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Engineering of entanglement in semiconductor nanowires DUNG PHAM, SATHWIK BHARADWAJ, L. R. RAM-MOHAN, Worcester Polytechnic Institute — Confined geometries such as semiconductor quantum wires and quantum dots are promising candidates for fabricating quantum computing devices. When several quantum dots are in proximity, spatial correlation between electrons in the system becomes significant, and leads to spatial entanglement. Spatial entanglement values can be tuned with external parameters, and this provides a new avenue for forming quantum bits. Here we examine the entanglement properties of two electrons in quantum dots formed inside GaAs/$Ga_xAl_{1x}As$ superlattice wires. We develop a fully variational formulation for calculating accurate few-electron wavefunctions in configuration space, and we use it to investigate the dependence of spatial entanglement on various geometrical parameters. Resonant behaviors associated with crossings of states are studied for the first time. We also observe the formation of electron clusters, and show that the entanglement value is a good indicator for the formation/dissolution of such clusters. Further, we show that a precise manipulation of the entanglement values is feasible with applied electric and magnetic fields.

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