PhD proposal

Structured light-matter interaction: wave and mechanical aspects

Location: Laboratoire Ondes et Matière d'Aquitaine, Université de Bordeaux, France

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Light can carry both spin and orbital angular momentum, which related to the polarization state of light and its spatial degrees of freedom, respectively. Inhomogeneous and anisotropic media can couple these degrees of freedom, hence leading to spin-orbit interaction for the light field [1]. When a material system is both inhomogeneous and anisotropic, there is room for versatile beam shaping capabilities, including the control of frequency dependence of the spatial properties of light. Recently, we have developed a few options to control the spatial modal content of light using either dielectric metasurfaces [2] or nanostructured glasses [3]. Also, noting that shaping light usually implies the modification of energy flux and of both linear and angular momentum fluxes, the question of whether the mechanical consequences of the shaping process can be used a tool to assess the structural wave properties has been addressed [4]. Now we aim at combining these approaches with frequency dependence toward spatiotemporal shaping of polychromatic light fields and its mechanical counterpart from the material point of view.

The proposed PhD project will take place at Laboratoire Ondes et Matière d'Aquitaine, University of Bordeaux, France, and will be strengthened by a solid international collaborative network within which we are contributing to develop the optics and optomechanics of various kinds of spin-orbit photonic materials.

References

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[2] D. Coursault and E. Brasselet, Nanostructured silica spin-orbit optics for modal vortex beam shaping, Nanophotonics 11, 805-812 (2022).

[3] M. Jin, B. Sanchez-Padilla, X. Liu, Y. Tang, Z. Hu, K. Li, D. Coursault, G. Li, and E. Brasselet, Spin-orbit modal optical vortex beam shaping from dielectric metasurfaces, Advanced Optical Materials, 2202149 (2022)

[4] M. El Ketara, H. Kobayashi, and E. Brasselet, Sensitive vectorial optomechanical footprint of light in soft condensed matter, Nature Photonics 15, 121-124 (2021)

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