



## Post-doctoral position opening

### Optical properties of complex disordered materials with structural correlations

**Host laboratory:** Institut Langevin, ESPCI Paris - PSL, CNRS  
1 rue Jussieu, 75005 Paris, France

**Supervisor:** Romain PIERRAT, CNRS researcher  
romain.pierrat@espci.psl.eu

**Co-supervisor:** Rémi CARMINATI, Professor at ESPCI Paris - PSL  
remi.carminati@espci.psl.eu

**Project** Wave scattering and propagation in complex disordered environments has been a very active field of research for many years, covering a wide range of physical systems (bulk materials, thin films, biological tissues, ...) and numerous applications (imaging, sensing, ...).

Currently, significant research efforts focus on the control of light scattering through the control of structural correlations in the positions of scattering centers in an otherwise continuous matrix [1]. As an example, hyperuniformity, a peculiar class of structural correlations, can induce transparency [2] or enhance absorption [3, 4]. This proves that structural correlations can have a huge impact on the optical properties of disordered materials.

The main objective of this post-doctoral position is to investigate theoretically and numerically the possibility to design correlated materials with predefined optical properties, such as target reflected and transmitted spectra. A feature of the work is that fabrication constraints will be taken into account from the outset, through a connection with experimentalists at ESPCI Paris - PSL, experts in soft matter physics. An effort in quantitative modelling will be carried out, through code development (Monte Carlo for light transport, T-matrix method, ...). Various types of scatterers (spheres, core-shells) and interactions (hard spheres, colloidal suspensions, ...) will be considered, in order to map a phase-space of realistic materials.

**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 one year with a possibility for a second year and is funded by a major French company with strong international presence, extensive R&D and patenting activities. 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 academic and industrial 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 [5]. The call will remain open until the position is filled. Planned starting date: July 2025.

## References

- [1] K. Vynck, R. Pierrat, R. Carminati, L. S. Froufe Pérez, F. Scheffold, R. Sapienza, S. Vignolini, and J. J. Sáenz, *Rev. Mod. Phys.* **95**, 045003 (2023).
- [2] O. Leseur, R. Pierrat, and R. Carminati, *Optica* **3**, 763–767 (2016).
- [3] F. Bigourdan, R. Pierrat, and R. Carminati, *Opt. Express* **27**, 8666–8682 (2019).
- [4] A. Sheremet, R. Pierrat, and R. Carminati, *Phys. Rev. A* **101**, 053829 (2020).
- [5] <https://www.institut-langevin.espci.fr/tdo>.