

# Title: **First light of the Rubin Observatory / LSST : toward the next generation of cosmological constrains.**

**Thesis director:** Pierre Antilogus    Tel : (+33) 6 61 52 75 18

e-Mail: [Pierre.Antilogus@in2p3.fr](mailto:Pierre.Antilogus@in2p3.fr)

**Group** : LPNHE Group of Cosmology

**Laboratory** : LPNHE, Sorbonne University , Tour 12-22 1<sup>er</sup> étage,  
4 Place Jussieu, 75252 Paris Cedex 05, France

**Web links :** [Rubin Observatory](#) , [Dark Energy Science Collaboration](#) , [LSST camera](#) , [LPNHE Laboratory](#) , [LSST in France](#)

**Work Place :** LPNHE, Sorbonne University campus in Paris + travels to the US and Chile.

**Collaboration Name:** Rubin Observatory , LSST - DESC

**Research field :** cosmology & instrumentation/data analysis

**Language :** English ( or French )

## **Description of the thesis work:**

The telescope of the V.Rubin Observatory is a wide field 8m class telescope that will see its first light mid-2024 in Chile. It will play a unique role in observational cosmology through its Legacy Space and Time Survey (LSST) , which corresponds to a continuous deep full sky survey running for 10 years, starting in late 2025.

The LPNHE Cosmology group is involved in key projects to study the Dark Energy .Today, in the group, 9 staff scientists , 2 Pdoc and 5 PhD are preparing the LSST first light. The group plays a central role in the usage of the Supernova Ia (SNIa) in cosmology. Following the evolution for the new generation of cosmological projects (LSST, Euclid, DESI) , it extended its activity to a multi-probe approach including SNIa , weak lensing and BAO cosmological probe. Starting in 2006, the group has been an early contributor to the LSST project . It has done key contributions to its camera construction, namely its focal plane and filter exchange system and it is involved in the preparation of the LSST survey calibration .

The PhD will append during the V.Rubin Observatory first light and camera commissioning combined with the first LSST data. The proposed work will cover two aspects:

- It will have a strong focus on the camera and survey commissioning during the first year. The LSST focal plane is the largest existing focal plane (201 CCD for a total number of pixels of  $\sim 3,2 \cdot 10^9$  and a field of view of  $9.6 \text{ deg}^2 \sim 40$  times the apparent surface of the moon). The requested precision for the LSST science implies a precise understanding of the instrumental signature removal of its sensors. This will be a key for the LSST success, in particular for CCD effects impacting the shape and flux measurements, both quantities being at the core of the cosmological probes measurements . Using commissioning data the PhD student will work on these effects with the support of the LPNHE group which has a strong expertise on sensor.

- Using her/his knowledge obtained during the commissioning phase, the PhD student will contribute to the first cosmological analyses within the LPNHE group. The focus will be on the systematics to the cosmological probes (SNIa vs flux biases or weak lensing vs shape biases), induced by the CCD instrumental signature removal applied. This is part of a global effort on the systematics , as their understanding and control will ultimately fix the precision of the futur LSST cosmological constrains.

The PhD student will join the LPNHE laboratory on the Jussieu campus of the Sorbonne University in the center of Paris. Still a direct contribution in Chile to the commissioning may imply ~ 2-3 months stay on the V.Rubin observatory site during the PhD.