

Narrow Na I D absorption lines in SN spectra

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MOTIVATION

Na I D lines



Reddening correction?
Circumstellar Medium (CSM)?
Insterstellar Medium (ISM)?

MOTIVATION

Na I D lines



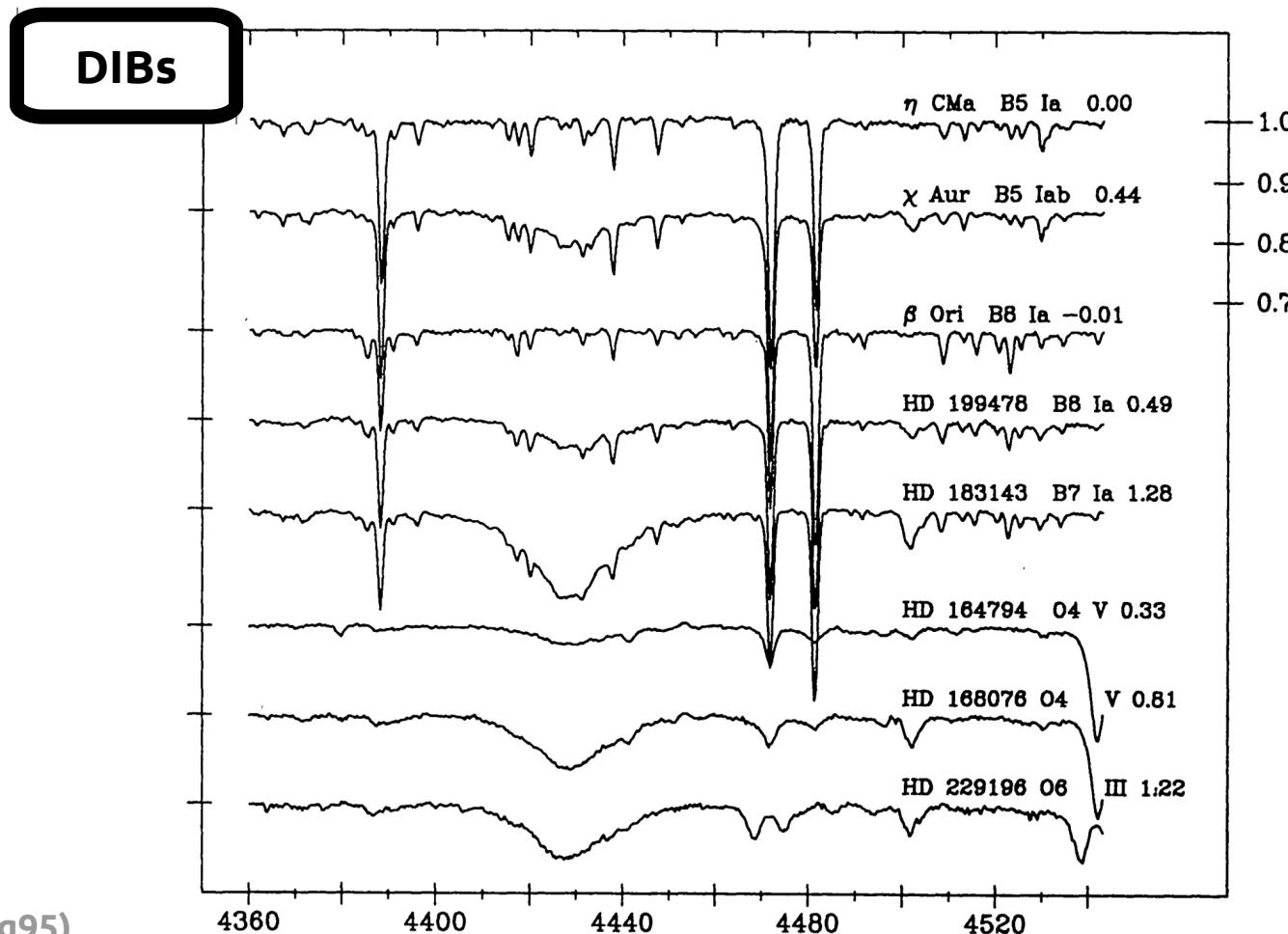
(Ca II H&K and the DIBs)

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Na I D lines →
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(Ca II H&K and the DIBs)

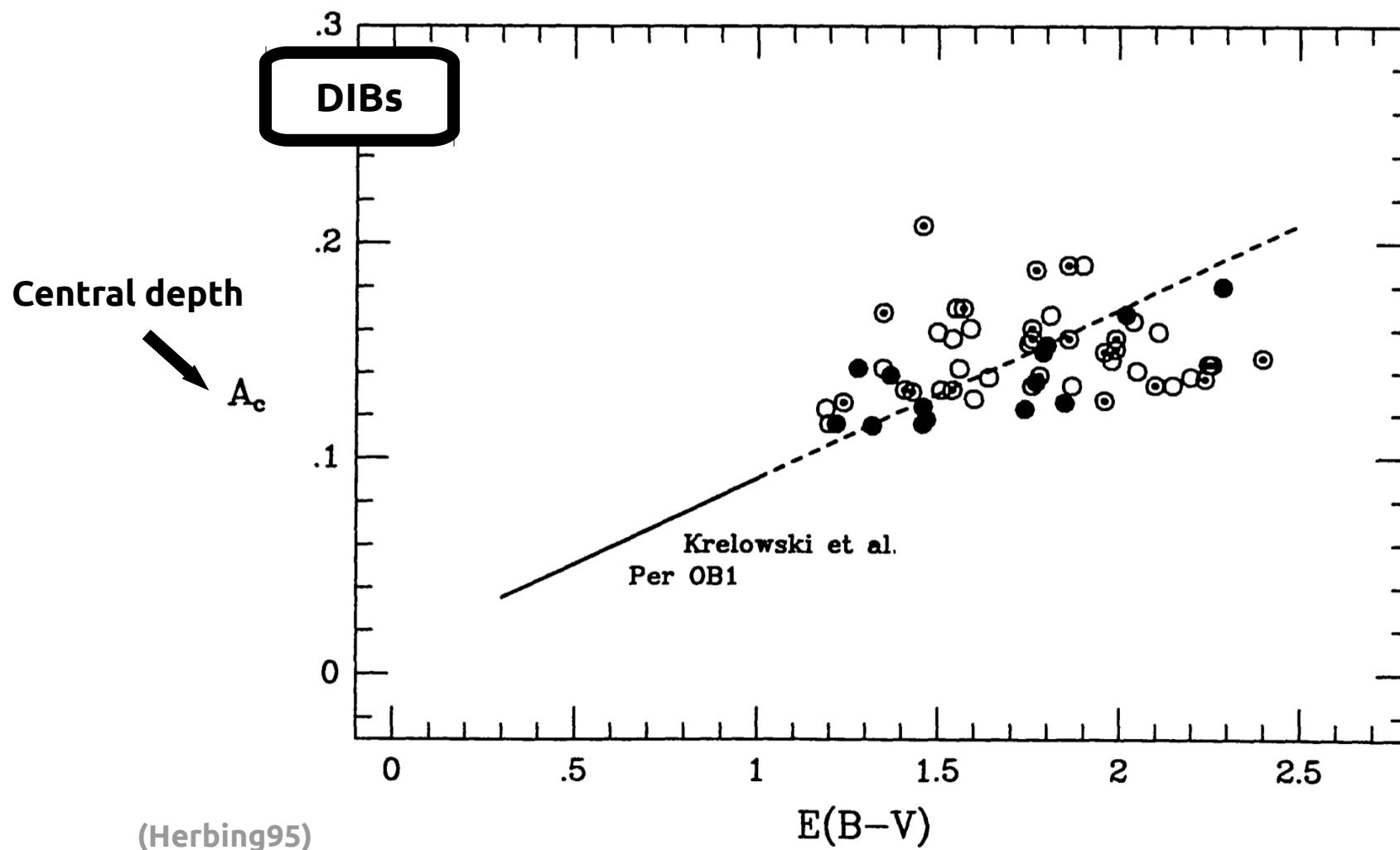
In the Milky Way



Na I D lines and the DIBs correlate with dust extinction (Hobbs 1974; Herbing 1995).

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Na I D lines → Reddening correction?
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Na I D lines ➔
(Ca II H&K and the DIBs)

Reddening correction?
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In the Milky Way ➔

Na I D lines and the DIBs correlate with dust extinction (Hobbs 1974; Herbing 1995).

