The Raman and Hyper-Raman Scatterings of light by LO-Phonons in a CdS Crystal Under Excitation near Resonance with the $\mathbf{A_{n=2}}$ and $\mathbf{B_{n=1}}$ exciton levels

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In this work, the theoretical treatment of the scattering of light by LO-phonons under one-photon and two-photon excitation near resonance with the $A_{n=2}$ and $B_{n=1}$ exciton levels in a CdS crystal of the wurtzite structure is given. The Frohlich mechanism of exciton-lattice interaction is considered. It is assumed that intermediate virtual states of an electronic system are the hydrogen-like Wannier excitons. But the influence of the complex structure of the top valence band on the closely spaced levels $A_{n=2}$ and $B_{n=1}$ was taken into account by the use of the perturbation theory. The selection rules allow the dipole transitions between the A and B subbands. The assumption of the nonzero matrix elements of these transitions leads to the fact that linear combinations of the 1s- and 2p-exciton wave functions relating to the B and A series, respectively, correspond to the two "perturbed" energy levels. This results in additional scattering mechanisms. The possible manifestations of this mixing of the states in the resonance Raman and hyper-Raman scattering are discussed.