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Semiconducting nanodimer as a photonic cavity: Large and well-defiined Rabi splitting[1] MITSUHARU UEMOTO, Graduate School of Engineering Science, Osaka University, HIROSHI AJIKI, Photon Pioneers Center, Osaka University — A metallic nanodimer acts as a photonic cavity because a strong light field appears at the gap region due to a surface plasmon resonance. In this talk, we propose a photonic cavity consisting of a semiconducting nanodimer with a small gap, and theoretically demonstrate large and well-defined vacuum Rabi splitting of a two-level emitter placed at the photonic cavity. A light field is strongly enhanced at the gap region of the semiconducting nanodimer due to an exciton resonance. The interaction between the enhanced light and the emitter is significantly larger than that in a conventional photonic cavity, because the semiconducting nanodimer has a small cavity-mode volume beyond the diffraction limit as well as the metallic nanodimer. In contrast to the metallic nanodimer, the exciton decay rate at low temperature is very small, and as a result, the quality factor reaches $Q \sim 10^4$ which is about 100 times larger than that of the metallic nanodimer. Consequently, the large Rabi splitting energy (~ 1.7 meV) appears for the small dipole moment (~ 25 Debye) of the emitter, and the splitting energy is two times larger than the spectral width. Such a well-defined Rabi splitting is highly suited for both fundamental researches and applications.

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Mitsuharu Uemoto
Graduate School of Engineering Science, Osaka University

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