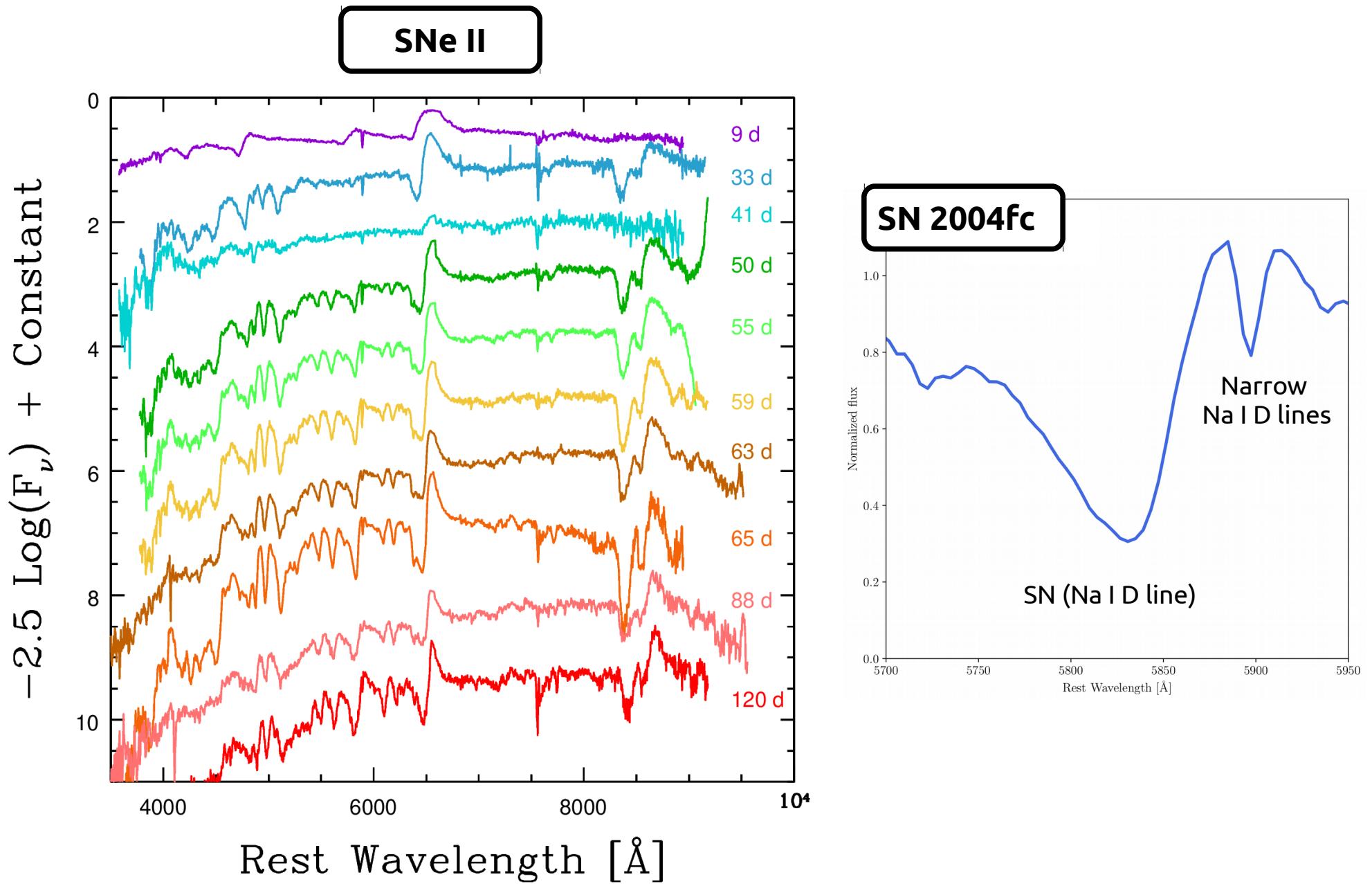


Na I D, Ca II H&K lines and the DIBs have been detected in SN spectra

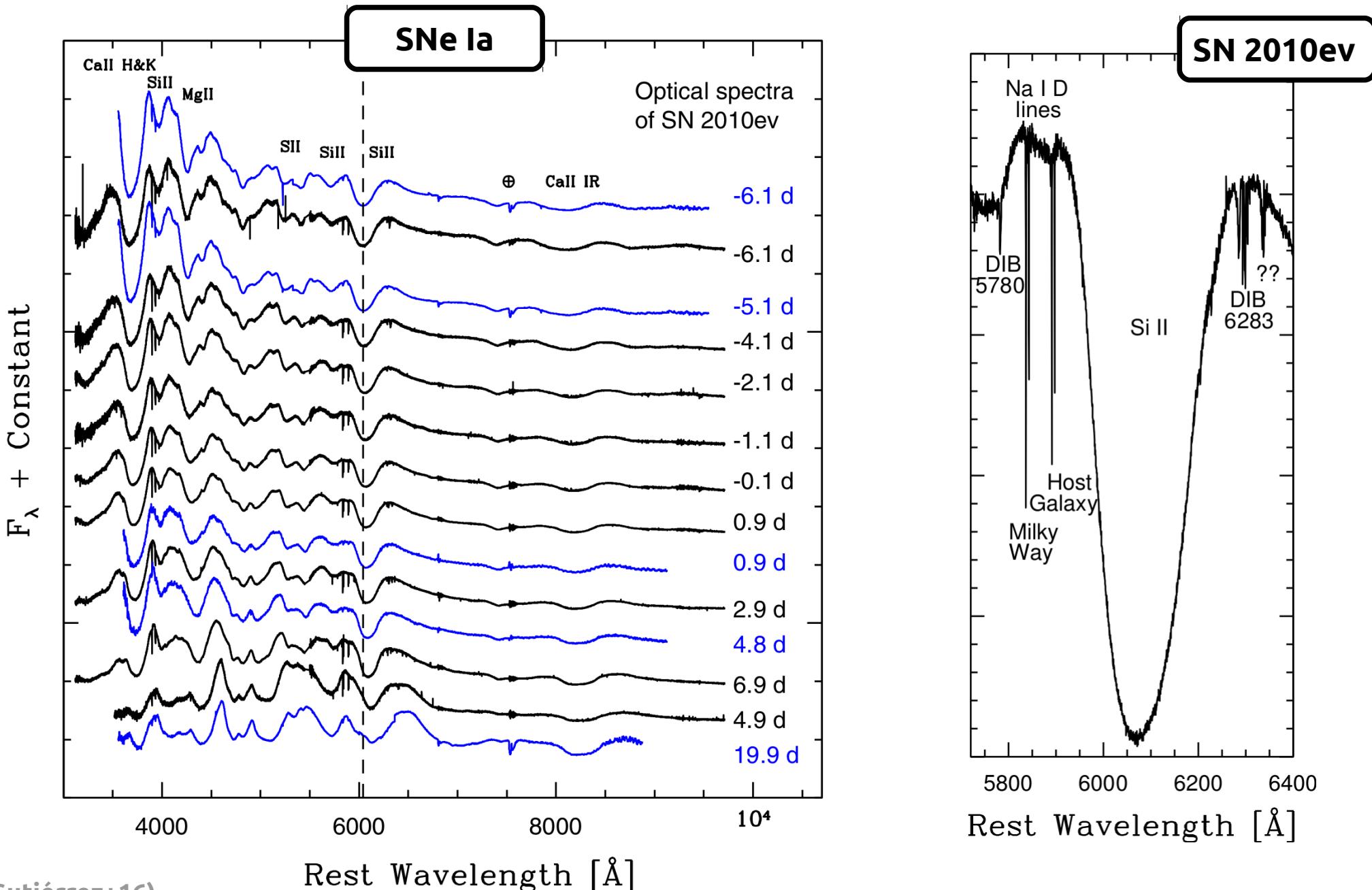
The properties of the ISM of the host galaxies and also the environment of the SNe (CSM) can be studied with medium/high-resolution spectra.

