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Phonons in Ge/Si Superlattices with Ge Quantum Dots

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Ge/Si superlattices containing Ge quantum dots were prepared by molecular beam epitaxy and studied by resonant Raman scattering. It is shown that these structures possess vibrational properties of both two- and zero-dimensional objects. The folded acoustic phonons observed in the low-frequency region of the spectrum (up to 15th order) are typical for planar superlattices. The acoustic phonon lines overlap with a broad emission continuum that is due to the violation of the wave-vector conservation law by the quantum dots. An analysis of the Ge and Ge–Si optical phonons indicates that the Ge quantum dots are pseudoamorphous and that mixing of the Ge and Si atoms is insignificant. The longitudinal optical phonons undergo a low-frequency shift upon increasing laser excitation energy (2.54–2.71 eV) because of the confinement effect in small-sized quantum dots, which dominate resonant Raman scattering. ©2001 MAIK "Nauka / Interperiodica".

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