

# QSIT 2012 - Questions 8

04. May 2012, HIT F 13

## 1. Charge stability diagram for a double quantum dot

Consider two quantum dots (labeled as 1 and 2) with their chemical potentials controlled by gate voltages  $V_{g1}$  and  $V_{g2}$ . The equilibrium number of the electrons on the dot (expressed by the doublet  $(N_1, N_2)$ ) is determined by the gate voltages according to the charge stability diagram shown in Fig. 1.

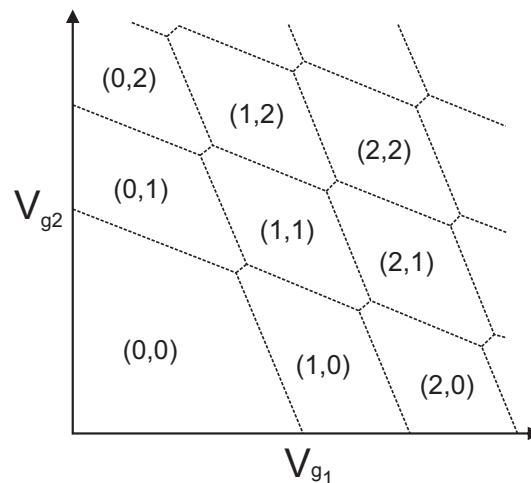


Fig. 1

- How would be the stability diagram for two completely uncoupled dots look like?
- What determines the angle of the lines with respect to the axes?
- What determines the distance between two closest triple-points?
- Assume weak bias from the source (a lead connected to the dot 1, see Fig. 2) and drain (a lead connected to the dot 2). At what conditions there will be current through dots? (show this region on the stability diagram).

2. **Spin states in a double-dot in two-electron regime**

Indicate all two-electron spins states corresponding to (1,1) and (0,2) regions in the charge stability diagram (hint: consist of singlet and triplet states). What states get coupled by the electron tunneling between dots? What determines the energy splitting between different states.

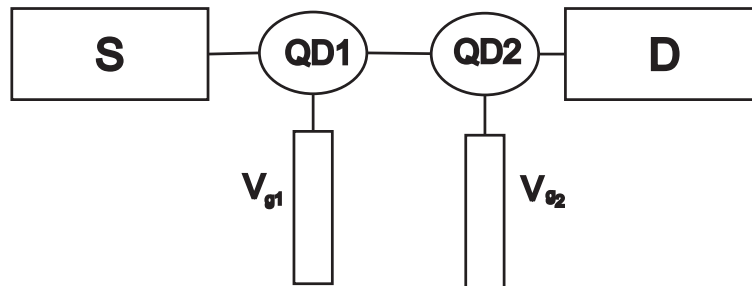


Fig. 2