Our analysis is focused on SNe II, SNe Ia and stripped-envelope SNe

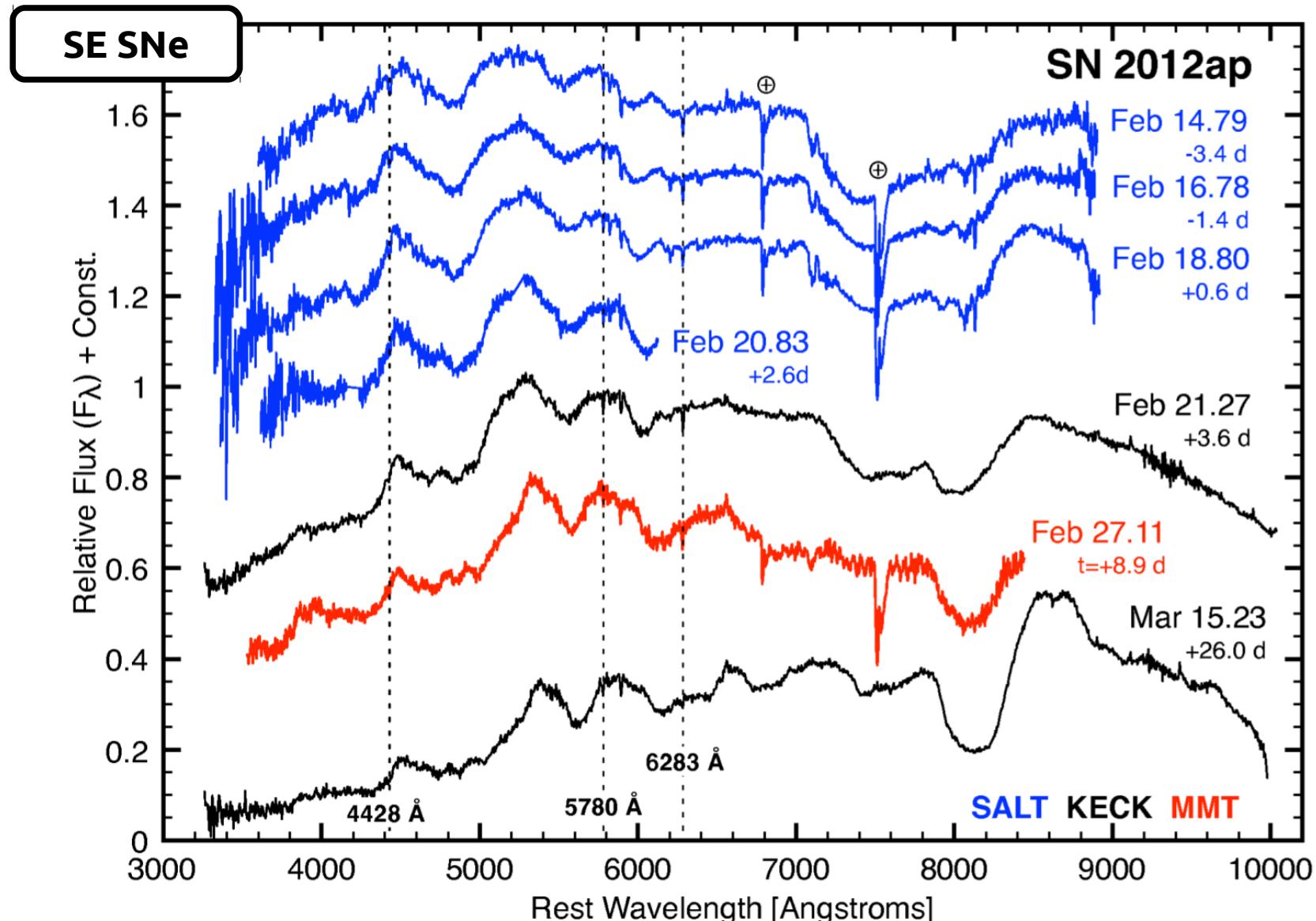
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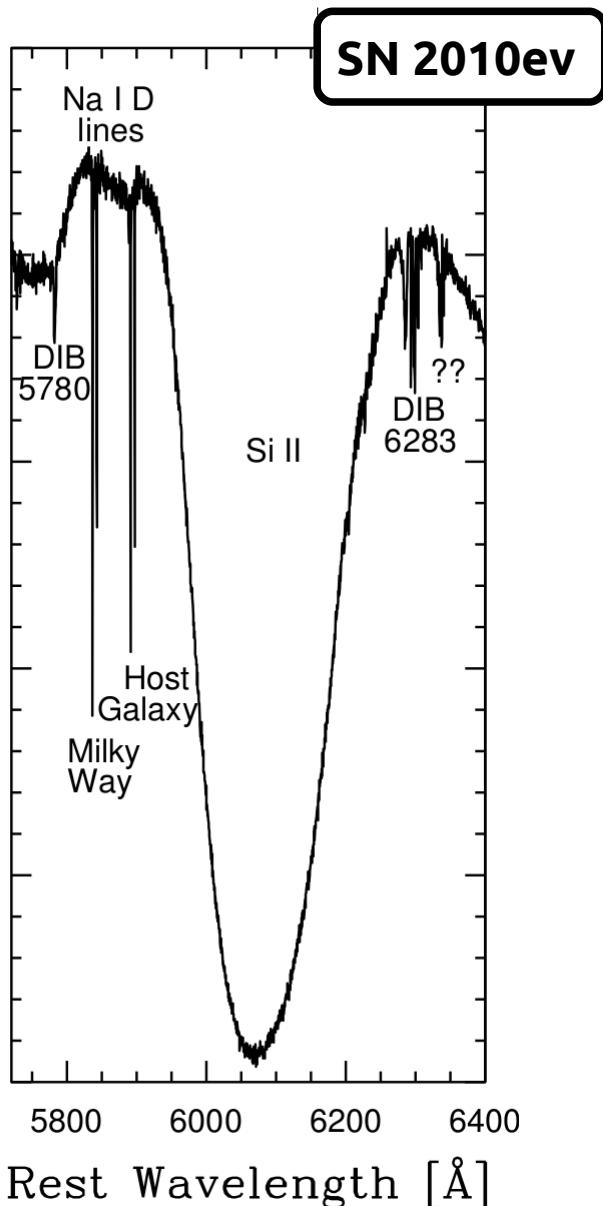
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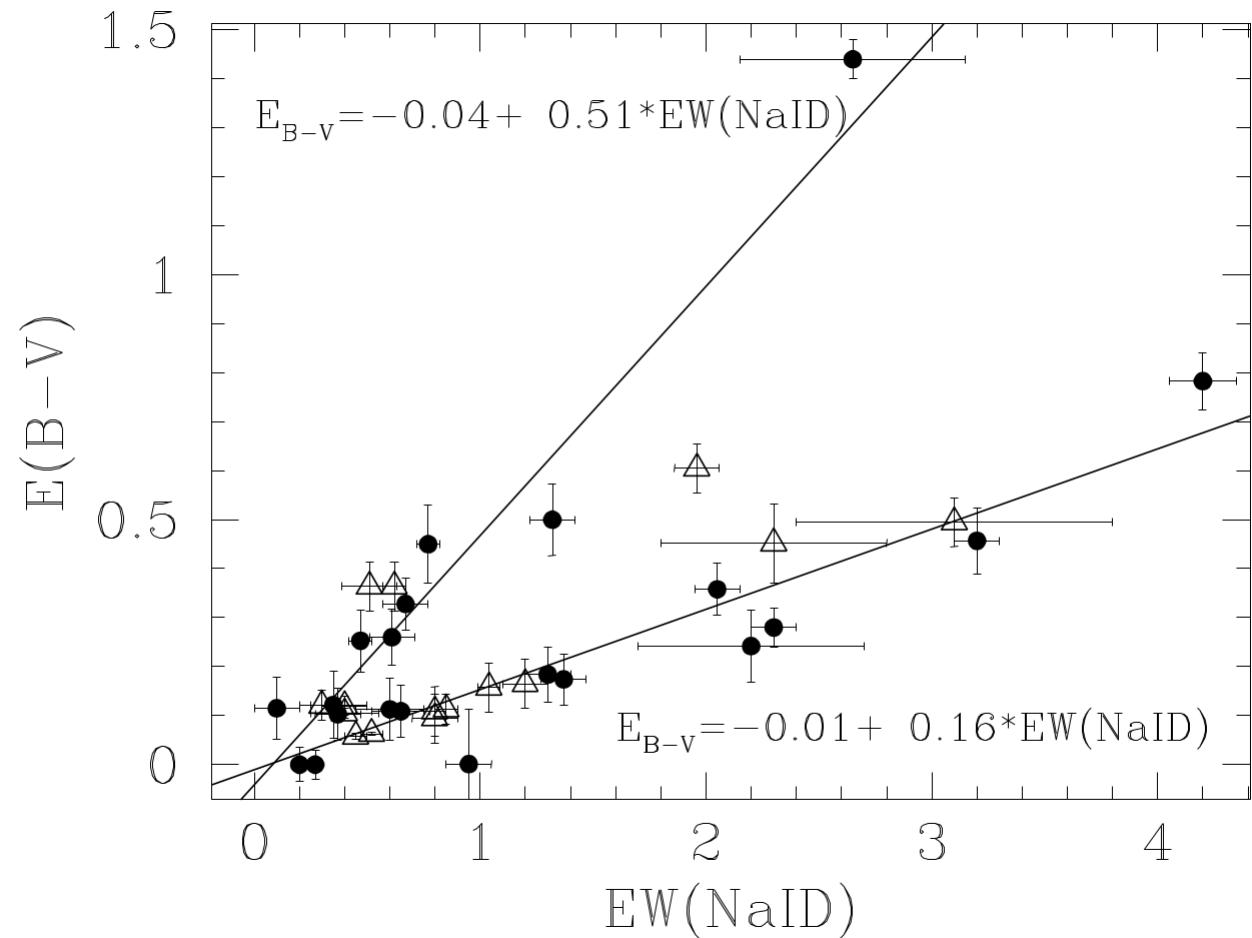
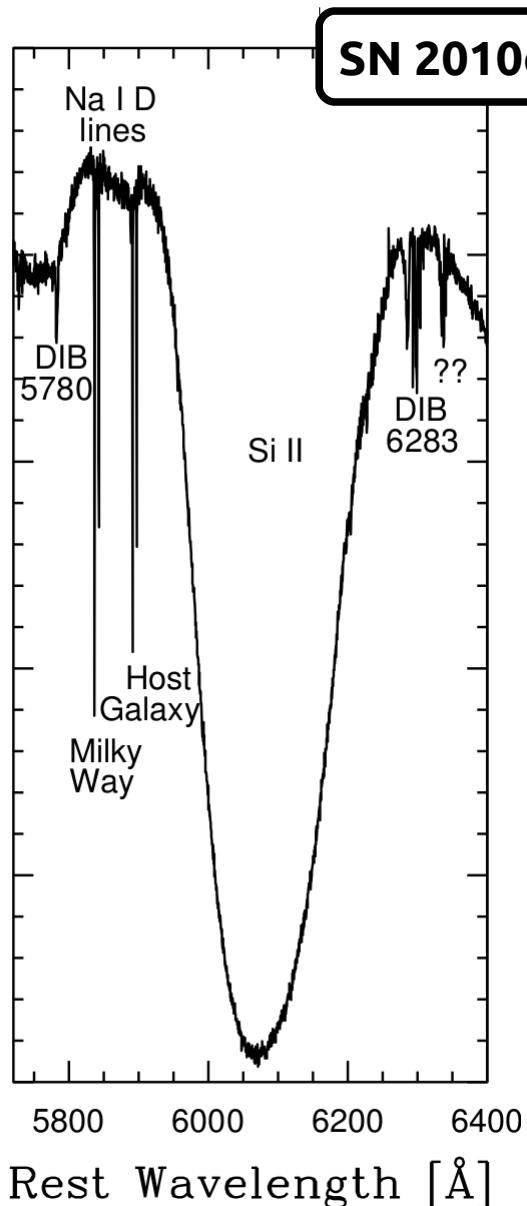
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NaID lines can give the gas column density, and then can be converted into reddening assuming an average dust-to-gas ratio.



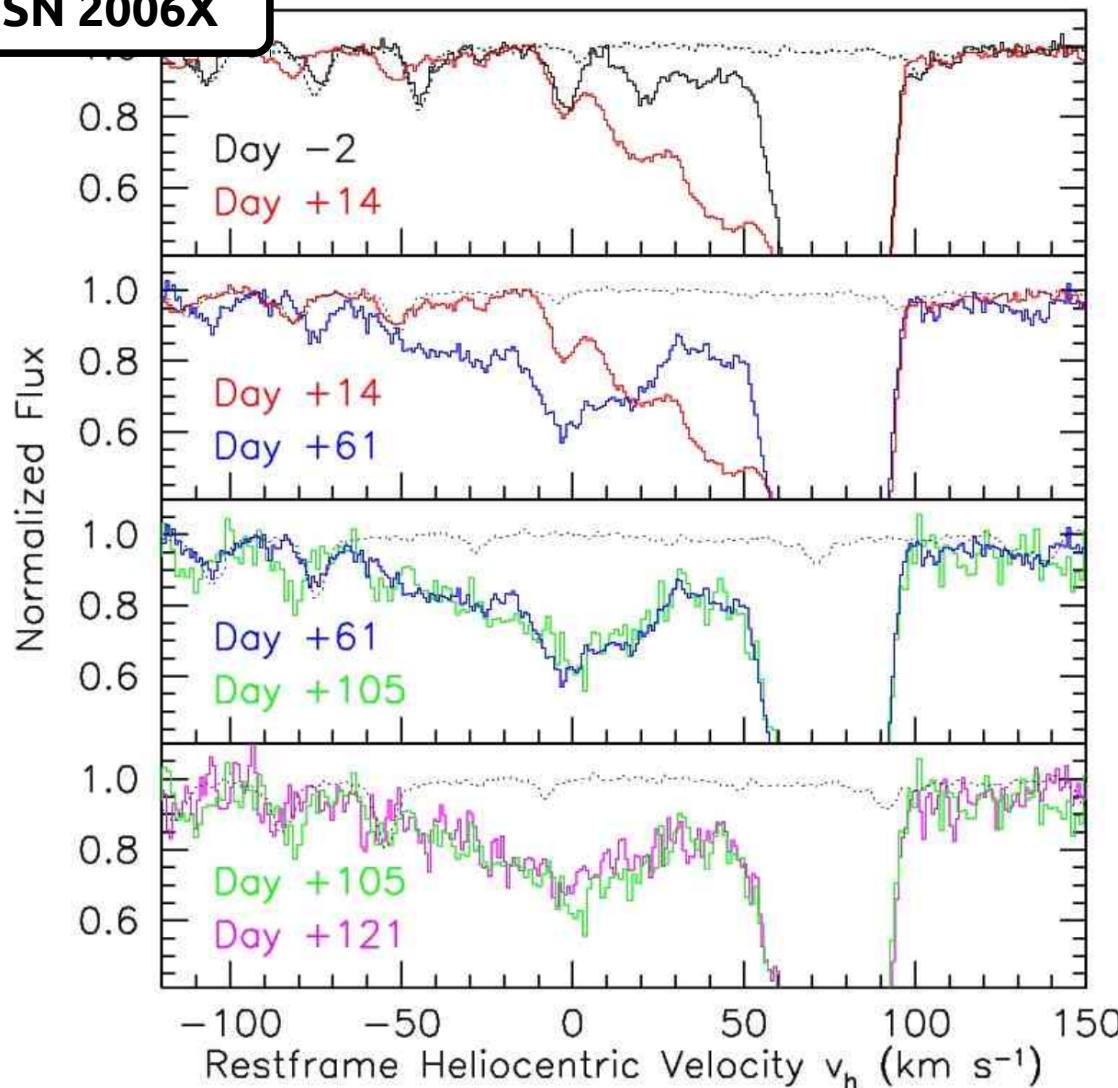
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The B-V color 2-3 months after explosion is independent on the SN photometric class (Phillips+99).

