Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Study of cosmological biases induced by Type Ia Supernovae new variabilities

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Summary :

1998 was an exceptional year for cosmology : the repeated observation of type Ia supernovae led to the conclution that the expansion of the Universe was undergoing an acceleration, and not a deceleration as expected. This astounding discovery was the first cornerstone of the cosmological concordance model, which is based on the assumption that a new force, called Dark Energy, is responsible for this acceleration. Yet little is known about the nature of this Dark Energy.

Since this discovery, numerous studies were devoted to the standardization of Type Ia supernovae, that is, how to properly take into account the variation of the luminous signal observed from one object to another when deducing the comological parameters. This long-lasting effort led our team to develop a new model of Type Ia supernovae spectral variability, which implies the existence of 2 new factors affecting the observed luminosity.

The aim of the PhD is to explore the cosmological consequences of these 2 new factors: are there biasses present in other methods that our new scheme allows to properly account for ? What is the link between these factors and host galaxy properties ? Which lessons are to be learnt in the view of future surveys like LSST ?

The PhD will use existing data sets such as CHFT/JLA data and/or SNFactory data as well as simulation data when appropriate to explore the consequences of the new model. The sucessful candidate should be proficient with numerical and statistical tools, as well as able to program specific algorithms in Python and C++. A strong cosmological background is also a requirement, in order to understand how biasses in Type Ia supervnoae measurements will impact cosmological analysis.