物理

电子隧穿耦合双量子阱的结构设计及光学特性控制

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摘要：

结合实际半导体工艺设计一个导带中有3个子带能级的非对称双量子阱结构, 并利用束缚电子的有效质量薛定鄂方程计算了各子带能级的能量位置. 其中, 两个紧邻的激发态子带能级由于电子隧穿效应而相互关联. 当一个中红外波段探测光将基态能级同时耦合到两个激发态能级时, 可观测到一个中间夹很窄透明窗口的双峰结构吸收谱线. 在该量子阱结构上施加直流电场可改变两个探测跃迁上的电偶极矩比值, 进而有效控制两个吸收峰的相对高度和透明窗口内的色散曲线.

关键词： 双量子阱结构 电子隧穿效应 量子关联 透明窗口 双峰吸收谱线

Structure Design and Optical Property Control of   Double Quantum Well Coupled via Electronic Tunneling

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Abstract:

The authors designed an asymmetric double quantum well structure with three subbands in the conduction   band, and then calculated energy values of the three subbands with the effective\|mass Schrodinger equation of confined electrons. In particular, the two adjacent excited subbands were correlated to wave   function   due to the electronic tunneling effect. A weak probe field coupling the ground subband to the two   excited   subbands was found to have a double-peak absorption spectrum with an in-between transparency   window . Applying a DC electric field on this double quantum well structure, one may easily change the ratio of dipole moments on the two probe transitions, and then effectively manipulate relative amplitudes of the two absorption peaks and the dispersion curve in the transparency window.

Keywords: double quantum well structure electronic tunneling effect quantum correlation transparency window double\ peak absorption spectrum

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