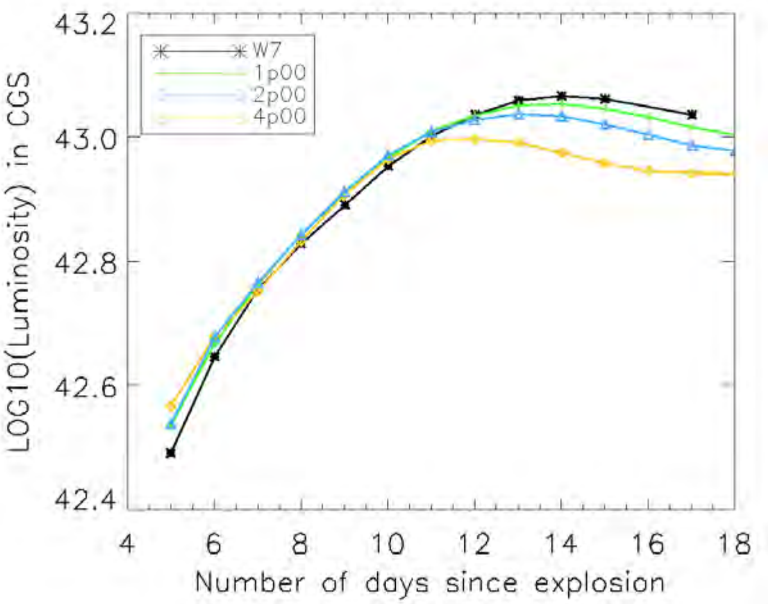
# On Determining the Metallicity of Individual Supernova Type Ia



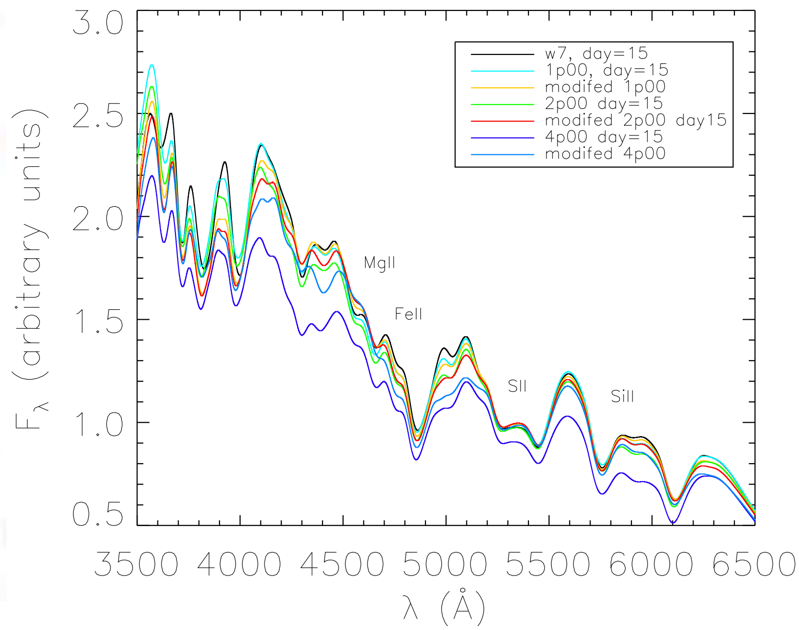




*Fig 1 - Light curves (left) and non-LTE spectra at peak luminosity (right) of post-processed W7 models with 0.0, 1.0, 2.0, and 4.0 times the solar $^{22}$Ne content. A few intermediate-mass element features in the maximum light spectra are labeled.*

Observational surveys of potential metallicity effects in SNe Ia invariably use the metallicity of host galaxy as a proxy for the metallicity of the progenitor white dwarf. However, there is a relatively large scatter in stellar metallicities, Δ[Fe/H] ~0.5, at any given age for dwarf stars in the Milky Way. For example, Feltzing et al. constructed an age-metallicity diagram for 5828 dwarf and sub-dwarf stars from the Hipparcos Catalog using evolutionary tracks to derive ages and Strömgren photometry to derive metallicities. They concluded that the age-metallicity diagram is well-populated at all ages, that old but metal-rich stars exist, and that the scatter in metallicity at any given age is larger than the observational uncertainties.

We are exploring avenues for determining the metallicity of individual SNe Ia from their light curves and spectra. We are using the PHOENIX radiation transfer code to produce synthetic lightc urves and spectra associated with our SNe Ia hydrodynamic models to search for signatures that carry information about the metallicity of the white dwarf that exploded. For example, aided by analytical expressions and post-processing W7-like models that suggest a near-linear relationship of the silicon and calcium yields on the progenitor’s metallicity, we are focusing on the silicon, sulfer, and calcium features in the spectra at maximum light.


**Contact:**
Soma De,
Arizona State University,
somad@asu.edu

**Researchers:**
Soma De (ASU)
Frank Timmes (ASU)
Themis Athanassiadou (ASU)
Wendy Hawley (ASU)
David Chamulak (ANL)
Ed Brown (MSU)
Alan Calder (SUNY)
Dean Townsley (Alabama)



**In Preparation:** De et al, Astrophysical Journal, 2012