

Laboratoire de Physique de Clermont (LPCA) – Cosmology Team

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Title of internship subject

Uniformity study of the Supernovae survey with LSST

Summary :

The Vera C. Rubin Observatory is located on the Cerro Pachon (2680 m) in North Chile. It will conduct the Legacy Survey of Space and Time (LSST), a synoptic astronomical survey of large étendue (more than 20000 deg²) starting in 2025. A systematic scan of the celestial sphere will be performed for ten years, leading to the largest astronomical catalog ever compiled (83 pB) with 17 billions of stars and 20 billions of galaxies.

The Cosmological Principle (CP) is a working assumption in modern cosmology stating that the spatial distribution of matter in the universe is uniformly isotropic and homogeneous at large (enough) scale. Probing the CP is a way to unveil the underlying mechanism leading to cosmic expansion. It is possible to use SNe Ia to study anisotropies by performing measurements of the cosmological parameters at various points in space. With a mean density of ~5-10 observed SNe Ia per deg², LSST could be a key survey for the measurement of cosmic expansion anisotropy.

Measuring cosmic expansion anisotropy requires collecting a uniform sample of SNe Ia in (Right Ascension, Declination, redshift) so as to perform studies using patches covering the entire observable sky. The (RA, Dec, z) distribution of the SNe Ia sample depends on the observing strategy characterized by the cadence and the number of visits per observing night and per band. The goal of the internship is to design a metric quantifying the uniformity of the SNe Ia survey. This metric could be used to select observing strategies leading to precise measurements of the cosmic expansion anisotropy.

This work is also one of the items for further investigation of a PhD thesis that will be proposed in 2025.