Miniature Lasers: what does and what does not matter?

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Recent years have seen an increase of interest in developing nano-scale sources of coherent radiation. Numerous schemes include novel confinement techniques such as plasmons and micro resonators as well as novel materials, such as two-dimensional transition metal di-chalcogenides have been investigated. In the process a lot of confusion has been produced by introduction into consideration of numerous parameters such as Purcell factor and the beta (fraction of spontaneous emission going into a given mode). That confusion makes comparative analysis of miniature lasers difficult. In this talk we show that the only parameters defining the laser threshold are the modal loss, quantum efficiency and physical volume of gain medium. Using this method, we compare the novel lasers with existing state of the art – DFB and VCSELs and draw conclusions.