Ang-Yang Yu

Henan University
China

Theoretical Insights into the Energy Levels of Quantum Dots

Abstract:

Quantum dots (QDs) are fundamental luminescent materials with wide applications in biotechnology, sensing, medical diagnostics and electronics. The luminescent QDs, including CoS and FeS QDs with emission tunable in a broad range, have been obtained in experiments recently. In my own work, energy levels of the QDs with different compositions, sizes and shapes were investigated by employing an eight-band k•p theory. It is known that determination of the HOMO and LUMO levels of the QDs is of great technical and fundamental importance in rational design of the devices with the QDs as building blocks. Thus, HOMO and LUMO levels of the quantum dots have also been determined based on the eight-band k•p model. In addition, the lifetime of resonant state of QDs is related to the energy width of the resonant level due to the uncertainty principle. Therefore, the lifetime of resonant state is calculated in order to estimate the limit of operation speed in resonant tunneling systems. Theoretical calculations are believed to be helpful for designing optimal resonant-tunneling devices in the near future.