MSCA Postdoctoral Fellowships at Sorbonne University
Call for expression of interest 2024

PHYSICS	
Code	**Topics and supervisors / research units**
PHY1	**Taking photos of entanglement** Hugo Defienne - Institut des NanoSciences de Paris (INSP) - Paris
	The researcher will investigate the problem of the certification of high-dimensional entanglement in photonics system. They will develop approaches to certify entanglement of unknown quantum states in an efficient (fast) and reliable (no assumptions) way by combining quantum imaging and structured light techniques. Tackling this challenge is a necessary step before any practical quantum information processing protocols based on high-dimensional entangled states can be developed.
PHY2	**Cooperative light emission from self-assembled semiconductor nano-objects** Laurent Coolen - Institut des NanoSciences de Paris (INSP) - Paris
	The aim will be to examine whether an ensemble of solid-state luminescent nano-emitters can exhibit superfluorescence, a mechanism by which incoherently excited dipoles spontaneously develop a coherence and interfere constructively. By microphotoluminescence, we will probe single self-assemblies of CdSe nanoparticles. This work is a collaboration with chemists for the particle assembly and theorists for the superfluorescence modelling.
PHY3	**Next-Generation Theory and Simulation of Open Quantum Systems with Tensor Networks** Alex Lin - Institut des NanoSciences de Paris (INSP) - Paris
	Real-world quantum systems are unavoidably coupled to macroscopic environments, leading to the emergence of phenomena such as decoherence that greatly limit the power of current quantum technologies (QTs). Our recent development of state-of-the-art tensor algorithms for open systems now allows these irreversible processes to be studied microscopically, and this project will advance these codes to explore how dissipative effects can be suppressed or or even exploited in future QTs.
PHY4	**Transient Reflection Microscopy of Solar Energy Conversion** James Utterback - Institut des NanoSciences de Paris (INSP) - Paris
	Charge transport across microscopic interfaces is fundamental to solar energy conversion, yet important questions about charge transport under realistic device conditions remain underexplored. The approach of this project will be to use pump-probe microsocpy to image local energy-carrier dynamics and transport under the influence of interfaces, defects, spatioenergetic heterogeneity in samples related to light energy conversion applications such as optoelectronics and photoelectrochemistry.

MSCA Postdoctoral Fellowships at Sorbonne University
Call for expression of interest 2024

PHY5	**Hydrogen in titanium dioxide: an overlooked issue ?** Rémi Lazzari - Institut des NanoSciences de Paris (INSP) - Paris
	In the context of photocatalysis, the role of H insertion in TiO2 is often overlooked. The issue will be tackled by a surface science approach on single-crystal surfaces using electron spectroscopies and near-field microscopy. The interplay between polaronic excess electrons, band-bending and intrinsic defects will be scrutinized by comparing controlled exposure of TiO2 to H2O and H. Information on sub-surface electronic and dielectric properties will be gained from (HAX)PES and HREELS.
PHY6	**Quantum information and sensing : defects as assets** Jean-Louis Cantin - Institut des NanoSciences de Paris (INSP) - Paris
	Quantum information and sensing can be realized by using spin states of point defects in semiconductors. Electron Spin Resonance allows the identification and manipulation of electronic spin of isolated defects and will be applied to study new systems capable to act as quantum bits, in silicon carbide and related materials. Optically or electrically detected spin resonance can be promoted during the fellowship. Experience in optics, magnetic resonance and programming is highly welcome.
PHY7	**Optics of complex media for computing and imaging** Sylvain Gigan – Laboratoire Kastler Brossel (LKB) - Paris
	Our team study light propagation in complex media, an ubiquitous phenomenon ranging with applications from biological imaging, sensing, to astronomy. The succesfful candidate will explore how computational tools (signal processing, machine learning) can be exploited to improve optical imaging in complex media, and conversely how propagation in complex media can be exploited to perform meaningful information processing information, in particular for machine learning tasks.
PHY8	**Quantum Simulation of Fermionic Matter at the Single Atom Level** Tarik Yefsah – Laboratoire Kastler Brossel (LKB) - Paris
	Atom-based quantum simulators have had tremendous success in tackling challenging quantum many-body problems. Here, we will use a 6Li-based quantum simulator featuring single-atom imaging and control, to explore some of the most challenging questions of strongly-correlated fermionic matter: from the BEC-BCS crossover in 3D and 2D, to frustrated magnetism in triangular lattices, to quantum Hall Physics.
PHY9	**Exploitation of the DAMIC-M direct dark matter search experiment at Modane** Antoine Letessier Selvon – Laboratoire de physique nucléaire et de hautes énergies (LPNHE) - Paris
	The project will initially focus on the installation and commissioning of the detector and then on the exploitation and analysis of data. Several subjects of analysis will be possible, ranging from the search for light WIMPS, to that of leptophilic dark matter or other candidate from the dark sector. The fellow will be required to regularly present his work to the international collaboration, which has very strong links with the University of Chicago and of Seattle in the United States.

MSCA Postdoctoral Fellowships at Sorbonne University
Call for expression of interest 2024

PHY10	**Particle simulations of shocks in weakly collisional plasmas** Andrea Ciardi – Laboratoire d'Etudes du Rayonnement et de la Matière en Astrophysique et Atmosphères (LERMA) - Paris
	Shocks stand as Nature's universal mechanism to efficiently convert kinetic energy into heat and radiation, as well as driving particle acceleration and turbulence. The project centres on employing cutting-edge simulations to understand the pivotal role played by wave-particle interactions, as well as Coulomb collisions on the formation and dynamics of shocks in plasmas. Insights gained will have broad applications in astrophysics, fusion research, and space science.
PHY11	**Investigation of the 3D to 1D thermoelectric transport in layered transition metal dichalcogenides** Yannick Klein – Institut de Minéralogie, de Physique des Matériaux et de Cosmochimie (IMPMC) - Paris
	Low-dimensional materials have been predicted to be superior thermoelectric (TE) materials. We have recently demonstrated a record high power factor in 2D Bi2O2Se. We aim to investigate the evolution of the TE properties as a function of the dimensionality in a range of competitive materials. These latter will be grown by chemical vapor transport at a 3D scale before extracting nano-layers (2D) by exfoliation procedure and 1D nano objects using a recently developed nanofabrication method.