

Short course

Quantum Optics in Complex Media

Speaker: Prof. Yaron Bromberg, The Hebrew University

September 22 – October 12, 2026

This short course introduces **graduate students, PhD students, researchers**, to the basic **concepts of quantum optics** and their application to **light propagating through complex media**. We will discuss photons and quantum **interference**, the generation of spatially **entangled photon pairs**, and how their **correlations** change as they propagate through **scattering media**. We will then explore ways to **control quantum light** and use spatially entangled photons for **quantum information** processing, including quantum key distribution, cluster states, and measurement-based quantum computation.



The course combines **tutorials** and **research seminars**. The tutorials will provide the **foundations** and some **historical background**, while the seminars will build on these ideas through **examples from our lab**. Throughout, we will discuss the connections and **differences between classical and quantum optics**, including how techniques developed for controlling classical light can be applied to quantum light.

Basic familiarity with optics and quantum mechanics is assumed, no prior background in quantum optics is required. Each research seminar will include a brief introduction so that it can also be attended independently.

Registration : Free of charges but registration mandatory. <https://evento.renater.fr/survey/short-course-quantum...-fupkxfww>

Where : Sorbonne Université – Campus Jussieu (4, pl. Jussieu, Paris 5e, Metro Jussieu) – Between towers 12 and 22, room 426 (4th floor).

Schedule :

Date	Topic	Duration
Tuesday, September 22	Tutorial 1: Photons, photon statistics, correlations, the Hanbury Brown-Twiss (HBT) experiment, and quantum interference.	2 hours
Thursday, September 24	Tutorial 2: Spontaneous parametric down-conversion (SPDC) and spatial entanglement.	2 hours
Monday, September 28	Tutorial 3: Scattering of entangled photon pairs, two-photon speckle, and the advanced-wave picture.	2 hours
Thursday, October 1	Seminar 1: Wavefront shaping of quantum light in random media.	1 hour
Monday, October 5	Seminar 2: Coherent backscattering of spatially entangled photon pairs.	1 hour
Monday, October 12	Tutorial 4 + Seminar 3: Quantum information processing with spatially entangled photons.	1-hour tutorial + 1-hour seminar