Comparing lightcurves of SN2014J to SN1987A between cooling phase and Nickel-56 peak

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1 Abstract

When a supernova explodes, the matter of the star is ripped apart with such force that even neutrons are ripped from protons. As the expanding cloud cools, the matter forms into ^{56}Ni, a relatively stable atom. ^{56}Ni decays over time into ^{56}Co, then ^{56}Fe. Each of step of this decay process releases gamma rays, which deposit energy into the surrounging gas, "propping up" the supernova's luminosity.

Preceding the peak of ^{56}Ni and thus luminosity in the supernova and after the drop in luminosity due to cooling, Type Ia supernovae like SN2014J and Type II-P supernovae like 1987A differ significantly. Here we compare example lightcurves from each category and discuss implications for how the supernovae explode and how we decide taxonomy.

2 Background and Data

Since oldest living memory, the dungeon has lived in the heart of the old wood.

3 Type Ia Example: 2014J

The reaction mechanisms of Type Ia supernovae are, like most other supernovae, only gestured at by modern astrophysics; we can guess some of what happens, but the exact mechanisms of the explosion and progenitors remain mysterious. What we do know is that Type Ia lightcurves are remarkably consistent. They have the steepest climb to the ^{56}Ni plateau of all the types, post-cooling. We plot this range here for SN2014J: first band by band, then with all the bands compared together.

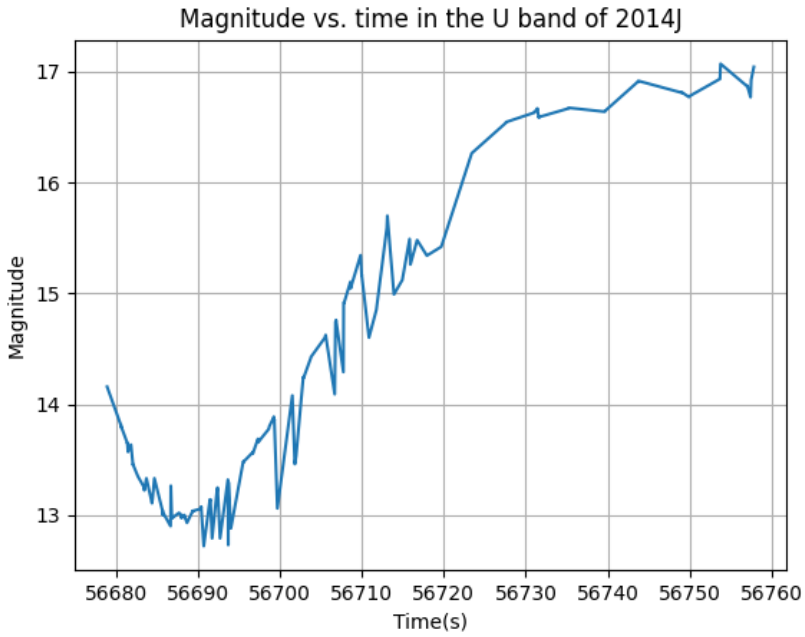

Figure 1: Change in brightness of SN2014J across time in the U band.

