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Quantum coherence of mesoscopic stadia and wires coupled to the environment[1] YUANTAO XIE, J. J. HEREMANS, Virginia Tech, Physics Department , C. LE PRIOL, Ecole Polytechnique (France), Physics Department , S. VIJEYARAGUNATHAN, T. D. MISHIMA, M. B. SANTOS, The University of Oklahoma, Homer L. Dodge Dept. of Physics and Astronomy — Quantum phase coherence was measured in quasi-1D wires and in mesoscopic stadia connected to wide sample regions by wire-like necks, to investigate the effects of environmental and interdevice coupling on decoherence as contrasted to intrinsic materials properties. Measurements of quantum phase coherence lengths used weak-antilocalization on nanolithographic InGaAs/InAlAs structures at 390 mK. For quantum wires, experiments show that longer wire lengths result in longer phase coherence lengths. The result is understood from the observation that longer wires average out decoherence introduced at the end sections by environmental coupling. For stadia with quantum-wire-like necks, stadium-wire coupling dominates decoherence in the stadia, rather than environmental coupling. Stadia with wider and shorter necks show longer phase coherence lengths. The result is understood from the observation that wider and shorter wires are geometrically similar to stadia, implying a stronger wave function hybridization between stadia and connecting necks and thus weaker decoherence from stadium-wire coupling. The work shows that geometry has to be taken into account in measured mesoscopic coherence.

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