

## Proposition de stage/thèse 2011-2012.Spécialité : NPAC

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### Titre de la thèse :

### Neutrinos as probes of new physics

### Lieu de travail :

IPN Orsay

### Sujet et nature du travail proposé :

Neutrino physics has entered a crucial phase. New experimental results will soon be available on important unknown neutrino properties such the third neutrino mixing angle or the neutrino nature, while several anomalies have been observed in running experiments that are currently the object of intense debate world-wide. These can represent indications for new physics and might receive confirmation in the near future. Key open questions include the possible existence of CP violation in the neutrino sector, or neutrinos being superluminal.

The theoretical thesis proposed focusses on forefront research in neutrino physics and its interfaces with astrophysics and/or cosmology. The goal is to study both the implications of key unknown neutrino properties in environments, such as supernovae or the early universe, and to push our understanding of neutrino flavour conversion in these media. Main developments are ongoing in this rapidly evolving domain, where unexpected new phenomena have been discovered. In this context, for example, we have recently realised pioneering work establishing the existence of effects, in media, from CP violation in the neutrino sector. We have also established a new connection between neutrino flavour conversion in supernovae and the magnetic resonance phenomenon. The object of the thesis will be to tackle the important open questions in the context of neutrino flavour conversion in media and its link with unknown neutrino properties. Other aspects of neutrino physics can be developed, depending on the upcoming experimental results. The thesis can cover both theoretical and phenomenological aspects depending on the interests of the candidate.