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Post-doctoral position opening

Theoretical and numerical investigation of photon thermalization in scattering media

Host laboratory: Institut Langevin, ESPCI Paris - PSL, CNRS
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Supervisor: Romain PIERRAT, CNRS researcher
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Co-supervisor: Rémi CARMINATI, Professor at ESPCI Paris - PSL
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Project Coupling quantum emitters to photonics cavities is a common way to control light-matter interaction and produce light sources operating in different regimes (LEDs, lasers, etc). Multiple scattering in a disordered medium is another and apparently simple way to enhance the interaction between an ensemble of emitters immersed within the medium and the emitted light. In particular, when the system size exceeds the scattering mean free path, photons undergo a diffusive random walk that increases the interaction with the emitters, thus mimicking the effect of a cavity. This idea led in particular to the concept of random lasers [1].

Beyond the example of random lasing, other regimes exist that combine quantum emitters and strong scattering and which have remained largely unexplored. In cavities, the phenomena of photon thermalization [2] and condensation [3] have already been observed. Simple theoretical calculations and preliminary experiments suggest that these regimes might be accessible in disordered environments.

The goal of the project is to study different regimes of light emission and propagation in strongly scattering media, especially photon thermalization and condensation. Various types of scatterers and emitters will be tested under a range of experimental conditions. The post-doctoral fellow will be in charge of the theoretical and numerical tasks (especially the development of a transport model coupling a rate equation with a radiative transfer equation), the numerical implementations and the theoretical investigations and interpretations.

Application Applicants should have a PhD in physics with a solid theoretical background on wave propagation in scattering media. Specific numerical skills are welcome. The position is for 18 months and is funding by an ANR project covering both the experimental and theoretical aspects of photon emission in fluorescent scattering media. The ability to work as part of a team and good communication skills are essential, as the post-doc will be working closely with all partners. Applicants should submit a motivation letter and a resume to Romain PIERRAT (romain.pierrat@espci.psl.eu) and Rémi CARMINATI (remi.carminati@espci.psl.eu). Please provide also the name and contact information of two reference persons if possible.

The successful candidate will be integrated to the theme "Theory of Waves" of the Langevin Institute in Paris, France [4]. The call will remain open until the position is filled. Planned starting date: second half of 2026.

References

[1] D. S. Wiersma, *Nat. Phys.* **4**, 359 (2008).

[2] J. Klaers, F. Vewinger, and M. Weitz, *Nat. Phys.* **6**, 512–515 (2010).

[3] J. Klaers, J. Schmitt, F. Vewinger, and M. Weitz, *Nature* **468**, 545–548 (2010).

[4] https://www.institut-langevin.espci.fr/tdo.