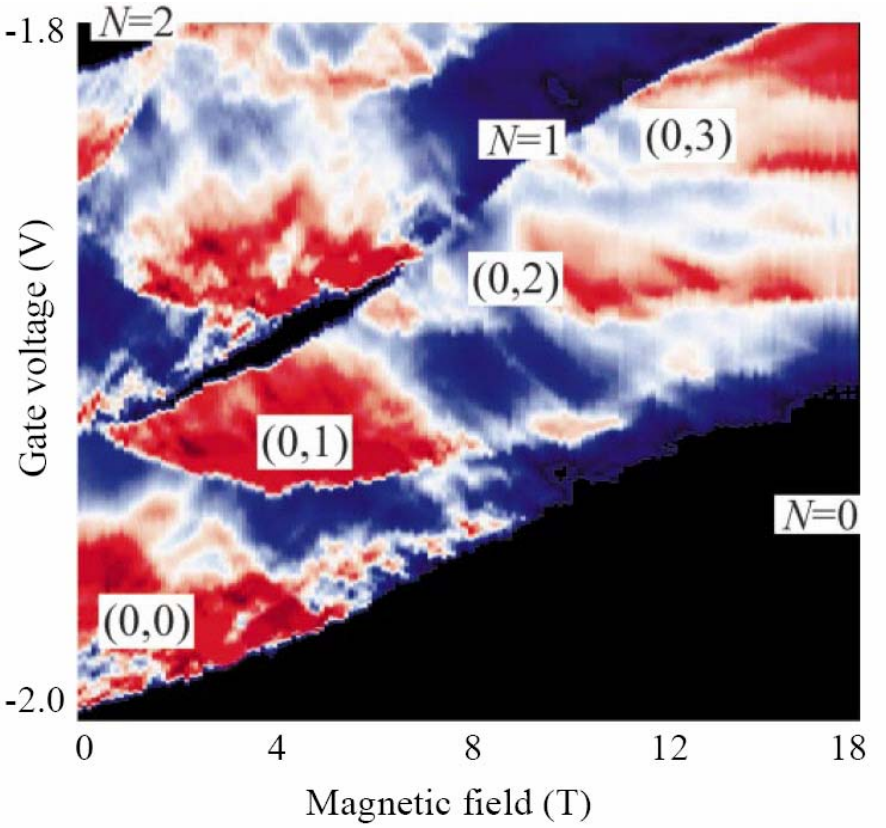


experiment

"atomic physics" like experiments not accessible in real atoms!!

Zero to One Electron Transition





Higher Transitions