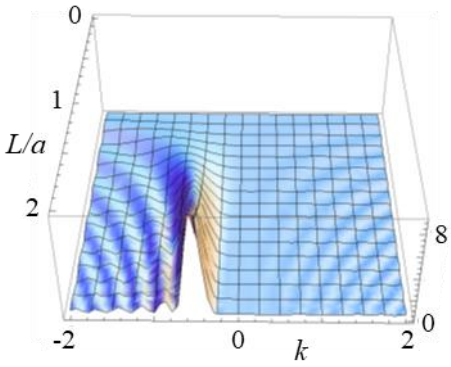
Master in Photonics – "PHOTONICS BCN"
Master ERASMUS Mundus "EuroPhotonics"

MASTER THESIS PROPOSAL

Dates: April 2023 – July or September 2022

Laboratory: DONLL group, Nonlinear Dynamics, Nonlinear Optics and Lasers
Institution: UPC, Universitat Politècnica de Catalunya
City, Country: Terrassa

Title of the master thesis: Asymmetric non-Hermitian polarizers



Asymmetric reflection of polarized light, depending on the direction of incidence (k>0 left incidence, k<0 right incidence)

Name of the master thesis supervisor and co-supervisor: Ramon Herrero, Muriel Botey, Kestutis Staliunas
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Keywords: Non-Hermitian optical systems, Parity-Time symmetry, metamaterials, asymmetric polarizers

Summary of the subject:

Aim: asymmetric left-right polarization selector based on non-Hermitian Photonics

Project. Classical polarizers are based on material anisotropies at the atomic or molecular level giving rise to dichroism and birefringence. Furthermore, structured materials and metamaterials presenting anisotropy can show effective permittivities strongly dependent on the orientation of light polarization relative to the metamaterial periodicities or to the orientation of asymmetric scatters.

Aside, structured media provide the momentum compensation for the scattering of waves. It is well-known that micro- and nano-scale modulations of the refractive index may lead to spatial control over light propagation. The management of the field propagation by photonic crystals (spatial modulations of the refractive index) has been an interesting research line for the control of the light flow, giving remarkable light effects.

Aside, complex spatial modulations, including both refractive index and the gain-loss profiles uncover a novel platform for the smart control of light. These non-Hermitian structures allow the introduction of directional couplings between waves leading to unidirectionalities in light management. Such directional couplings applied to a multidimensional space create directivity fields strongly enhancing the possibilities of light management. Thus, non-Hermitian photonics is amongst the most fertile grounds in optics.

Here, we propose non-Hermitian metamaterials showing asymmetric reflections and transmissions with strong dependences on the light polarization.

Additional information:

* Monthly allowance possible depending on value of candidate

* Recommended skills:
Programming (C++, MatLab,..)
Self-motivated, objective-driven student.

* Miscellaneous :
International environment with collaborations with foreign universities
Possibility of joining the DONLL group for a PhD
Early incorporation welcome.

*Expected outcome: One scientific publication