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**Semiconductor nano-gap antennas with high quality factor** MITSUHARU UEMOTO, Graduate School of Engineering Science, Osaka University, HIROSHI AJIKI, Photonic Pioneers Center, Osaka University — Metallic islands with nano-gap structure are one of the most popular optical antennas [1]. We theoretically propose a new nano-gap antenna utilizing exciton resonance of semiconductor. A light field at the nano-gap (hot spot) formed between two CuCl islands is significantly enhanced by a factor of metallic antennas. However, the hot spot of the semiconducting antenna exhibits much higher quality factor ($Q \approx 10^4$) at $T = 40$ K than those of metallic antennas which do not exceed $Q \approx 100$. Our result suggests the semiconducting antenna would function as a new type of photonic cavity. The calculation method is based on a finite element method which can take into account exciton resonance [2]. We also systematically study the geometry dependence of the enhancement factor and Q factor. In contrast to metallic antenna, blunt edges of semiconducting islands at the gap are preferable in order to achieve high enhancement factor. This is because of the fact that exciton wave function extends near the edge for blunt geometry.

[1] P. Mühlschlegel et al, Science 308, 5728, 1607-1609 (2005).
[2] M. Uemoto and H. Ajiki, in preparation.

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