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Directionally emitting plasmon laser and circuits REN-MIN MA, XIAOBO YIN, RUPERT OULTON, VOLKER SORGER, XIANG ZHANG, UC Berkeley — Scaling down of the laser promises unprecedented ultra-dense and ultra-fast integrated photonics. The research of nanoscale lasers is rapidly advancing and a variety of approaches have been explored including whispering gallery lasers, photonic crystal lasers, metallic lasers. However, a major obstacle of integrating nanolasers with other components is the strong divergence of emission from a sub-wavelength laser cavity due to the diffraction of light. Here, we demonstrate a deep sub-wavelength plasmon laser that directs more than 70% of its radiation into an embedded semiconductor waveguide. The laser naturally integrates photonic and electronic functionality allowing both efficient electrical modulation and wavelength multiplexing. A maximum modulation depth of 11 dB for a small 1 V of bias sweep is achieved. We demonstrate an ultra-compact plasmonic circuit integrating five independently modulated multi-colored laser sources multiplexed onto a single semiconductor waveguide, illustrating the potential of plasmon lasers for large scale, ultra-dense photonic integration.

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