Detection of blueshifted time-varying NaID absorption lines has been interpreted as evidence of CSM

SN 2006X

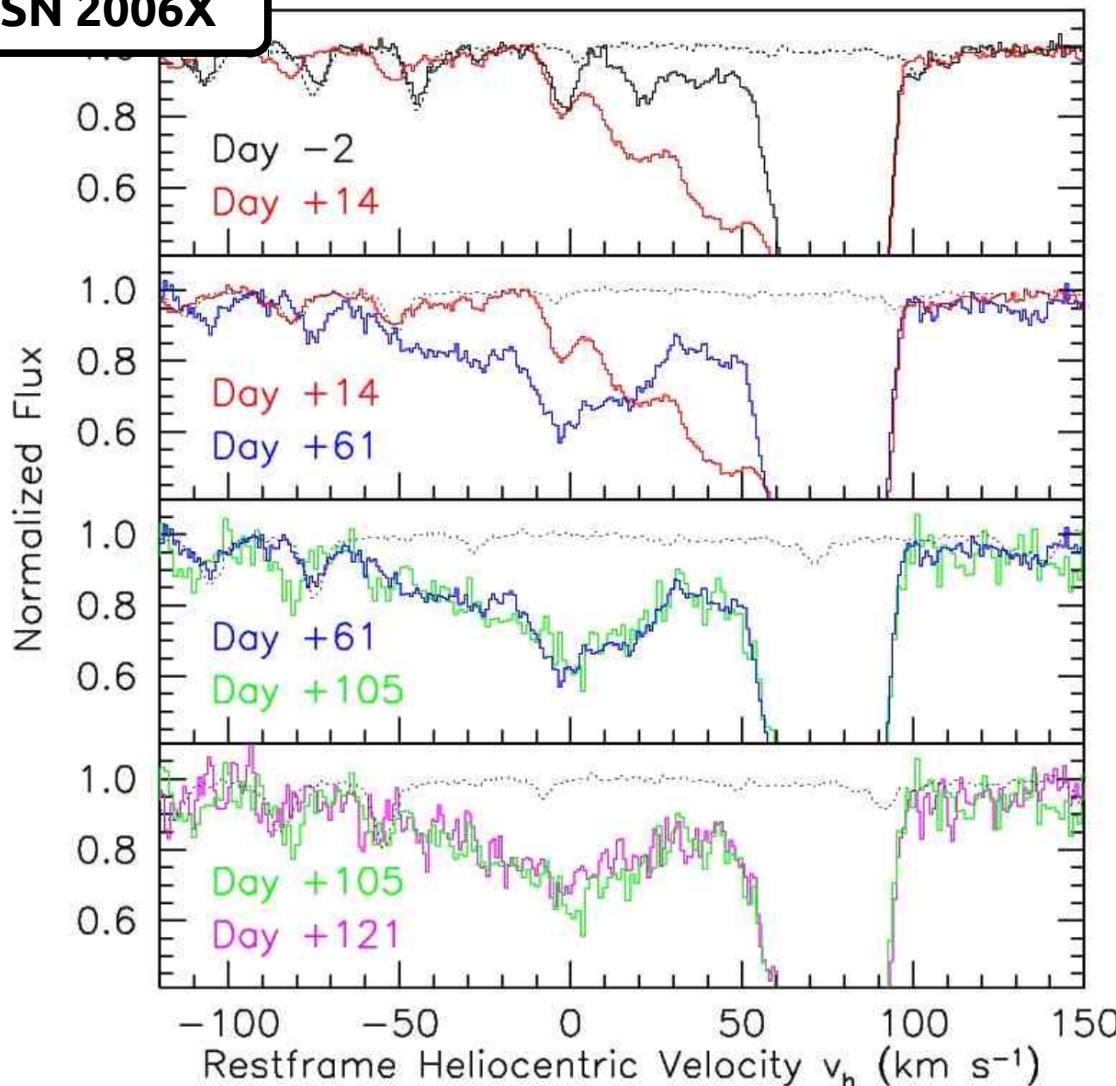


Detection of **CSM** material → Single degenerate scenario?

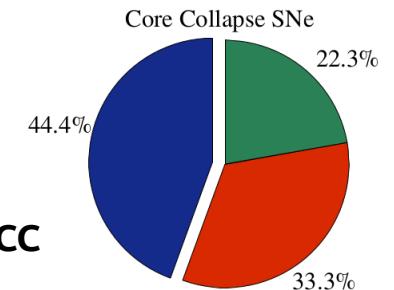
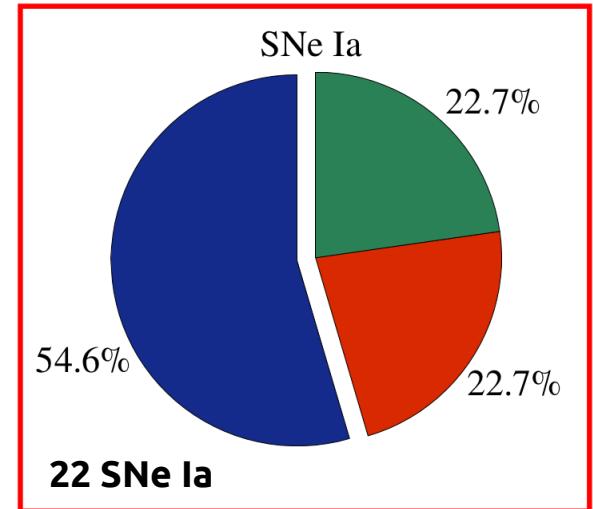
(Patat+07)

Detection of blueshifted time-varying NaID absorption lines has been interpreted as evidence of CSM

SN 2006X



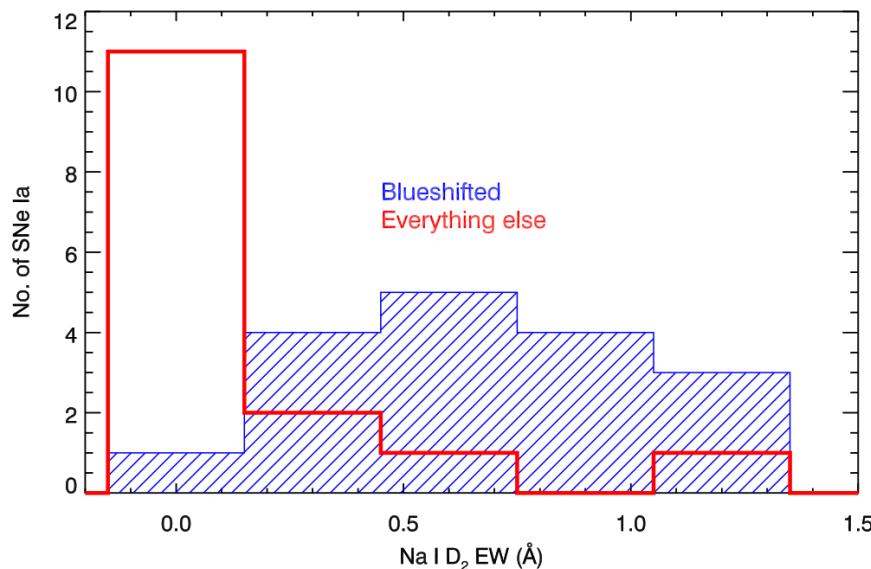
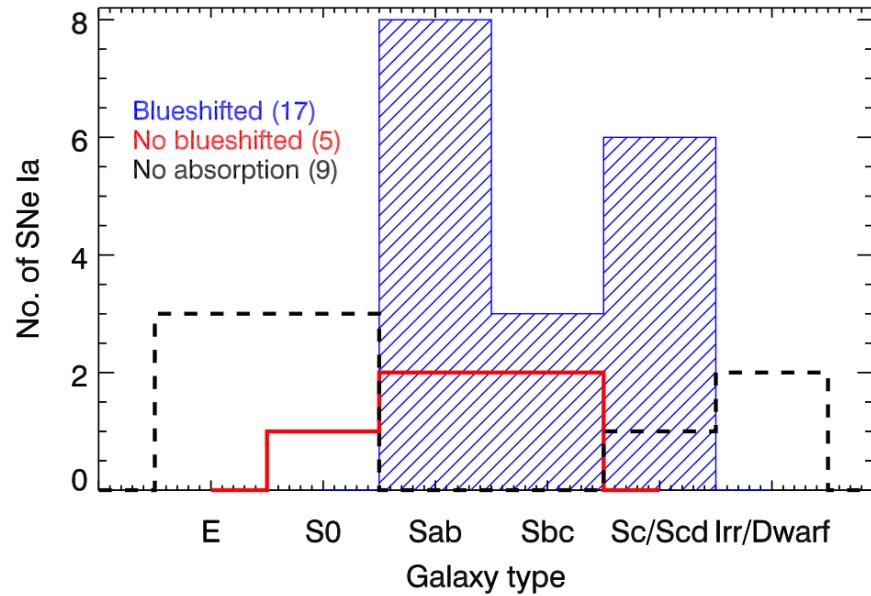
Blueshifted
Redshifted
Single/Symmetric



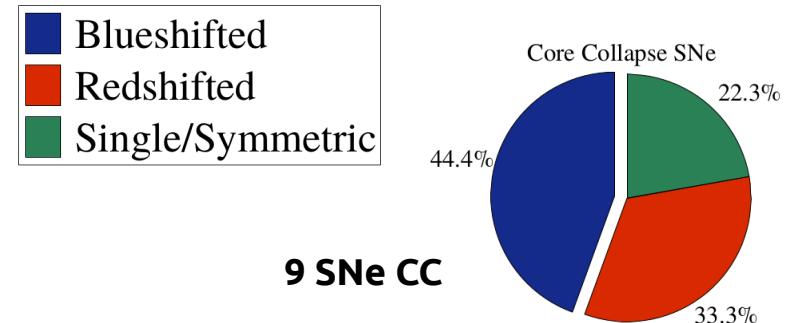
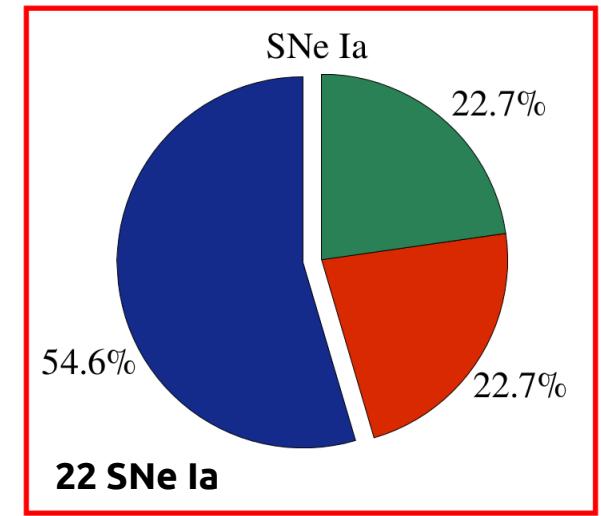
Blueshifted NaID lines are due to CSM that was ejected by the progenitor system prior to the SN explosion.

