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Time-dependent phenomena of electron-electron and electron-hole pairs confined in quantum dots TETSURO SATAKE, MASAKAZU MURAGUCHI , KYOZABURO TAKEDA, Waseda University — We report time-dependent (TD) phenomena of electron-electron (ee) and electron-hole (eh) pairs confined in 2D quantum dots (QDs). We solved TD Schrodinger equation numerically, under the assumption of the Hartree-type wave function with the singlet spin state for both pairs of ee and eh. The individual (e's and h's) QD orbitals are expanded by the basis of the real spatial mesh. We further combined Poisson's equation to determine the pair's coulomb interaction in QDs. The stationary ground states are first obtained by the scf-calculation. In accordance with the QD size, both of ee and eh pairs are characterized by confined, intermediate and free states, and the difference among them is more distinctive in ee pairs than in eh pairs. The coulomb repulsion calculated by Poisson equation extends the confined region, because of its logarithmic distance-dependence due to 2D QD. The TD change in the coulomb interaction induces the non-resonative oscillations among the individual eigen-states. The projection of the calculated pair's wave function into the QD single electron stationary states reveals that the resulting frequency is determined with the competition between the coulomb interaction and the size of QDs.

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