Study on Coherent Control of Exciton States in Quantum Dots Embedded in Pyramidal Microcavities

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【Outline of survey】

Coherent control of electronic wavefunctions will be possible when the electron-photon interactions are controlled coherently. For photon-based quantum computations and quantum cryptography, generation of sequence of indistinguishable photon pulses is necessary. The coherent control of the electronic states will establish an important milestone toward this direction. The main issue will be the control of the Rabi oscillation where the electronic state and photonic state are mutually oscillate with each other. This work aims to realize vacuum Rabi splitting by increasing the eletron-photon interactions with microcavities and also by the selection of the materials with large exciton oscillator strengths based on our previous efforts to realize pyramidal microcavities with quantum dots embedded inside.

【Expected results】

The observation of the vacuum Rabi splitting or oscillation due to the interaction of single quantum dot and coherent photon will give us a profound step toward the coherent control of quantum dots and electronic states. The Rabi splitting will be increased with the increase of the photon number, and this is the case in most of the previous reports. The coherent control of the single photon and an exciton will encourage the development of quantum information processing and quantum cryptography, and this work will give a breakthrough toward this direction.

【References by the principal researcher】

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【Term of project】 FY 2004 — 2008 | 【Budget allocation】 84,700,000 yen

【Homepage address】 http://opmac06.es.hokudai.ac.jp/