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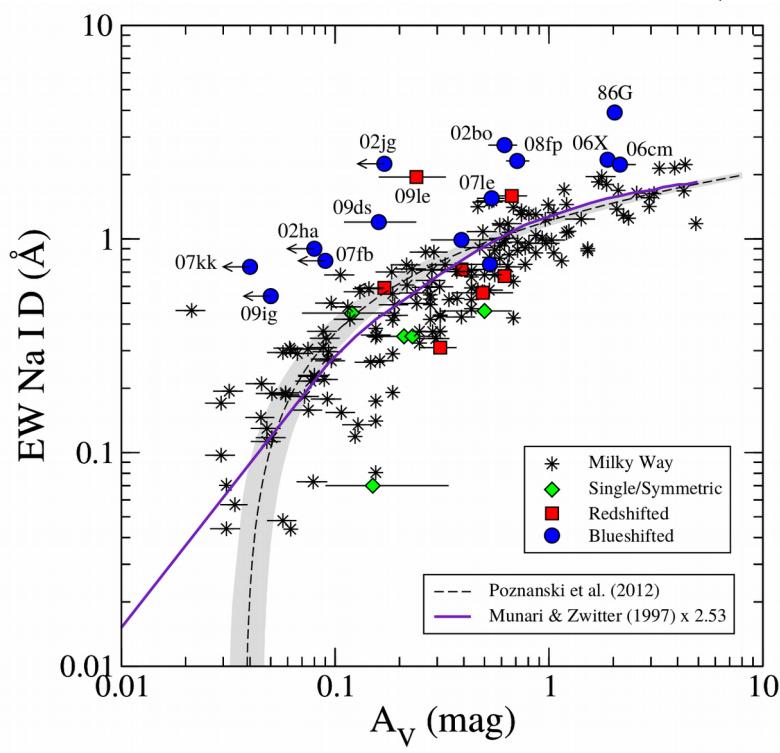
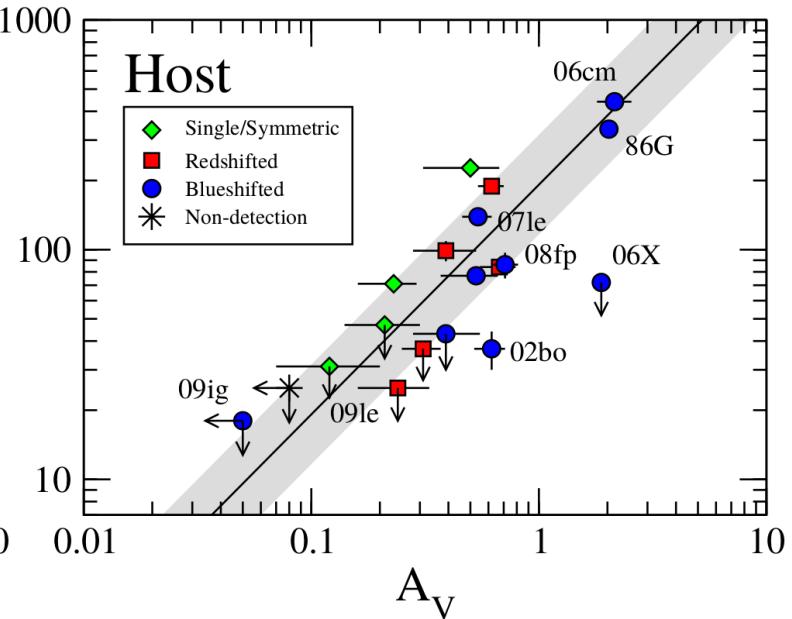
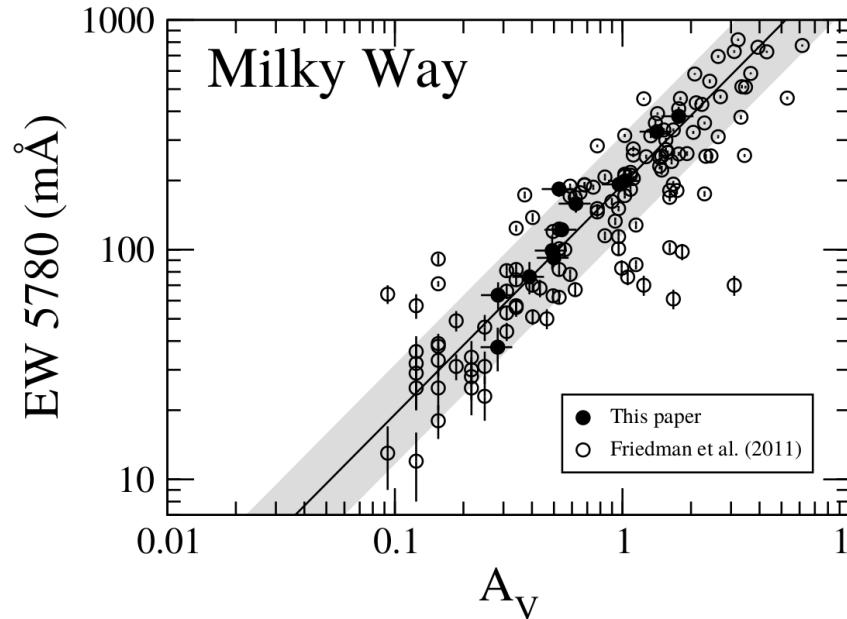


The absorbing material is local to the SN



Blueshifted NaID lines are due to CSM that was ejected by the progenitor system prior to the SN explosion.

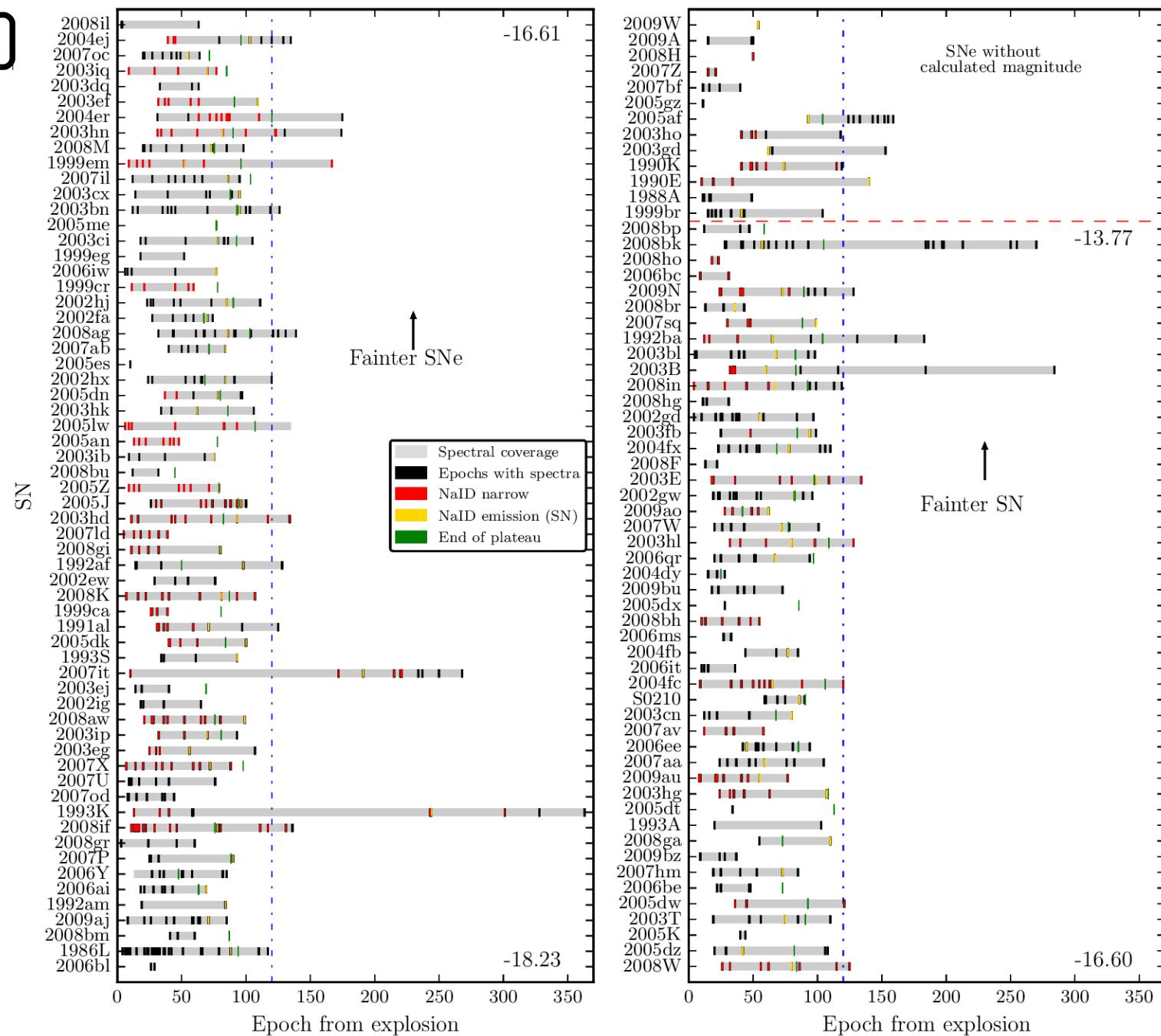
The dust producing the extinction is predominantly located in the ISM of the host galaxies



The most accurate predictor of individual SN extinction to be the equivalent width of the diffuse interstellar band at 5780 Å

