

# "Plasmonic Nano Ring Laser"

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Interactions between a semiconducting gain medium and confined plasmon-polaritons are studied. We investigated the amplification of wave propagating in a plasmonic metal-semiconductor-metal waveguide filled with semiconductor gain medium and obtained the conditions required to achieve net optical gain. The MSM gain waveguide is used to form a plasmonic semiconductor nano-ring laser (PSNRL) with an effective mode volume of 0.007 cubic micrometer, which is about an order of magnitude smaller than the smallest demonstrated integrated photonic crystal based laser cavities. The simulation shows a lasing threshold current density of 1kA/cm<sup>2</sup> for a 300nm outer diameter ring cavity with 80nm-wide ring. This current density can be realistically achieved in typical III-V semiconductor.