

Seminar/Talk

Non-linear optical processing with random media

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Host: Charles Roques-Carmes

Multiple scattering of light in a disordered medium is usually seen as a nuisance to be corrected, for instance in imaging. Yet a scattering medium is also an extremely rich physical system: it mixes an enormous number of optical modes in a fixed, deterministic way, and can therefore act as a very large random matrix multiplier for information encoded on the light field. In this talk, I will show how this property can be harnessed to perform computations at scale, with applications ranging from random projections for machine learning and optical reservoir computing to the acceleration of large-scale inference. Linear scattering alone, however, is not sufficient: non-linearity is the key ingredient of any expressive neural computation. I will discuss several strategies to introduce non-linearity into scattering-based optical processors, from the non-linearity of intensity detection and data re-encoding, to recurrent linear scattering, to genuinely non-linear disordered materials. I will conclude with perspectives on how such physical systems can be trained, and what they could offer in terms of energy efficiency and scalability. Sylvain Gigan has been a Professor of Physics at Sorbonne Université since 2014. He conducts his research at the Kastler Brossel Laboratory (Physics Department of the École Normale Supérieure), where he leads a research group dedicated to photonics and complex media.After earning his PhD in quantum optics at UPMC in 2004 under the supervision of Claude Fabre , he joined the University of Vienna (Austria) as a postdoctoral researcher in the group of Markus Aspelmeyer and Anton Zeilinger, working on quantum optomechanics. From 2007 to 2014, he was an Associate Professor at the Langevin Institute (ESPCI ParisTech), where he pioneered his research on controlling light in complex media. His current work focuses on wave propagation in highly scattering media. Historically centered on deep imaging and mesoscopic physics, his research has now expanded to harnessing optical disorder for high-dimensional quantum information and optical computing (hardware acceleration for artificial intelligence). In 2016, his fundamental research led to the co-founding of the spin-off LightOn.

Thursday, October 15, 2026 02:00pm - 03:00pm
Heinzel Seminar Room

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