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Heat Pulse Studies of the Emission and Absorption of Acoustic Phonons in GaAs Quantum Wells and Wires

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Abstract: This paper reviews some recent experiments in which heat pulse techniques have been used to study the interaction of acoustic phonons with electrons in semiconductor quantum wells and wires. Heat pulse experiments provide temporal and spatial resolution of the phonons that are emitted or absorbed by the electrons and so give more detailed information about the electron-phonon interaction than can be obtained by other methods (e.g. transport measurements). Phonon experiments demonstrate clearly the effect of the electron confinement on the carrier-phonon interaction and the overall energy loss rate due to acoustic phonon emission. A qualitative explanation of the results is given in terms of the reduction of phase-space available for electron-phonon scattering when the electrons are confined in one and two dimensions. It is also shown how phonons can be used as spectroscopic probes of the electronic states in semiconductor nanostructures.

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