Hall Coefficient in the Presence of Strong Electromagnetic Waves Caused by Confined Electrons and Phonons in a Rectangular Quantum Wire

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Abstract : The analytic expression for the Hall Coefficient (HC) caused by the confined electrons in the presence of a strong electromagnetic wave (EMW) including the effect of phonon confinement in rectangular quantum wires (RQWs) is calculated by using the quantum kinetic equation for electrons in the case of electron - optical phonon scattering. It is because the expression of the HC for the confined phonon case contains indexes m, m’ which are specific to the phonon confinement. The expression in a RQW is different from that for the case of unconfined phonons in a RQW or in 2D. The results are numerically calculated and discussed for a GaAs/GaAsAl RQW. The numerical results show that HC in a RQW can have both negative and positive values. This is different from the case of the absence of EMW and the case presence of EMW including the effect of phonon unconfinement in a RQW. These results are also compared with those in the case of unconfined phonons in a RQW and confined phonons in a quantum well. The conductivity in the case of confined phonon has more resonance peaks compared with that in case of unconfined phonons in a RQW. This new property is the same in quantum well. All results are compared with the case of unconfined phonons to see differences.

Keywords : Hall coefficient, rectangular quantum wires, electron-optical phonon interaction, quantum kinetic equation, confined phonons

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