Abstract

Nearly two decades ago, distances measured from type Ia supernovae (SNeIa) were used to discover the accelerated expansion of the of the universe. While the accelerated expansion of the Universe is now commonly accepted, understanding what causes this effect is unknown and requires precise, unbiased measurements. Supernovae (SNe) are divided into several categories which can only be distinguished by their spectral properties, and of all SN types, only the SNeIa are used as a cosmological probe because of their properties of standardizable candles. With different types of SNe having different intrinsic luminosities, any misclassified objects will lead to a bias in the cosmological parameters.

Spectral classification is fairly straightforward for SNe occuring in isolated environments, but the closer an event occurs close to the core of a galaxy, the more the spectral contamination intensifies and this analysis becomes difficult or even impossible.

This PhD thesis has been carried out at the *Institut de Physique des 2 Infinis de Lyon* (IP2I Lyon) as part of the Zwicky Transient Facility (ZTF) wide field cosmological project, using data obtained from a low-resolution 3D spectrograph : the Spectral Energy Distribution machine (SEDm). The objective of this research work is to answer the problem of the classification of SNe in the case of strong spectral contamination by the host galaxy.

I present in this manuscript a new method to separate signal from SN from that of the galaxy in the form of a scene modeling tool, HyperGal, which allows us to confidently extract and classify SN previously missed or mis-classified. The core of this pipeline is based on the use of photometric data of the host galaxy, taken before the SN explosion. Using the knowledge of the physics of galaxies, we model the spectral properties of the host, adjusting and scaling appropriately to create a 3D cube model of the isolated host galaxy. Convolving this model to the instrumental response of SEDm, we produce a projection of this hyperspectral model in the space of the observations. Modeling the SN as a wavelength dependent point source, and fitting both the galaxy and supernova simultaneously, we have produced a scene modelling pipeline that can extract the properties of the SN from highly contaminated environments. This model is validated on simulated samples of SN drawn from observed data.

At the end of this manuscript, I present the preliminary scientific results from the ZTF-DR2 dataset of the Type Ia Supernovae & Cosmology group of ZTF, composed of $\sim$ 3000 SNeIa where the vast majority of which has been classified with this new extraction technique.