

## Polaronic Effects of an Exciton in a Cylindrical Quantum Wire

WANG Rui-Qiang, XIE Hong-Jing, GUO Kang-Xian, YU You-Bin, and DENG Yong-Qing

Department of Physics, Guihuagang Campus, Guangzhou University, Guangzhou 510405, China  
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**Abstract:** The effects of exciton-optical phonon interaction on the binding energy and the total and reduced effective masses of an exciton in a cylindrical quantum wire have been investigated. We adopt a perturbative-PLL [T.D. Lee, F. Low, and D. Pines, Phys. Rev. B90 (1953) 297] technique to construct an effective Hamiltonian and then use a variational solution to deal with the exciton-phonon system. The interactions of exciton with the longitudinal-optical phonon and the surface-optical phonon have been taken into consideration. The numerical calculations for GaAs show that the influences of phonon modes on the exciton in a quasi-one-dimensional quantum wire are considerable and should not be neglected. Moreover the numerical results for heavy- and light-hole exciton are obtained, which show that the polaronic effects on two types of excitons are very different but both depend heavily on the sizes of the wire.

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Key words: exciton binding energy, polaronic effect, cylindrical quantum wire

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