

Fermion Zero Modes and Induced-charge on a Domain Wall of a Narrow-gap Semiconductor-dot

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Brocke et al.[1] have investigated InAs self-assembled quantum dots by resonant inelastic light scattering. With resonant inelastic light scattering, they can directly observe the elementary electronic excitations of the few-electron quantum-dot atoms at low temperatures. They observe excitations which they identify as transition of electrons from the s- to the p-shell(s-p transitions) and from the p- to the d-shell(p-d transition) of the quasiatoms. They explain the shift and broadening of the s-p transitions of collective excitations in the experiment to be due to additional excitations at lower energies, which cannot be individually resolved. Recently the present author [2] has indicated the importance of the photo-induced domain-wall in magnetoresistance in diluted magnetic semiconductors. In this study, we will discuss the additional excitations in the quantum dot from collectively induced-charge effects on a domain wall around the semiconductor-dot, extending the previous formula[2] and Callen-Harvey theory[3]. and from the p- to the d-shell(p-d transition) of the quasiatoms. They explain the shift and broadening of the s-p transitions of

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¹[1] T. Brocke et al., *Physica E* **22**, 478(2004). [2] I. Kanazawa, *Physica E* **40**, 277(2007).[3] C. Callen,J. Harvey, *Nucl. Phys. B* **250**, 427(1985).