Soutenance de thèse

Jeudi 28 Septembre

15 h, Amphithéâtre C2N

En visioconférence : [https://cnrs.zoom.us/j/96963634802? pwd=K0VycWg2TUI1N2NwYlh0VGJpOEVhZz09](https://cnrs.zoom.us/j/96963634802?pwd=K0VycWg2TUI1N2NwYlh0VGJpOEVhZz09)

Novel optical devices with non-Hermitian physics

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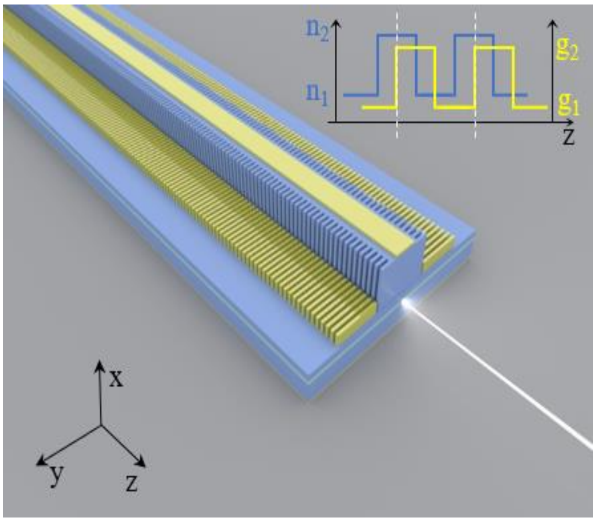
Abstract :
This PhD thesis deals with the development of a new concepts of optical sources exploiting the concept of Hon-Hermitian physics. To this end, two new approaches in the non-Hermitian formalism for achieving single-frequency lasers have been proposed and demonstrated. One demonstration is applying the concept of PT symmetry to the platform of first-order complex coupled Bragg grating distributed feedback lasers. Lower threshold and higher output power, as well as more stable single-frequency emission, were achieved compared to previous work with a PT-symmetric grating operating at third order. An asymmetrical behavior of the external feedback resistance with respect to the phase arrangement modulation for the real and imaginary parts of the PT-symmetrical grating was observed. A complementary concept, still based on the non-Hermitian formalism, exploiting gain-loss modulation using metamaterial gratings to realize single-frequency lasing was experimentally demonstrated at a working wavelength of 1.55 µm. A robust single-frequency laser emission, with an SMSR of 70 dB, was obtained. The concept of non-Hermitian physics has also been applied to the study of optimal detection using Fano resonant metasurfaces. The control of Fano resonance asymmetry and sharpness obtained by navigating between dark mode conditions and exceptional points was demonstrated. Optimal operations with single-layer and double-layer metasurfaces were discussed. The introduction of the third dimension into the system allows greater flexibility to manipulate the spectral response. New additional features resulting in cliff-like Fano resonance have been obtained in the case of an identical double-layer metasurface with deep sub-wavelength cavity length. In addition, tunability mechanisms based on the variation of gain or loss in such types of system have been discussed. The conditions required to reach the dark mode condition corresponding to the lasing threshold have been established.



Legend : Parity-Time symmetry broken DFB Laser