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# NEXT LITE-SEMINAR

## *How small can one shrink a laser?*


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1040, Floragasse 7, 1st Floor, Seminar Room 362
Host: G. Strasser


### Abstract

Recently there has been a surge in activity devoted to development of the nano-scale lasers, in particularly the lasers employing surface-plasmon polaritons in metal dielectric structures ("spasers"). In my talk I will review the recent effort and present a theory that would clearly outline the fundamental limits of how small can the nano-laser actually be. First I will show that in order to go beyond diffraction limit one absolutely must use metallic structures with associated loss. Then I will show that the lasing threshold of the single mode metal-semiconductor nano-laser (spaser) is determined only by the photon absorption rate in the metal and exhibits very weak dependence on the composition, shape, size (as long as it is less than half-wavelength) and temperature of the gain medium. This threshold current is on the order of a few tens of micro-amperes for most semiconductor-metal combinations which leads to unattainably high threshold current densities for a substantially subwavelength laser (spaser). I will also discuss the coherence properties of nano-laser, and the modulation speed, which is comparable to that of a standard VCSEL. Therefore, in my view, surface plasmon emitting diodes, (SPED's), operating far below "spasing" threshold may be a more viable option for the chip scale integrated nanophotonics.



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