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(G*) A PT-symmetric microchip laser using nanostructure grating mirrors for single mode emission

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Microchip single mode lasers capable of high output powers are paramount for use in photonic integrated circuits, light detection and ranging (LIDAR) for the automotive industry and remote sensing in general. Of the many developments done to miniaturize single mode lasers, we take interest in parity-time (PT) symmetric lasers. These types of lasers rely on the interplay between the gain and loss of micro resonators to obtain single mode emission. Our proposed laser architecture exhibits PT-symmetric behavior in the polarization space. To control the polarization eigenstates of our laser, we use a pair of nanostructured mirrors consisting of an inscribed diffraction grating on the top layer of a Bragg mirror to obtain a phase shift of π and a difference in reflectance between transverse electric and magnetic polarization states. The addition of a phase shift on the mirrors provides control of the amplitude of the standing wave inside the resonator by changing the relative angle (α) of the two mirrors' principal axes. Thus, suppressing multiple longitudinal modes emission arising from spatial hole burning. Moreover, with the addition of a difference in attenuation between the mirrors' two principal axes, the polarization eigenstates of this laser are no longer orthogonal and for a specific angle of (α), they merge into one eigenstate called an exceptional point. Experimental results reveal enhanced purity of the emission spectrum compared to a resonator with conventional mirrors.

Keyword-1

single mode lasers

Keyword-2

PT-symmetric lasers

Keyword-3

nanostructured mirrors

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