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Optical Investigations of Semiconductor Nanowires: New Physics, New Heterostructures, and a New Experimental Probe[1]

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Semiconductor nanowires have recently emerged as a new class of materials with significant potential for both new fundamental physics new applications in device physics. Semiconductor nanowires are prototypical quasi one dimensional materials that come in many forms from singular materials to complex heterostructures.˜˜These materials can now be grown with high crystal quality and thus explored for their intrinsic physics.˜We will present recent results exploring the properties of GaAs/GaAlAs core-shell nanowires, the role of symmetry in InP nanowires, and a unique heterostructure called a quantum well tube. We utilize a variety of optical techniques to advance our understanding of these structures.˜We introduce a new optical technique that is shown to provide unique insights into the photoexcited carrier dynamics in nanowires. Finally, we show that this technique may have powerful capabilities to characterize a wide array of less studied materials with band gaps well into the near to mid IR energy region. This research has the potential for designing higher-efficiency solar cells and for significantly impacting nanowire electronics and nanowire-based chemical or biological sensors.

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[2]invited talk