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Interplay between Quantum Well Width and Interface Roughness for Electron Transport Mobility in GaAs Quantum Wells[1] DOBROMIR KAMBUROV, KIRK BALDWIN, KENNETH WEST, MANSOUR SHAYEGAN, LOREN PFEIFFER, Princeton Univ — We report transport mobility measurements for clean, two-dimensional (2D) electron systems confined to GaAs quantum wells (QWs), grown via molecular beam epitaxy, in two families of structures, a standard, symmetrically-doped GaAs set of QWs with $Al_{0.32}Ga_{0.68}As$ barriers, and one with additional AlAs cladding surrounding the QWs. Our results indicate that the mobility in narrow QWs with no cladding is consistent with existing theoretical calculations where interface roughness effects are softened by the penetration of the electron wave function into the adjacent low barriers. In contrast, data from AlAs-clad wells show a number of samples where the 2D electron mobility is severely limited by interface roughness, exhibiting a 6^{th} power dependence on the quantum well width. These measurements across three orders of magnitude in mobility provide a road map of reachable mobilities in the growth of GaAs structures of different electron densities, well widths, and barrier heights.

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