Self-Injection Locking of Two Laser Diodes to a Single Integrated Microresonator

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Diode laser self-injection locking to a whispering gallery mode of a high-quality factor resonator is a widely used method for laser linewidth narrowing and high-frequency noise suppression. Self-injection locking has already been used for the demonstration of ultra-low-noise photonic microwave oscillators and soliton microcomb generation and has a wide range of possible applications. Here we both theoretically and experimentally investigate the dual-laser self-injection locking of two multifrequency laser diodes to different modes of an integrated Si_3N_4 microresonator. The simultaneous spectrum collapse of both lasers was obtained, as well as linewidth narrowing and high-frequency noise suppression. The strong nonlinear interaction of the two fields with each other was observed. Coherent addition, as well as simultaneous frequency and phase stabilization of output signal, are investigated for locking both lasers to the same mode. Microcomb generation in the process of dual-laser self-injection locking of two single-frequency diode-lasers was observed.