

INTERNSHIP PROPOSAL

(One page maximum)

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Internship location: LPENS/LPEM

Thesis possibility after internship: YES

Funding: NO

If YES, which type of funding:

Probing the cosmic dawn with a quantum correlator

The constant pace of discoveries of new radio sources in the Universe calls for new receivers which would be faster, more sensitive and less subject to parasitic signals. An outstanding problem which could benefit from new detection schemes is, for example, the accurate measurement of the 21-cm, strongly red-shifted, cosmological signal, in the low 100 MHz range. Many pioneering experiments have been carried out, such as EDGES, REACH, NENUFAR or SARAS, but the cosmological signal has been elusive so far.

The main idea to be developed in this project is to use quantum technologies, and in particular multicavity setups with granular aluminum Josephson circuits in order to develop a quantum correlator which could unlock very feeble cosmological signals connected to deep questions about the early universe or fast bursts entailing ununderstood astrophysical processes. We have recently shown that we could have a clear advantage of a cavity quantum electrodynamics setup over a classical receiver chain for the very low redshifted 21-cm signal from benchmark constellations such as the Cygnus or Cassiopea. We would like to test the same ideas on a quantum correlator first on pulsars or galactic masers as a benchmark before going to the very high redshifted signals.

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

Condensed Matter Physics: YES/NO

Soft Matter and Biological Physics: YES/NO

Quantum Physics: YES/NO

Theoretical Physics: YES/NO