Science Case for SN2014J +300d proposal for NIR Spectra

November 13, 2014

SN2014J is a nearby supernova of Type Ia in the spiral galaxy M82. It is heavily occluded by host galaxy dust (E(B-V)=1.3, Patat+ 2014). It also exhibits a peculiar reddening law (Amanullah+2014). This makes it difficult to extract useful information from optical only observations and hence, makes observations in the NIR imperative.

From γ-ray observations, there has been a direct detection of Cobalt at late times in the ejecta (Churazov+2014, Diehl+2014b). This offers an extinction-independent method of deriving the total amount of ^{56}Ni produced in the SN.An NIR spectrum at $\sim$ +300 days can provide a firm constraint on the extinction value, which along with the multi-band photometry available (eg. Foley+2014)can be used to derive an ^{56} measurement that is independent of the value γ ray observations.

1 Nebular epoch velocity effects (to revise title)

In Mazzali+1998 and Blondin+2012 (Cfa+Mazzali sample), the authors show a relation between the nebular FWHM of the FeIII4700 line and Dm15, although in the latter reference, there is less of a claim for a correlation in the 'normal' Ia sample and the authors claim that this correlation is driven by 86G and 91bg.

In S04, there are 2 NIR spectra from Sofi and ISAAC at +250 and +344 days. The authors observe a shift in the velocity of the FeIII lines. They argue that the relation for nebular spectra can then be a function of the epoch of observations.

Getting a spectral series of 4-5 spectra interspersed at 50d intervals might be important for observing this effect

2 Asymmetries

3 Extinction Measurement

SN2014J is a heavily reddened supernova with an optical extinction (E(B-V)) of 1.3 of which1.16 mags is contributino from the host galaxy. It also has a peculiar

reddening law which makes the final, derived absorption vlaue in the optical, very highly debatable. In Margutti+2014, the Av is 1.7 mag and in goobar+ it is 2.5 mag. this yields remarkably different M_{Ni} values from the bolometric light curve of 0.37 and 0.77 $M_{\odot}$. In order to resolve this discrepancy, an NIR spectrum will be useful. The ratio of line widths from the 1.644 μm and 1.275 μm would yield an absorption value that can be applied to the bolometric light curve calculated from existing data.

The proximity of SN2014J has led to the first direct detection of ^{56}Co at late epochs in the ejecta. This measurement of Ni mass can be compared with the value derived using the extinction measurement from the NIR spectrum