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Institut Langevin
ONDES ET IMAGES

Postdoc position

A matrix approach of elastic wave scattering on a percolated disordered network

A one-year Post-Doc position is opened at Institut Langevin, an internationally renowned research unit dedicated to wave physics and its applications (https://www.institut-langevin.espci.fr/home).

The Post-Doc is funded by LabEx (Laboratory of Excellence) WIFI (Waves and Imaging from Fundamentals to Innovation) within the French Program "Investments for the Future".

Duration: one year

Expected date of employment: from October 2019

Salary: about 2600 € net of tax

Description: dry granular media are assemblies of macroscopic grains that interact through repulsive and frictional contact forces. They may serve as a model system for athermal amorphous media or seismic fault gouges. For given values of macroscopic control parameters, such as the packing density and the confining pressure, they exhibit many microstates, each characterized by a specific highly heterogeneous contact force network that can rearrange under driving. Among systems that scatter waves, granular media are a very special case. Elastic waves propagate from grain to grain, thus providing a unique probe of the contact force network[1]. In this project, the Post-Doc will study the possibility of probing the contact force network via a matrix approach that has already been the subject of numerous studies at the Langevin Institute, since the pioneering work in acoustics[2,3] to the most recent work in optics[4,5]. To this end, sound propagation through a granular medium will be modeled numerically on the basis of a random network of point-like masses (grains) interacting with each other via linear springs[1,6,7].

Tasks: the hired Post-Doc will adapt the existing code in order to build the transmission matrix, T, of the mass-spring network. The first issue will be to check if the number of significant eigenvalues in transmission (i.e., the eigenvalues of the Time Reversal Operator $TT^{\dagger}$) can be related to the number of percolation paths and to determine if these latter can define *particle-like scattering states*, a concept introduced by S. Rotter[8]. Particle-like scattering states can be found as the eigenstates of the Wigner-Smith matrix and are connected to the paths according to which the wave can maintain both spatial and temporal coherence.

Skills: the candidate is required to have an excellent knowledge of theoretical and numerical approaches of wave propagation in complex media. The hired Post-Doc will be creative and motivated. He/she will be able to work independently as well as to regularly communicate with the team members.

Application modalities: candidates are requested to send a detailed CV, a motivation letter and at least one recommendation letter from a reference researcher to Prof. Arnaud Tourin (arnaud.tourin@espci.psl.eu) and Prof. Xiaoping Jia (Xiaoping.jia@espci.psl.eu).

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