

SEDM WP for Unusual Transients in Elliptical Galaxies

Science Case:

The goal of this proposal is to trigger the SEDm on transients in elliptical galaxies whose absolute magnitudes and lightcurves, based on their phot-z's, are discrepant with the main transients that occur in these hosts – Type Ia Supernovae. This idea is built upon that in Goldstein & Nugent (2017) in their search for gravitationally lensed supernovae: The technique is to look for supernovae that appear to be hosted by elliptical galaxies, but that have absolute magnitudes implied by the apparent hosts' photometric redshifts that are far brighter than the absolute magnitudes of normal SNe Ia (the brightest type of supernovae found in elliptical galaxies).

Here we extend the idea to include transients whose absolute magnitudes and lightcurves are discrepant with any known Type Ia Supernova at the implied photometric redshift of the elliptical galaxy – i.e. those which are brighter, fainter, bluer, redder and/or rise or fall more rapidly or slowly than SNe Ia. This should garner us the following exotic transients: gravitationally lensed Type Ia and core-collapse supernovae, TDE's, NS-NS mergers, SLSNe, O2cx-like SNe, as well as the occasional core-collapse SN in an elliptical galaxy.

We would set the trigger to be at 19th magnitude and brighter.

Uniqueness:

This would be the first survey to attempt such a classification scheme.

Triggering Criteria and rates:

The criteria can be simply built into the proposed Ampel framework being worked on by the Berlin group. Basically it is a != SN Ia selection. Looking at the PTF and iPTF db's we had 63 transients that were not SNe Ia in elliptical galaxies brighter than 19th magnitude between 2009-2016 – averaging 9 per year. Of these some were certainly nuclear events that could be screened out via better lightcurves from the PTF/iPTF data. But conservatively speaking, given an order of magnitude increase in these events from ZTF, this results in 90 transients per year or less than 2 triggers of the SEDm per week.

A back of the envelope calculation shows that this method will be useful for screening NS-NS mergers to 150Mpc with SEDm alone and, with nightly co-additions, could be extended to 400Mpc with other facilities.

Expected outcome and publication plan:

By its very nature this trigger would result in a unique transient every time. Higher resolution follow-up, at Keck, Lick, the 200", etc., will be useful for those cases in which the host blends in with the transients and the SEDm spectrum is inconclusive. We envision that these objects will constitute papers in and of themselves. However, the most intriguing paper will be on the rates of transients in Elliptical galaxies.