4 TypeII-b Example: 1987A

5 Lightcurve Comparison

6 Summary

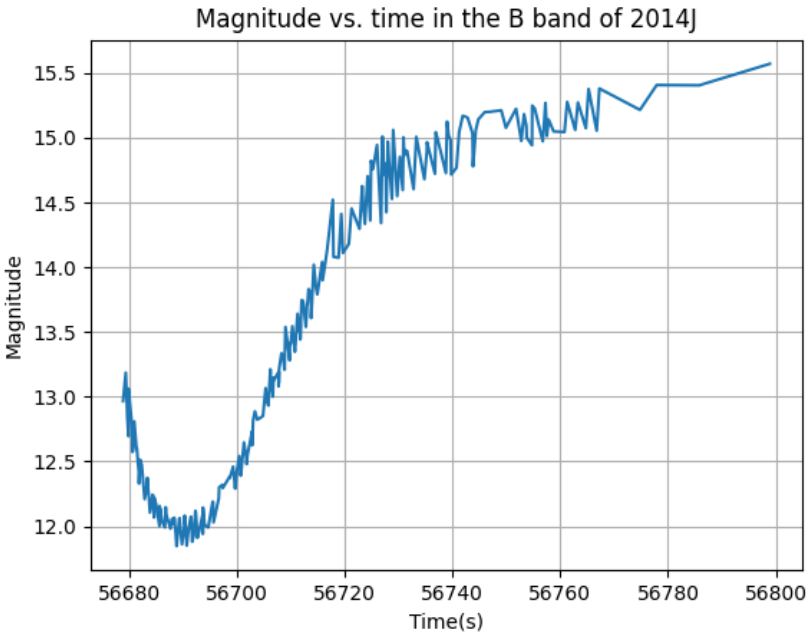

Figure 2: Change in brightness of SN2014J across time in the B band.

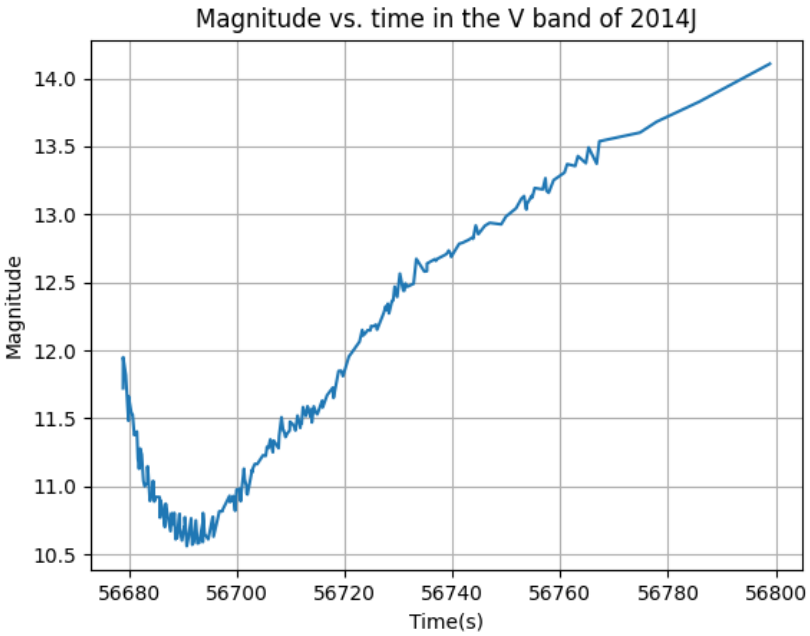

Figure 3: Change in brightness of SN2014J across time in the V band.

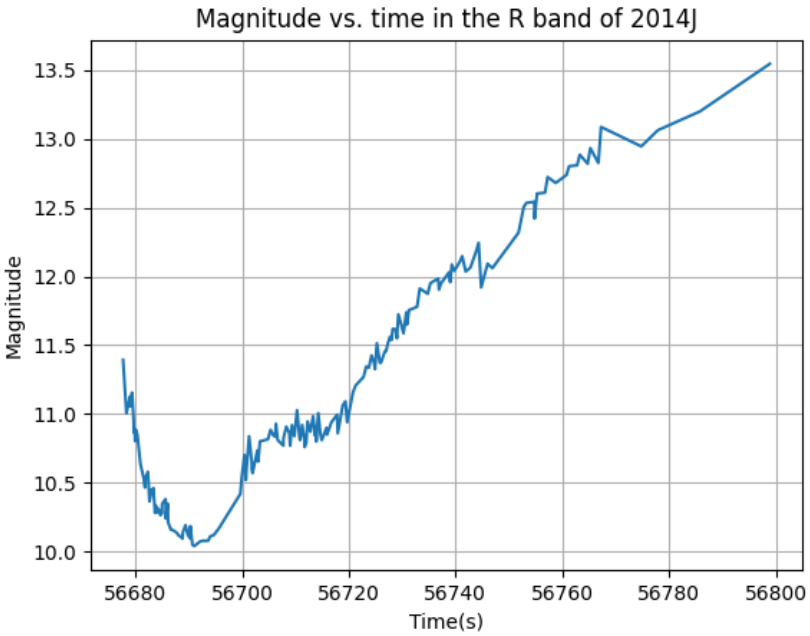

Figure 4: Change in brightness of SN2014J across time in the R band.

