

15th of December 2018

COLLABORATOR STATUS

— IMPLEMENTING SCENE MODELING IN ZTF —

Dr Clare Saunders from Dr M. Rigault's USNAC Group

Context

State-of-the-art light curve extraction is based on scene modelling (see, Betoule et al. 2014 for SDSS & SNLS | Scolnic et al. 2018 for PanStarrs | Brout et al. 2018 for DES). First implemented for SN cosmology by the SNLS team (Astier et al. 2013), this method consists of a simultaneous fit of all images — all epochs — containing the transient of interest. During the fitting procedure, all elements are assumed to be stable except for the transient flux, while observing conditions (seeing, zeropoints, etc) are varying. Reference stellar light curves, assumed to be on average constant, enable a strong handle on photometry of individual images. In addition, the background light contamination, notably the host signal, is much better subtracted than any image subtraction algorithm could do, since all existing data is used in the scene modelling. The latest implementations of the algorithm account for stellar variabilities and peculiar motions as given by Gaia. A next step could include flat fielding and astrometric solutions, which would be incorporated into the algorithm to make a complete forward model down to the raw pixels, thus mitigating calibration biases.

Implementing the scene modelling is the last step of the calibration effort. It is built upon flat fielding — we need to interpolate the flux calibration from the stars to the transient — and various artefact removal, such as ghosting.

Workplan

Dr. C. Saunders is currently implementing the SNLS scene modelling into python and is running and testing it with the SNLS team on recent Subaru SNeIa Data. She has agreed to join Dr. Rigault's USNAC team to lead the scene modelling effort for ZTF. As such, and with success of this proposal, she will be part of the ZTF Cosmology working group. Furthermore, Dr. C. Saunders has recently published the most advanced Type Ia supernova standardisation algorithm. With her joining our working group, we plan to apply this new technique to ZTF data.

With the success of this proposed collaboration status, we should have percent precision lightcurve extractions for any ZTF transient within two years. This kind of data product shall be shared with the entire collaboration and will be the core data used by the SN cosmology group for cosmological analyses. In this effort, Dr. C. Saunders will be helped by the rest of the USNAC group and, more generally, by the entire ZTF Cosmology group.

Algorithm development will be done locally using data from a select few fields. Scene modelling is inherently a post-processing step and will never be part of the real-time processing pipeline.

The ZTF Cosmology group have given their full support to this application.

Dr. Mickael Rigault,
*proposing Dr. Clare Saunders as
collaborator of the ZTF Cosmology
group for core calibration work.*

