Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Room temperature sub-diffraction-limited plasmon laser by total internal reflection RENMIN MA, RUPERT OULTON, VOLKER SORGER, GUY BARTAL, XIANG ZHANG, UC Berkeley — Plasmon lasers are a new class of coherent optical amplifiers that generate and sustain light well below its diffraction limit. Their intense, coherent and confined optical fields can enhance significantly light-matter interactions and bring fundamentally new capabilities to bio-sensing, data storage, photolithography and optical communications. However, metallic plasmon laser cavities generally exhibit both high metal and radiation losses, limiting the operation of plasmon lasers to cryogenic temperatures, where sufficient gain can be attained. Here, we present room temperature semiconductor sub-diffraction limited laser by adopting total internal reflection of surface plasmons to mitigate the radiation loss, while utilizing hybrid semiconductor-insulator-metal nano-squares for strong confinement with low metal loss. High cavity quality factors, approaching 100, along with strong lambda/20 mode confinement lead to enhancements of spontaneous emission rate by up to 18 times. By controlling the structural geometry we reduce the number of cavity modes to achieve single mode lasing.

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Date submitted: 13 Nov 2011 Electronic form version 1.4