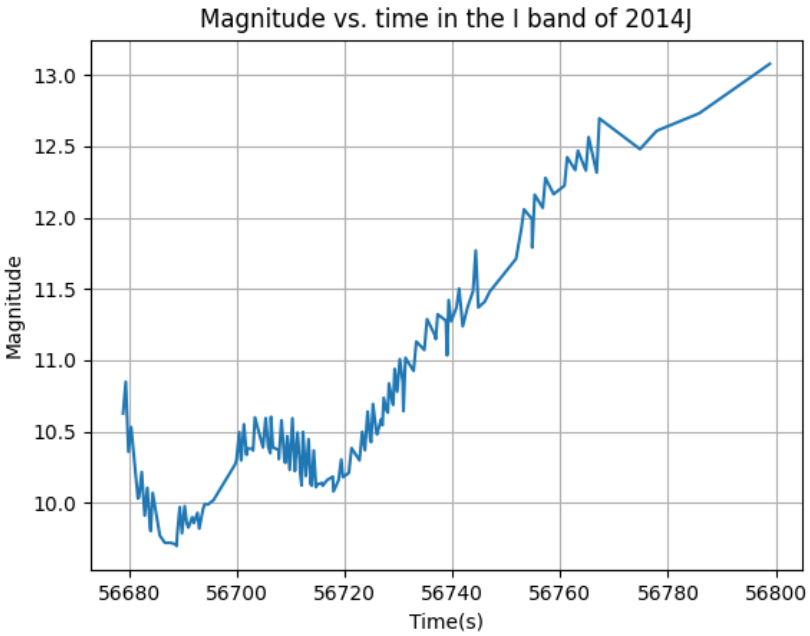

Figure 5: Change in brightness of SN2014J aross time in the I band.

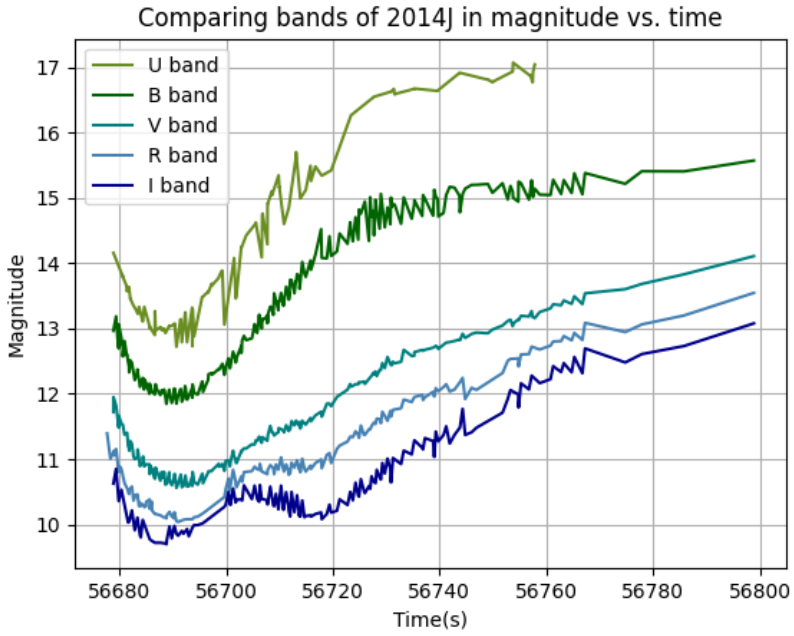

Figure 6: All bands of SN2014J together. Note especially the differences between the shape of the I band brightness over time compared to the bluer colors. Just before 56720 seconds, a "shoulder" is visible in the curve. It's beginnings show up in the R band as well.