CTA200 Project

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1 Integrating Spectra

Integrate the spectra of the SNe above (or other ones) to obtain magnitudes. Do they match the magnitudes in the left hand plot? You may have to correct for an overall offset, or calibration. What is that calibration if any? Is it constant across the filters?

1.1 Method (Notebook)

I chose to demonstrate the results in working with the spectroscopy data for SN2007jg. The code written can also be applied to integrate other Supernovae spectra in order to attain their corresponding photometry.

I downloaded the observed wavelength data for each spectra provided for SN2007jg found on the Open Supernova Catalog, and the data for the SDSS filter transmission curves.

For each spectra, I split the data according to the filter transmission curve each flux value's corresponding wavelength fell within. From there, I scaled each the data within each range by their corresponding "scaling factor" as provided by the filter transmission data, and interpolated the scaling factors for certain wavelengths that the filter did not provide.

Finally, I summed the values within each band, and converted the values using a flux-to-magnitude conversion equation. In this case, the transmission curve data was calibrated to the Vega System (our star A in the equation below).

Vega System

Property	Specified	Calculated	Unit
Zero Point (?) :	-------	3.639e-9	(erg/cm2/s/A)
	-------	1568.54	(Jy)
ZP Type (?) :	Pogson		
PhotCal ID (?) :	SLOAN/SDSS.u/Vega		

Figure 1: Calibration properties

1: *"If two stars, A and B, have fluxes, f_A and f_B, their magnitudes are related by:"* *(src)*

$$m_A - m_B = -2.5log(\frac{f_A}{f_B}) \tag{1}$$

1.2 Results

After integrating the spectra of SN2007jg, I found that the magnitudes I attained did closely match the magnitudes in the photometry plot, although not exactly. I did need to calibrate my results, with a scaling factor that was set to approximately 2.3, to scale down the apparent magnitudes values I attained to more closely resemble the photometry graph on the website.

The scaling proved to be constant across the filters.

1.3 Improvements

Although the scaling factor appeared to be sufficient to scale the apparent magnitude values I attained to match the photometry on the Open Supernova Catalog, the fact that it was constant across the filters signal that there may have been a systemic error in the way I integrated the spectra. This area should be investigated further in the future.

Additionally, I could try alternate integration techniques in the future to compare the apparent magnitude values I get in integrating spectra, to see which one provides a better estimate.

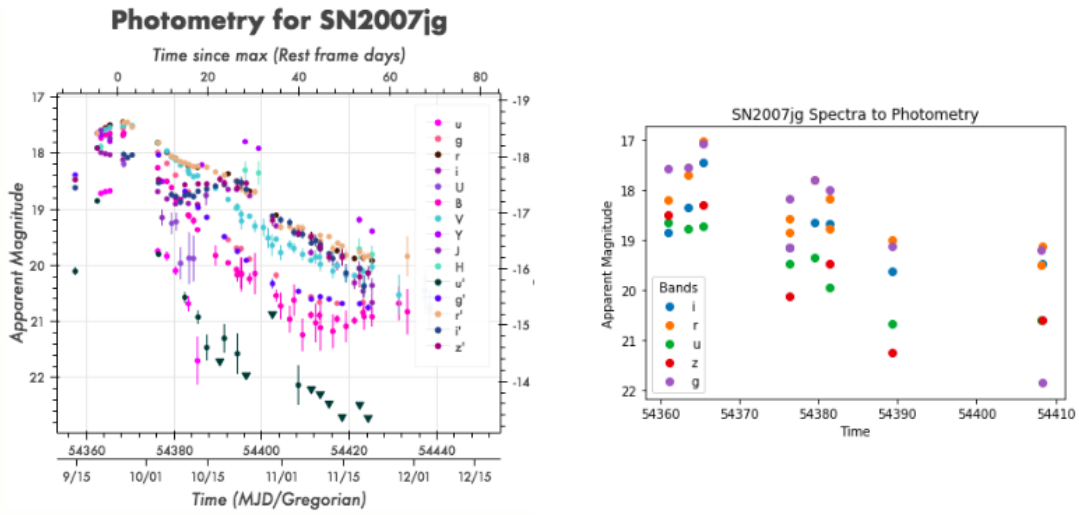

Figure 2: Comparison: Photometry from Open Supernova Catalog vs. Generated Photometry

2 Fitting Supernova Data to Templates

Download Peter Nugent's supernova templates. Plot the light curve templates on top of the data. Do they match the light curve data reasonably well by eye?

