RESONANT TUNNELING IN NANOCRYSTALLINE SILICON / SILICON DIOXIDE SUPERLATTICES

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Vertical carrier transport in layered structures comprised of layers of Si nanocrystals separated in the growth direction by angstrom-thick, tunnel transparent silicon dioxide layers exhibits at low temperature distinct peaks in conductivity. Performing measurements under resonant conditions, we observe giant several interesting phenomena such as self-oscillations in the conductivity and unique signatures of phase coherent carrier transport, including low (0.001 T) magnetic field induced phasing of electron waves and negative magnetoresistance. Using the technique of frequency resolved tunnel spectroscopy we observed and identified resonant transitions associated with hole tunneling via quantized states in nanocrystalline silicon - silicon dioxide superlattices. Under optimized conditions, negative differential resistance with a high peak-to-valley ratio and narrow resonance peaks were observed and identified.