Post-doctoral position opening

Light localization and absorption in complex environments

Host laboratory: Institut Langevin, ESPCI Paris, CNRS
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Project and position Waves propagation in complex environments is a very active field of research for many years because it covers a large set of physical systems including e.g. electronic transport, matter wave physics or acoustical and optical waves propagation in disordered media.

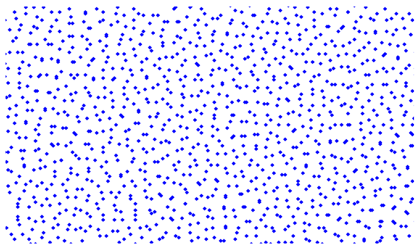

Figure 1 – A hyperuniform structure.

Currently, significant research efforts focus on the control of wave propagation in such systems. This can be done by shaping the wavefront [1] with potential applications in imaging. But it can also be done through the control of the structural correlations of the system. The local order at play can have a strong impact on the optical properties of a scattering medium. For example, hyperuniform structures, a new emerging class of correlated materials, can be dense and transparent at the same time [2] which shows the huge impact of scatterers positions rearrangement on the scattering mean-free path. This makes these materials of primary interest to enhance light-matter interaction and, in the same way, we can wonder if these structures are good candidates for light absorption enhancement.

Another way to make light strongly interact with matter consists in considering the ANDERSON localized regime, a transport regime where a disorder medium behaves as a cavity and can confine light in very small regions of space defined by the localized modes extents. The strong light confinement can be used for example to achieve strong coupling between a scatterer and a localized mode [3]. Historically, this regime was also proposed to enhance the absorption level in a complex system [4].

The main objective of this post-doctoral position is to investigate the possibility to control and design the disorder to optimize the power absorbed by a material. For that purpose, the ANDERSON localized regime can be a starting point because of the high interaction degree between wave and matter. Nevertheless, light confinement makes the injection of energy in the system difficult and disorder correlations could help light penetrating the structure. This is the reason why a correlated disordered structure near the ANDERSON localized regime could be a good candidate and will be studied with great attention. This question will be addressed theoretically and in the light of intensive numerical simulations.

Application Applicants should have a PhD in wave physics with a solid experimental and/or theoretical background on waves propagation in disordered materials. Specific numerical skills are welcome. The position is for one year with a possibility for a second year and is funding by a project of the

French National Agency for Research (ANR). Applicants should submit a motivation letter and a resume to Romain PIERRAT (romain.pierrat@espci.fr) and Rémi CARMINATI (remi.carminati@espci.fr). Please provide also the name and contact information of two reference persons if possible.

The successful candidate will be integrated to the team "Mesoscopic and Theoretical Optics" of the Langevin Institute in Paris, France [5].

The call will remain open until the position is filled and the starting date is negotiable.

References

[1] S. Popoff, G. Lerosey, M. Fink, C. Boccara, and S. Gigan, *Nat. Commun.* **1**, 81 (2010).

[2] O. Leseur, R. Pierrat, and R. Carminati, *Optica* **3**, 763–767 (2016).

[3] A. Cazé, R. Pierrat, and R. Carminati, *Phys. Rev. Lett.* **111**, 053901 (2013).

[4] S. John, *Phys. Rev. Lett.* **53**, 2169–2172 (1984).

[5] https://www.institut-langevin.espci.fr/metheo.