Postdoctoral fellowship

Correlated disordered materials for broadband absorption of light

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The design of strong absorbers of light (and more generally waves) with broadband and wide angular acceptance is of interest for many applications (e.g. in sensing or heat transfer). Materials made of scatterers or absorbers randomly distributed in a matrix are appealing, due to the possibility to fabricate them using self-assembly techniques, and to their expected robustness to fabrication imperfections.
Recently, we have demonstrated the possibility to make either transparent of strongly absorbing materials using hyperuniform disorder, a special class of correlated disorder [1,2]. These studies were mostly based on numerical experiments, and developing a real theory of absorption in hyperuniform correlated materials will be an important step.

The purpose of the project is to develop a theoretical framework to compute the scattering and absorption mean free paths in a disordered material in the presence of spatial correlations, and to deduce the dependence of the average absorbed power on the level and type of correlations. A possible approach is to develop a diagrammatic theory for the averaged absorbed power, in which the influence of the structure factor of the medium is explicit. The theory will be checked against numerical simulations using a coupled dipole or a T matrix method. The theory should lead to a strategy to maximize the absorbed power by changing only the degree of correlations in the disorder, and to provide estimates of the bandwidth and angular acceptance.

Profile: the candidates should have a PhD in physics, with an expertise in modeling of light-matter interaction in complex environments, and an experience in numerical simulation.

[1] O. Leseur, R. Pierrat and R. Carminati, *High-density hyperuniform materials can be transparent*, Optica 3, 763 (2016).
[2] F. Bigourdan, R. Pierrat and R. Carminati, *Enhanced absorption of waves in hyperuniform disordered media*, submitted (2018). http://arxiv.org/abs/1806.08188