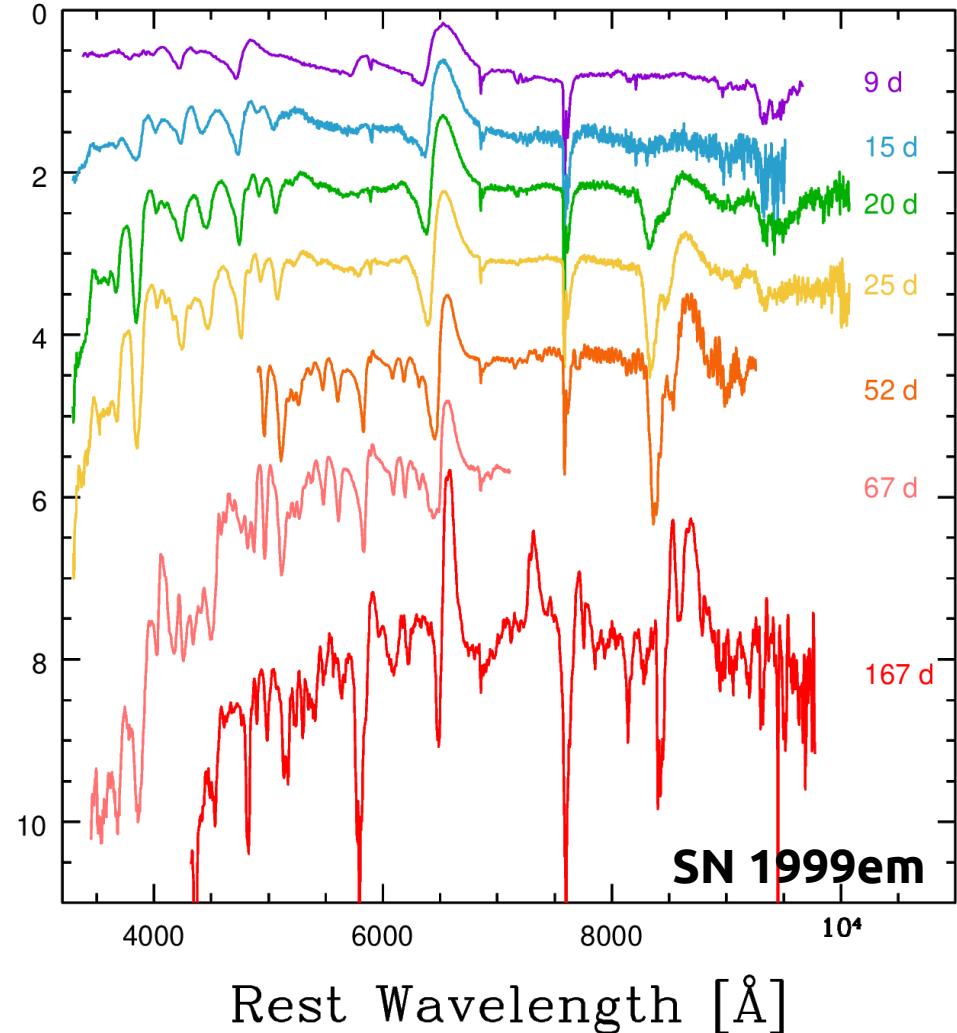
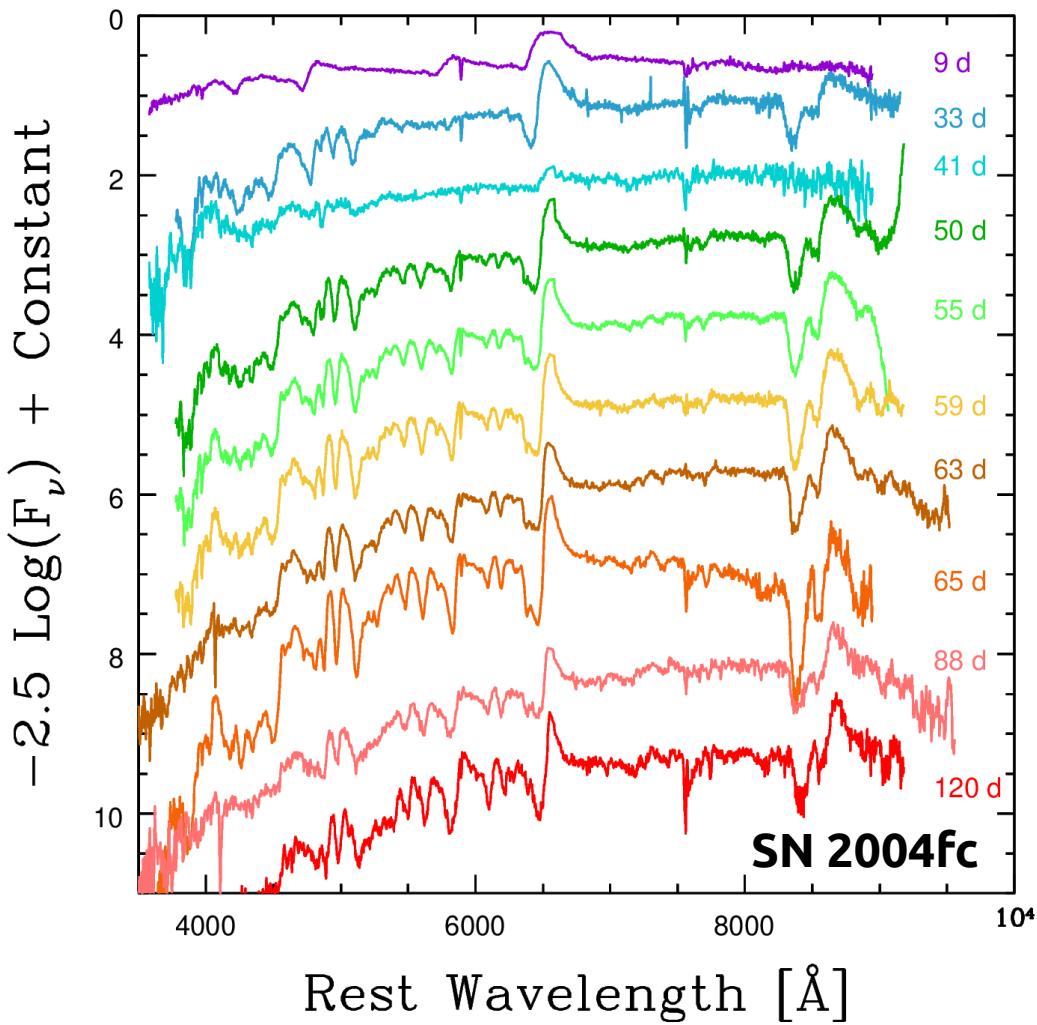
What about SNe II?

SNe II (CSP)



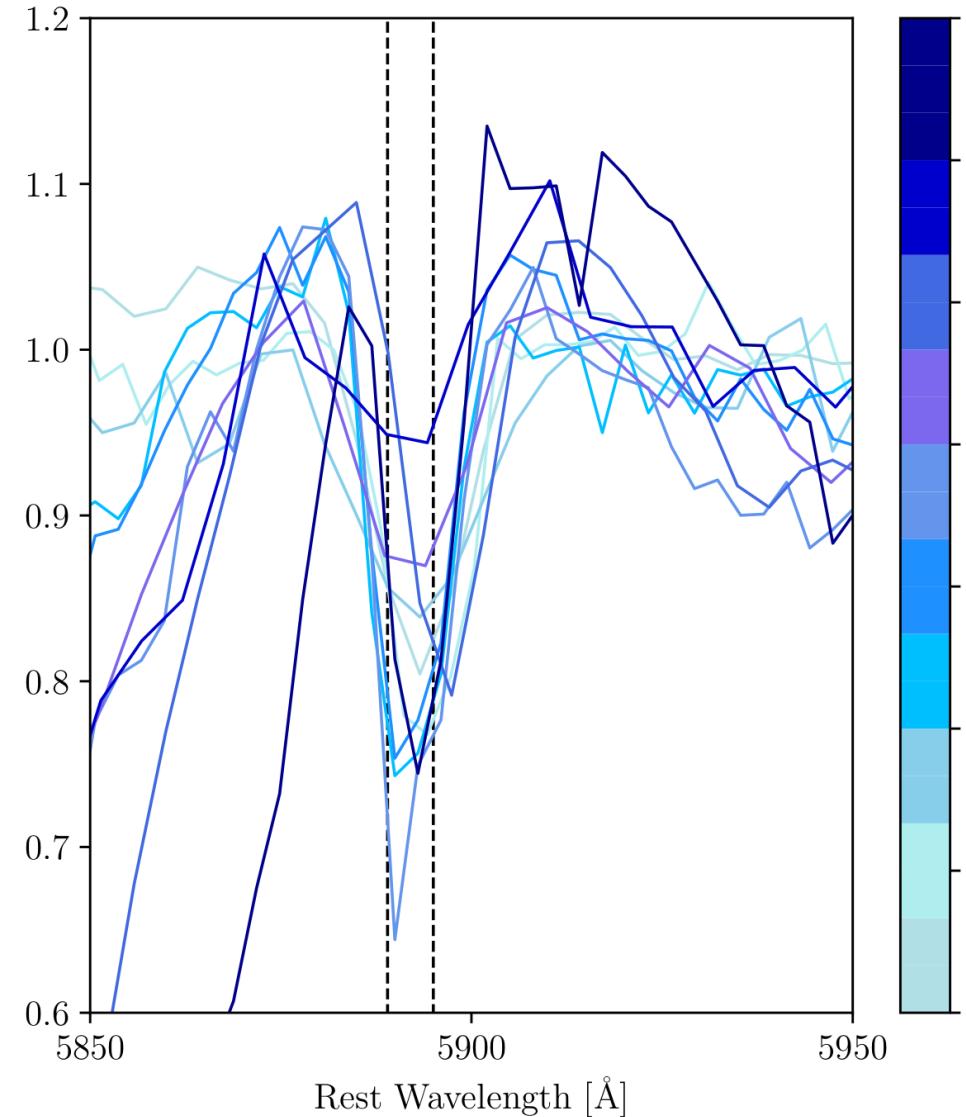
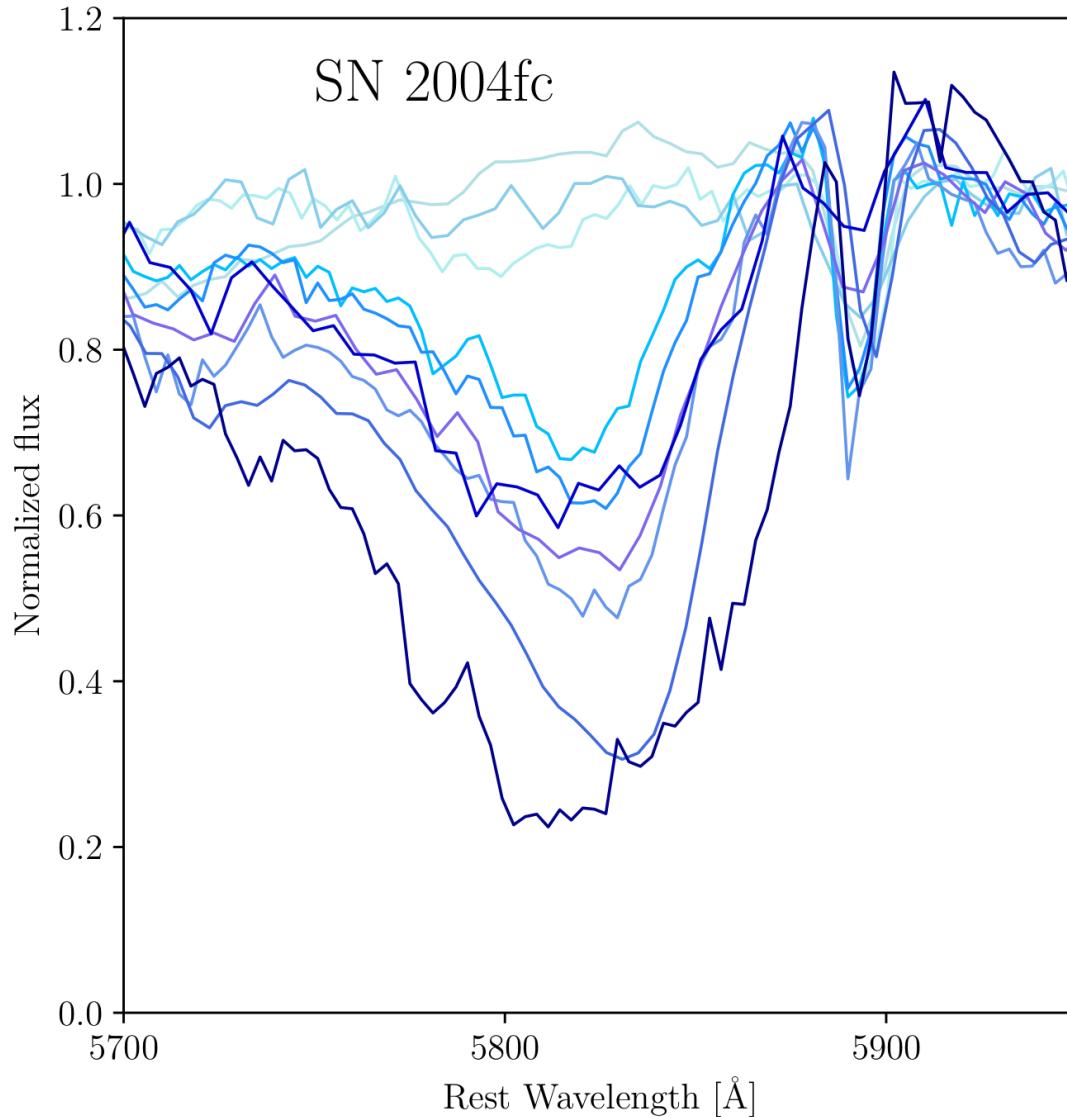
