Recent Progress in Semiconductor Photonic Crystals
－Ultrahigh-*Q* Nanocavities and 2D Band-Edge Lasers－

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In the present talk, I would like to describe two important steps forward in semiconductor photonic crystals. First is the ultrahigh-*Q* nanocavities based on the concepts of “light should be confined gently to be confined strongly” [1] and “photonic-double heterostructure” [2,3]. Up-to-date experimental and theoretical results will be discussed. In addition to the drastic increase of *Q* factor, a new concept to control *Q*-factors dynamically will be described, which is very important to achieve the stopping and/or slowing light by photonic nanocavities. The second is on the 2D band-edge lasers, which give rise to an unprecedented type of laser capable of 2D broad area coherent oscillation [4]. I will show that the control of the 2D photonic crystal structure enables tailored beams important for progress in several areas including optical tweezers, ultra-high-density optical memory, and microfluidics [5]. In addition, I will show that the high-power single longitudinal & lateral mode oscillation over 60mW has been achieved successfully under CW condition.

[1] Y.Akahane, T.Asano, B.S.Song, and S.Noda, *Nature*, 425 (2003) 944.
[2] B.S.Song, S.Noda, T.Asano, and Y. Akahane, *Nature Materials*, 4 (2005) 207,
[3] T. Asano, B.S.Song, Y. Akahane, and S.Noda, *IEEE Sel.Top.Quant.Electron.*, 12 (2006) 1123.
[4] S. Noda, M.Yokoyama, M.Imada, A.Chutinan, and M.Mochizuki, *Science*, 293 (2001) 1123.
[5] E. Miyai, K. Sakai, T. Okano, W. Kunishi, D. Ohnishi, and S. Noda, *Nature*, 441 (2006) 946.