Crystal phase induced bandstructure modifications

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The talk will focus on showing the understanding of the modifications of electronic and optical properties under shape and dimensional restrictions. Indeed, semiconductor nanowires (NWs) often exhibit different optoelectronic properties with respect to the bulk counterpart due to the different crystal phases.

In this work, low-temperature micro-photoluminescence measurements on the wurtzite (WZ) GaP NWs illustrate strong emission at 2.09eV (594nm) with 0.78ns lifetime, typical for a direct band gap material [1].

Furthermore, resonant Raman spectra of individual WZ AlAs-GaAs core-shell nanowires display a resonance between 1.83 and 2.18 eV for the AlAs E_1(TO) phonon mode [2]. Our findings substantiate the lowest conduction band of WZ AlAs to comprise Γ_8 symmetry and a low effective mass.

Finally, resonant Raman experiments were carried out on WZ InAs nanowires. Resonant conditions have been obtained by tuning either the excitation energy or the band gap through external high pressure at fixed excitation energy. The measured E_2^H mode resonance indicates that the E_1(A) gap is about 2.4 eV. Instead, the TO(A_1+E_1) mode does not exhibit a resonance in the investigated energy range. From the excitation energy dependent measurement, we deduced that the resonance is shifted to energies higher than 2.71 eV, possibly due to the transitions from the light hole valence band and the gap from crystal-field split-off valence band at the A point [3].

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