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SPECTRAL ANALYSIS OF TYPE II SUPERNOVAE

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We present a spectroscopic analysis of 58 type II supernovae concentrating on the H$_\alpha$ P-Cygni profiles. Preliminary results shown that the spectral parameters of H$_\alpha$ are correlated with photometric properties (decline rates, absolute magnitudes).

Type II Supernovae (SNe II) were initially classified in two subclasses depending to the shape of the light curve: SNe with linear decline are called SN IIL, and SNe with quasi constant luminosity are called SN IIP (Barbon et al 1979). SN II spectra are characterized by strong P-Cygni hydrogen features, however, an overall picture describing the physics which underpins their diversity is lacking. Patat et al (1994) examined some properties of 51 SN II and concluded that SN IIL have large ratio of absorption to emission (a/e) of H$_\alpha$ P-Cygni profile values. Here, we show how the spectral and photometric properties are correlated.

A total of 58 type II supernovae obtained by Carnegie Supernova Project (CSP) between 2004 and 2009 plus data from previous samples were used to study the spectral diversity. Concentrating on the H$_\alpha$ P-Cygni profiles we measured the expansion velocities and the ratio of absorption to emission (a/e) at the epoch of transition between initial and plateau decline phases in the light curve. These spectral properties are correlated with photometric properties: absolute magnitudes (M$_{max}$), decline rates (s_1: initial decline from maximum, s_2: *'plateau'* decline rate, and s_3: radioactive tail decline), and the optically thick duration phase ($OPTd$). In Figure 1 we correlated our defined parameters against each other. Using the Pearson correlation test we found that a/e is the dominant parameter in terms of describing the diversity in our measured supernovae properties. The plot shows that SNe with smaller a/e have higher H$_\alpha$ velocities, more rapidly declining light curves, are brighter and have smaller $OPTd$ values. SNe with higher a/e show opposite behavior. Also, we can see a continuum of events in terms of spectral diversity, which was seen by Anderson et al (submitted) analyzing the V-band light curves. We speculate that the most likely parameters which influence the morphologies of H$_\alpha$ profiles are the mass and density profile of the hydrogen envelope, together with extra emission components due to circumstellar interaction.

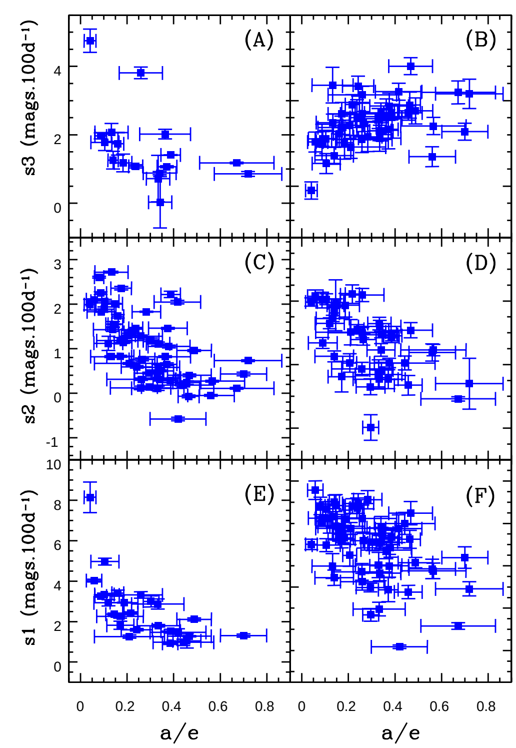

Fig. 1. Correlations between (a/e) in H_α and ejecta velocity, s_1, s_2, s_3, M$_{max}$ and $OPTd$.

REFERENCES

Barbon, R., Ciatti, F., Rosino, L. 1979, A&A, 72, 287
Patat, F., Barbon, R., Cappellaro, E., Turatto, M. 1994, A&A, 282, 731

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