

Statistical Mechanics and Complexity

Post Doc Position in Statistical Mechanics and Inference of Light in Random Media

Statistical physics approaches have become more and more important in the investigation of optical systems in random media. Because of disorder and nonlinearity, light scattering through opaque media and random fibers, as well as light amplified by stimulated emission - the so-called random lasers - turn out to display complex collective behavior that can be accounted for by statistical mechanical models. In particular, a graphical model characterisation of interacting light mode networks can be implemented allowing for an analysis of the optical properties such as, e. g., interference, transmission, gain and amplification, spectral emission, phase locking, in terms of mode interactions and competition. This approach not only yields fundamental insight on complex optical phenomena at the theoretical level but turns out to be effective also for computational and experimental applications.

The project proposed for this position will be dedicated to

- build and exploit graphical model representation of linearly and non-linearly interacting light mode networks;
- apply and develop statistical inference state-of-the-art techniques on random graphical models with continuous variables, in an inverse problem approach;
- optimize inference methods both for sparse and dense graphs, including the influence of light-mode frequencies and the occurrence of phase locking;
- apply statistical inference to study light propagation through random media, including transmission matrix reconstruction and imaging;
- investigate the formal link between mode-locking statistical physics models and optimization problems in computer science;

The successful candidate will be affiliated to the **CNR Institute of Nanotechnology** - nanotec.cnr.it - for one year. She/he will work in the Rome Unit of the Institute, by the Department of Physics of Sapienza University, will have access to computing facilities, will have considerable financial support to attend conferences and workshops and will enjoy a very lively research environment at the interface between statistical physics, photonics and high performance computing. The expected net amount of the fellowship is about € 24.000 per year.

The research projects will be performed under the supervision of **Luca Leuzzi**.

Candidates with a strong background in statistical physics and parallel CPU and GPU computing are encouraged to apply by sending a CV, as well as three names of references for letters, to luca.leuzzi@cnr.it

Review of applications will be taken up by the end of September 2017, and will continue till the position is filled.