OMICS International
conferenceseries.com

J Laser Opt Photonics 2016, 3:1(Suppl)
http://dx.doi.org/10.4172/2469-410X.C1.003

International Conference on
Quantum Physics and Nuclear Engineering
March 14-16, 2016 London, UK

PT-symmetry in semiconductor lasers

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This paper will describe our recent experimental and theoretical efforts on realizing a PT-symmetric dimer in a pair of optically coupled semiconductor lasers. The origin of PT-symmetry in this system will be motivated by starting from the Lang-Kobayashi laser rate equations and showing how they can be reduced to a PT-symmetric model with appropriate approximations. An experimental implementation of the model will be detailed and comparison to theoretical predictions is made. The results show that the coupled laser system can be a versatile model for the study of PT-symmetric quantum mechanics.

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Generation of tunable dual-wavelength laser by filtering of mode-locked laser using silicon-based microring resonator

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Generation of dual-wavelength fiber lasers (DWFLs) has attracted many research interests recently. We demonstrate a stable tunable dual-wavelength erbium-doped fiber laser generated by launching mode-locked laser into an add-drop microring resonator. Two silicon-based high index contrast microring resonators with Q-factors of 1.2×10^5 and 0.6×10^5 have been used as add-drop filters independently. The two silicon oxynitride (SiOxNy) microring resonators have different diameters and used as narrow band filter for the generation of stable tunable dual-wavelength lasers with variable free spectral range (FSR) accordingly. As a result, multi-wavelength generation was achieved and demonstrated both theoretically and experimentally with free spectral range (FSR) of 0.202 and 0.404 nm corresponding to the microrings' diameter of D=2.54 and D=1.27 mm. A high resolution tunable band pass filter (TBPF) and FBG are then used to filter out switchable and tunable dual-wavelength signals. The dual-wavelength fiber laser (DWFL) with different FSR from 0.404 to 3.232 nm as an integer coefficient of minimum obtained FSR presents. The resulting dual-wavelength output had a side-mode suppression ratio (SMSR) of more than 30 dB. Therefore, the microring resonator can be readily integrated into a photonics integrated chip (PIC) for multifunctional applications as the achieved FSR is in linear relation with the ring resonators' diameter.

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