

INTERNSHIP PROPOSAL

Laboratory name: Laboratoire de Physique des Solides	
CNRS identification code: UMR8502	
Internship director's surname: Siham Benhabib & Marino Marsi	
e-mail:	
siham.benhabib@universite-paris-saclay.fr	
mrino.marsi@universite-paris-saclay.fr	Phone number: +33169155395
Web page : https://equip2.lps.u-psud.fr/puls/	
Internship location: University Paris Saclay, Bat. 510, 91405 Orsay Cedex	
Thesis possibility after internship:	YES
Funding: NO	If YES, which type of funding:

Title: The quest for quantum supreme matter in strange metals

Understanding interactions in quantum matter is one of the most complex assignments in contemporary research. In condensed matter, the strong interactions generate strange metals. They are hallmarked by a linear electrical resistivity unaccountable by textbook theories [1]. A new theoretical approach explains the anomalous behavior of strange metals by the presence of two charge sectors, conventional and entangled [2]. The latter generates a quantum limit that breaks the concept of quasiparticles, for unparticle physics, giving rise to power law scaling in the electronic properties. In this approach, the strange metal is seen as a many-body entangled problem with a complexity that can be solved only by quantum computers, thus named Quantum Supreme Matter [3].

In this internship will investigate the strange metal phase of high T_c superconductors (cuprates) by means of time-resolved angle-resolved photoemission spectroscopy (tr-ARPES) to study the ultrafast relaxation process in strange metal phase, seeking a major hallmark of unparticle physics as a signature for the quantum supreme matter. The student will use a unique platform for tuneable pump time-resolved micro ARPES located at LPS. Furthermore, She/he will consolidate tr-ARPES studies by electronic Raman scattering measurements at Institut Néel (Grenoble). This proposal is in collaboration with various experimental and theoretical collaborators located in Institut Néel Grenoble, TU Wien Vienna (Austria), Leiden (Netherlands), EPFL (Switzerland) and Paris Saclay plateau (Ecole Polytechnique and Soleil synchrotron).

[1]: Schofield, A. J. *Contemp. Physics.* 40, 95 (1999)

[2]: Zaanen, J. *SciPost Phys.* 6, 061 (2019)

[3]: Zaanen, J. *arXiv :2110.00961v1* (2021)

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

Condensed Matter Physics: YES	Soft Matter and Biological Physics: NO
Quantum Physics: YES	Theoretical Physics: YES