Doctoral positions
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Thesis supervisor

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Thesis topic: Sound and light localization on a random metasurface

The study of optical and acoustic waves in complex media has considerably evolved over the last decades and has largely contributed to break conventional physical limitations such as the sub-wavelength focusing of waves. In parallel, the coupling of phonons and photons in a same platform has been extensively studied, giving rise to a new class of artificial ordered materials, the phoXonic crystals which simultaneously present phoNonic and phoTonic crystals properties. The PhD work aims to investigate the role of the disorder, strictly controlled by mathematical probability laws, in the wave transport.

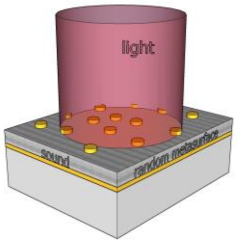

Figure 1: *3D schematic general principle of the RANDOM phoXonic metasurface. The different colors correspond to the materials involved in the structure, i.e. Au (yellow), and* SiO_2 *(grey)*

Actually, when an ordered system is structurally disturbed, the waves propagating there undergo multiple diffusions which, for important degrees of disorder, lead to the spatial confinement of the waves. It is this phenomenon that we want to demonstrate experimentally in two-dimensional random environments (see Figure), the ultimate goal being to locate elastic waves and electromagnetic waves on the same sites. In addition to its interest for a better global understanding of the behavior of localized waves, this metasurface must ultimately enable the co-localization of photons and phonons on clusters of diffusers with lateral dimensions smaller than $\lambda/10$, where λ is the common value of optical and acoustic wavelengths.

This extreme confinement is expected to exalt the photon-phonon coupling with the perspective of applications for the coding of information: elastic modes randomly located on the metasurface can be seen as states 0 or 1 that can be further read by the optical modes when they are located on the same sites.

Type of thesis: Experimental

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