Master 2: *International Centre for Fundamental Physics*

INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Institut des nanosciences de Paris (INSP)
CNRS identification code: UMR 7588
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Internship location: Jussieu Campus 75005 Paris

Thesis possibility after internship: YES
Funding: NO

Theory of cooperative multi-charge quantum dynamics in organic nanomatter

Nature has developed complex nanostructures that convert energy into functions like photosynthesis, sensing, catalysis... with incredible energy and material efficiency, e.g. [FeFe]-hydrogenases. Remarkably, some proteins can coordinate **joint quantum dynamics** of Proton-Coupled Electron Transfer (PCET) [1] so that simultaneous process is much faster than two sequential transfers - but underlying role of quantum correlations and protein environment remains to be explored.

This project will use advanced theory and numerical techniques to explore on realistic model systems the fundamental physics behind 'energy processing' and transport in PCET, aiming to show how quantum-correlated real-time dynamics could lead to novel non-classical design concepts for efficient nanomachines.

[1] O. Lampret, J. Duan, E. Hofmann, M. Winkler, F. A. Armstrong and T. Happe, PNAS **117,** 20520 (2020).

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES Biological Physics: YES
Quantum Physics: YES Theoretical Physics: YES