Cosmology with type Ia supernovae: the ultraviolet 'catastrophe'?
Evolution with redshift of type Ia supernovae in the ultraviolet domain

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Why should we care?
The significant evolution of their UV colors with redshift shows that type Ia supernovae are not as homogeneous as previously thought, resulting in potential bias of their cosmological results.

Type Ia supernovae as standard candles
To be used as cosmological tools, type Ia supernovae (SNe Ia) have to be standardized thanks to their light-curve, color and host galaxy properties [Betoule et al., 2014]. Unfortunately, these empirical corrections are not sufficient. Hence, complementary or, even better, more elementary laws have to be found to improve our cosmological use of SNe Ia.

Previous studies
[Milne et al., 2013; 2015]

Dataset & methodology

80 SNe Ia
Very low redshift: direct UV observations (Ultraviolet Optical Telescope on Swift mission).
Higher redshift: spectrophotometry on SNe Ia spectra (space- and ground-based telescopes).

Ultraviolet studies
Recently, the SNe Ia rest-frame UV spectra have been extensively studied as they are affected by SNe Ia explosion physics as well as by their progenitor metallicity. Hence, the ultimate standardizing law could be hiding in the UV domain.

Evolution of distribution in subpopulations
No evolution within each subpopulation

Evolution with redshift
When using standardizing laws, SNe Ia are assumed to not intrinsically change with redshift at the risk of biasing the subsequent cosmological results. But this assumption may not hold in UV when talking about the SNe Ia progenitor metallicity.

Continuous distribution of SNe Ia u-v colors

700 SNe Ia
Spectrophotometry on a SNe Ia template spectra [Hsiao et al., 2007 - Barbary et al., 2016] calibrated on optical light-curves from the Joint Light-curve Analysis (JLA) compilation [Betoule et al., 2014]

Significant evolution of SNe Ia u-v colors at low redshift (z ≤ 0.2)

References

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