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Electron-Electron and Electron-Phonon interactions effects on the tunnel electronic spectrum of PbS quantum dots[1] HONGYUE WANG, EMMANUEL LHUILLIER, QIAN YU, ALIREZA MOTTAGHIZADEH, Laboratoire de Physique et d'Etude des Materiaux, UMR 8213, ESPCI-ParisTech-CNRS-UPMC, 10 rue Vauquelin, 75231 Paris, France, CHRISTIAN ULYSSE, Laboratoire de Photonique et de Nanostructures, CNRS, 91460 Marcoussis, France, ALEXANDRE ZIMMERS, BENOIT DUBERTRET, HERVE AUBIN, Laboratoire de Physique et d'Etude des Materiaux, UMR 8213, ESPCI-ParisTech-CNRS-UPMC, 10 rue Vauquelin, 75231 Paris, France — We present a tunnel spectroscopy study of the electronic spectrum of single PbS Quantum Dots (QDs) trapped between nanometer-spaced electrodes, measured at low temperature T=5 K. The carrier filling of the QD can be controlled either by the drain voltage in the shell filling regime or by a gate voltage. In the empty QD, the tunnel spectrum presents the expected signature of the 8x degenerated excited levels. In the drain controlled shell filling regime, the levels degeneracies are lifted by the global electrostatic Coulomb energy of the QD; in the gate controlled shell filling regime, the levels degeneracies are lifted by the intra-Coulomb interactions. In the charged quantum dot, electron-phonons interactions lead to the apparition of Franck-Condon side bands on the single excited levels and possibly Franck Condon blockade at low energy. The sharpening of excited levels at higher gate voltage suggests that the magnitude of electron-phonon interactions is decreased upon increasing the electron filling in the quantum dot.

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Hongyue Wang
Laboratoire de Physique et d'Etude des Materiaux, UMR 8213,
ESPCI-ParisTech-CNRS-UPMC, 10 rue Vauquelin,
75231 Paris, France

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