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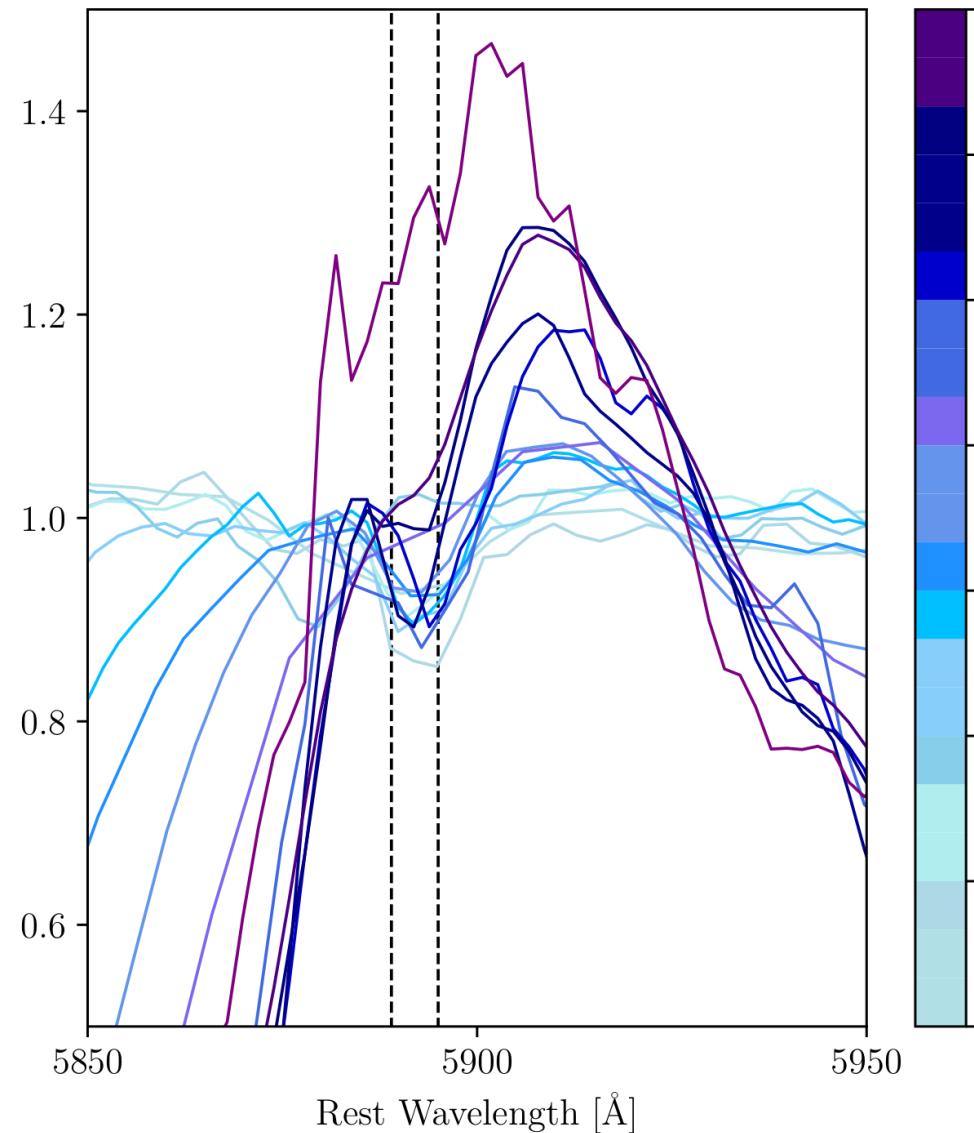
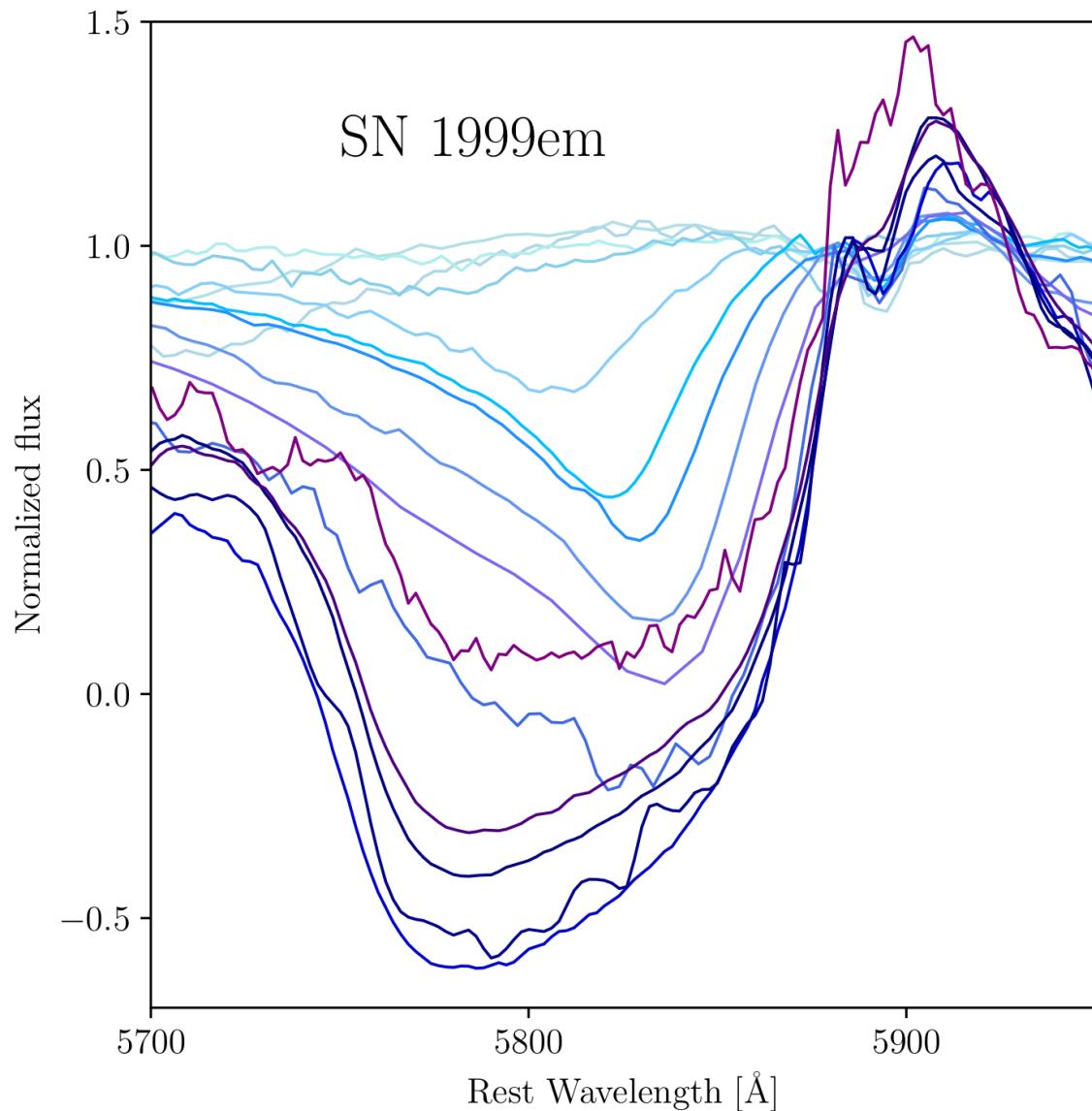
What about SNe II? Evolution: NaID P-Cygni profile? NaID narrow line?