Compute the chi^2 of the model templates to the data. Can you show quantitatively that the template for the Type II is a better match to the Type II data than the template for the Type Ia?

2.1 SN2007jg on Type Ia Template (Notebook)

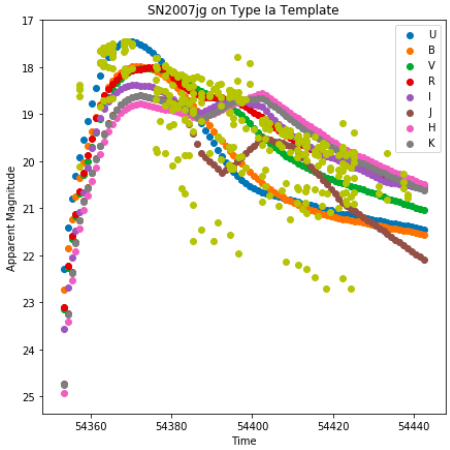

Figure 3: The neon data points indicate the light curves generated by SN2007jg, and the plots in the background indicate the template data for a SN Type Ia, in respective bands.

2.2 Goodness-of-Fit (Notebook)

We found that the p-value in comparing the V-Band of SN2007ld light curve data against the template data for a SN Type IIp to be 0.99 (Cell 22 of notebook), and template data for a SN Type Ia to be 0.99 (Cell 33 of notebook).

We note that the p-value is exceptionally high in both cases. However, we know from visual inspection that it's most likely the case that SN2007ld should be classified as a Type II P Supernova.

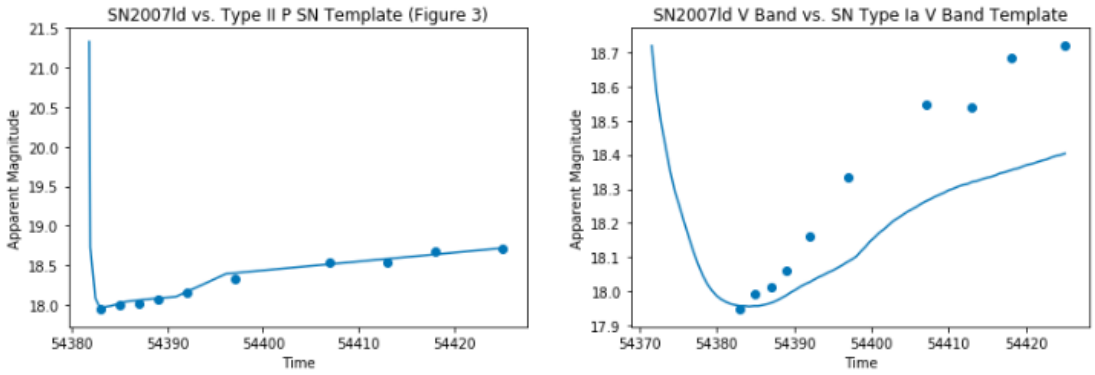

Figure 4: Comparison of SN2007ld v-band fit against SN Type II P template, and SN Type Ia Template

Our analysis could be improved if we had template data for magnitudes other than the V band, as upon visual inspection of our data from SN2007ld (Figure 2), all the bands in general conform with the template provided for a SN Type II P (Figure 1).

Additionally, our fitting of our templates to our SN data could be improved. In particular, here, we first fit our Type II P SN template to our SN data, before using the same methodology to fit our Type Ia SN template to our SN data. This could have biased our fit towards the Type II P SN template.

We may attempt to use a probabilistic method in the future (such as Monte Carlo Markov Chain) for a more robust curve fitting procedure.