Explicit Form for Exciton Damping with Accounting LO-Phonon Dispersion

Nicolas Grigorchuk
Bogolyubov Institute for Theoretical Physics
of National Academy of Sciences of Ukraine,
POB 240, Kyiv-187, 03187, Ukraine

The scattering of excitons by phonons is one of most important problems in condensed matter physics. This problem is treated recently more intensively for anisotropic [1] and low-dimensional crystals.

The theoretical study of the effect of LO-phonon dispersion on frequency and temperature dependence of exciton damping in crystals with weak and strong coupling is carried out. Using for the phonon dispersion [2]

$$\Omega^2(q) = \Omega_{LO}^2 - \hbar^2 q^2 \upsilon_L^2.$$

there an explicit form for exciton damping in one-phonon approximation has been obtained. It is shown that, with increasing dispersion, the edge of the phonon emission processes shifts to the short-wave side of the spectrum. For frequencies higher than corresponding to the exciton band bottom this results in the nonzero damping even for zero temperature. It is noticed that for low temperatures there exist a temperature range where damping is decreased with the growth of dispersion.

We find some details which defers this our result from that one obtained earlier [3] with using cosine low for LO-phonon dispersion.

The TlBr and ZnS crystals were chosen as the models for illustrations.

1. N.I. Grigorchuk, Phys. Rev. B**55**, 888(1997).
2. B.K. Ridley, Phys. Rev. B**49**, 17253(1994).
3. N.I. Grigorchuk and I.Yu. Goliney, Phys. Rev. B**60**, 5470(1999).