SNe II (CSP)

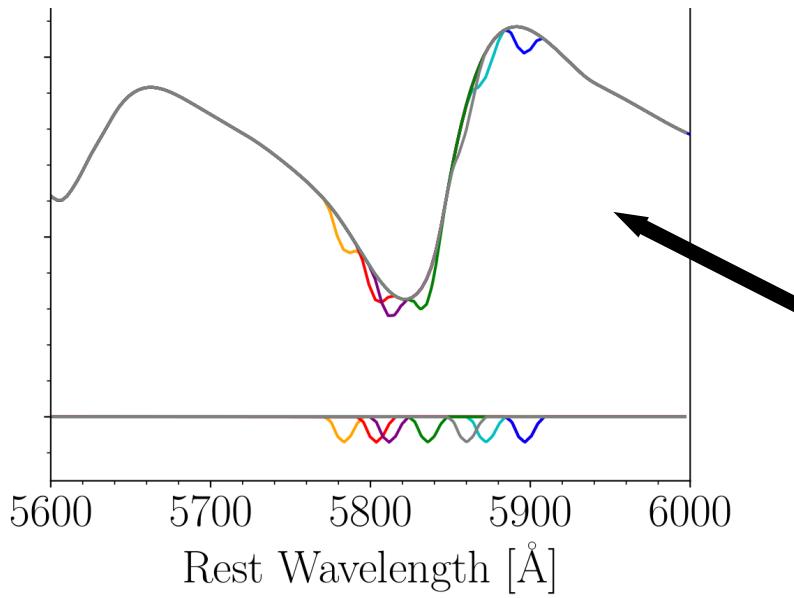


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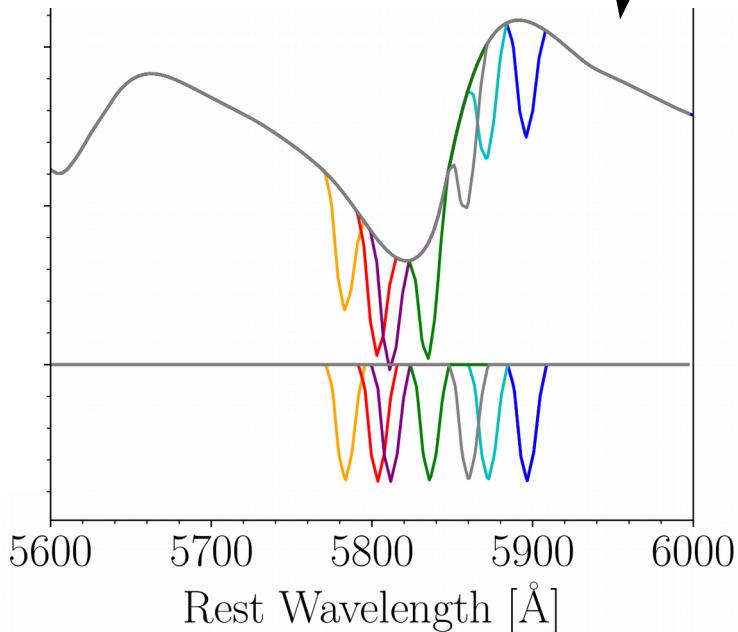
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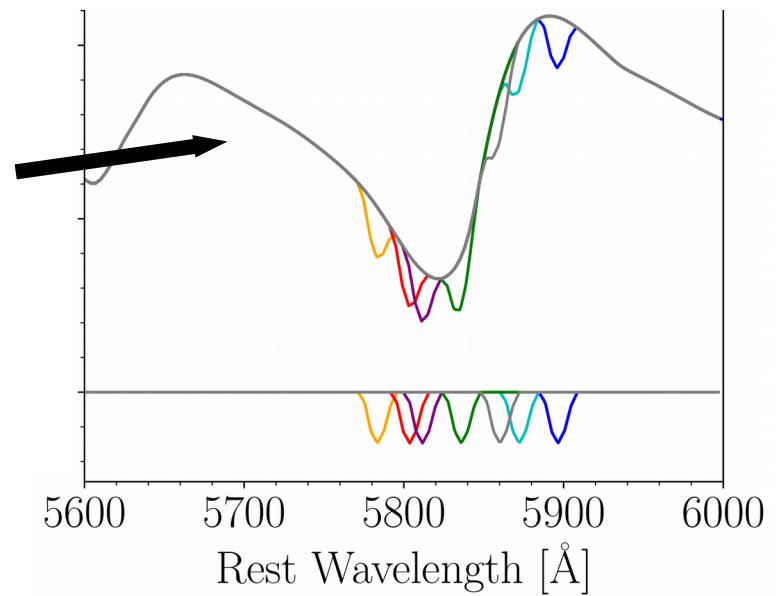
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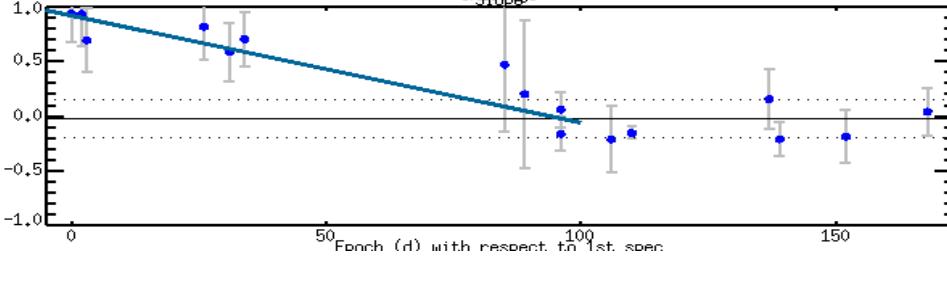
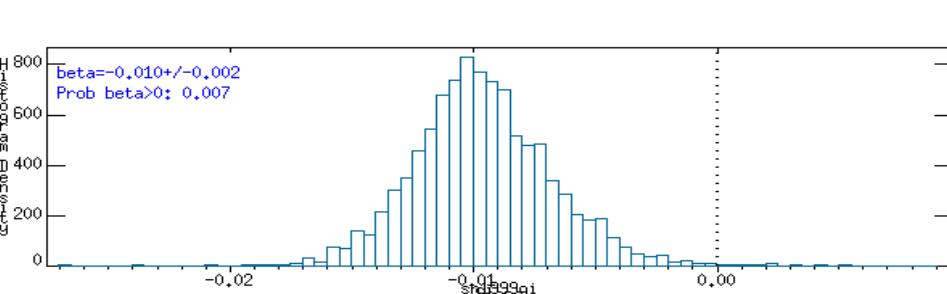
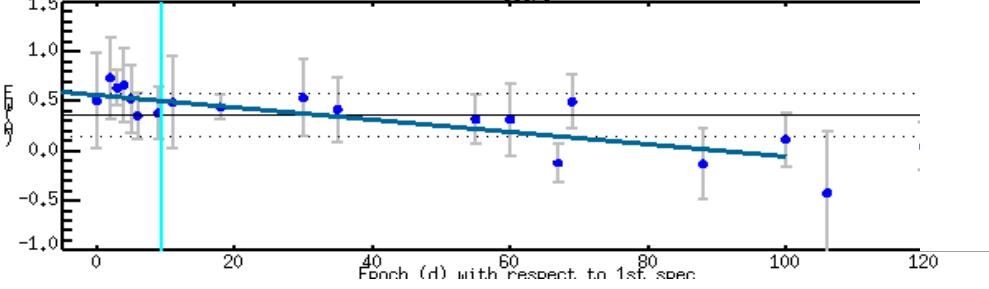
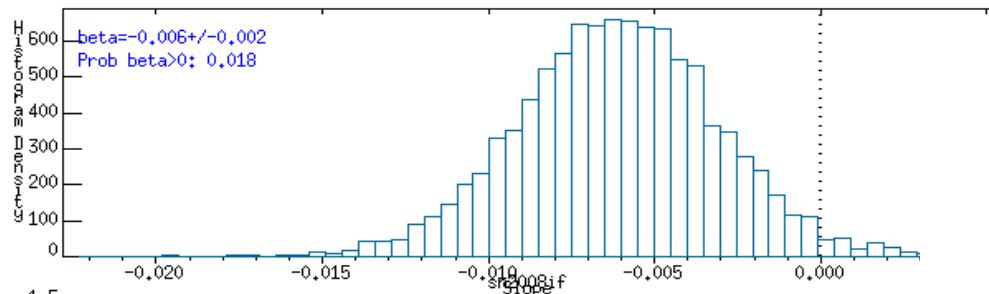
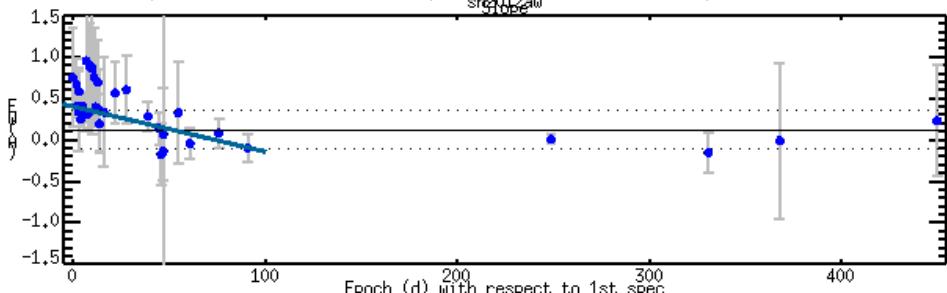
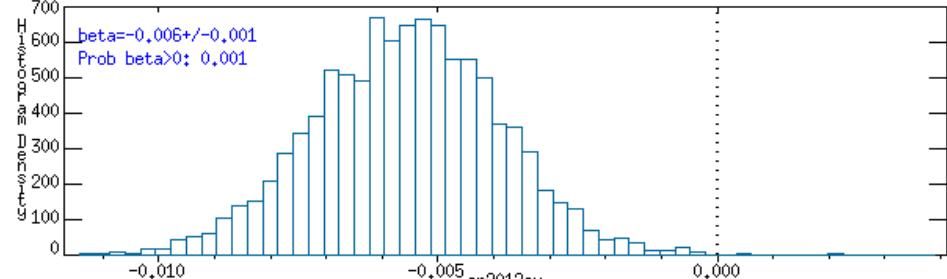
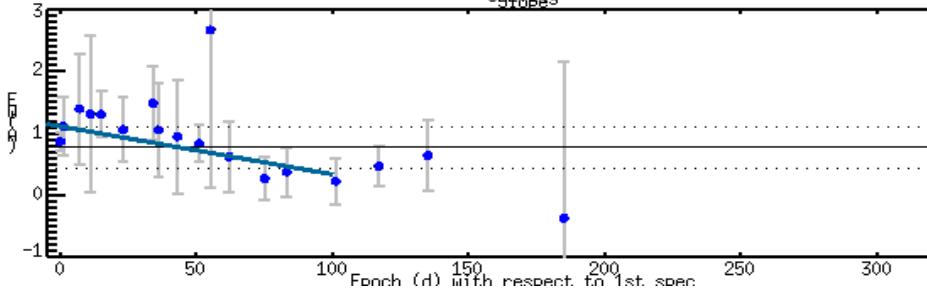
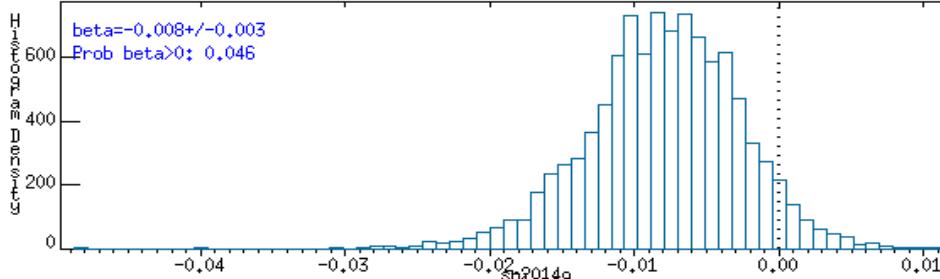
SN P-Cygni
profile:
NaID line



Testing the evolution...



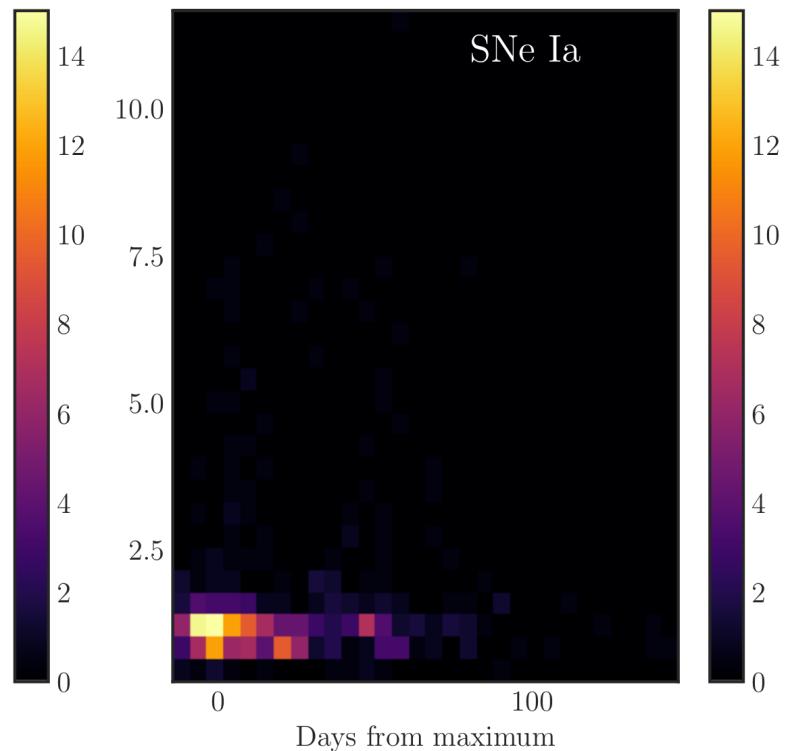
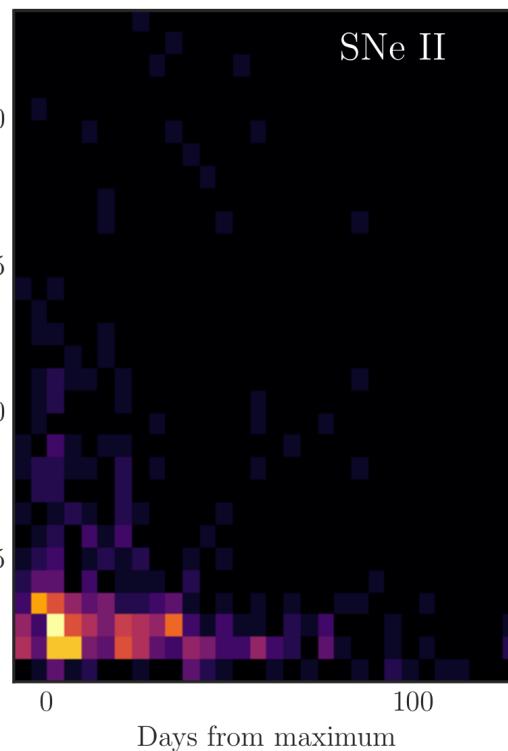
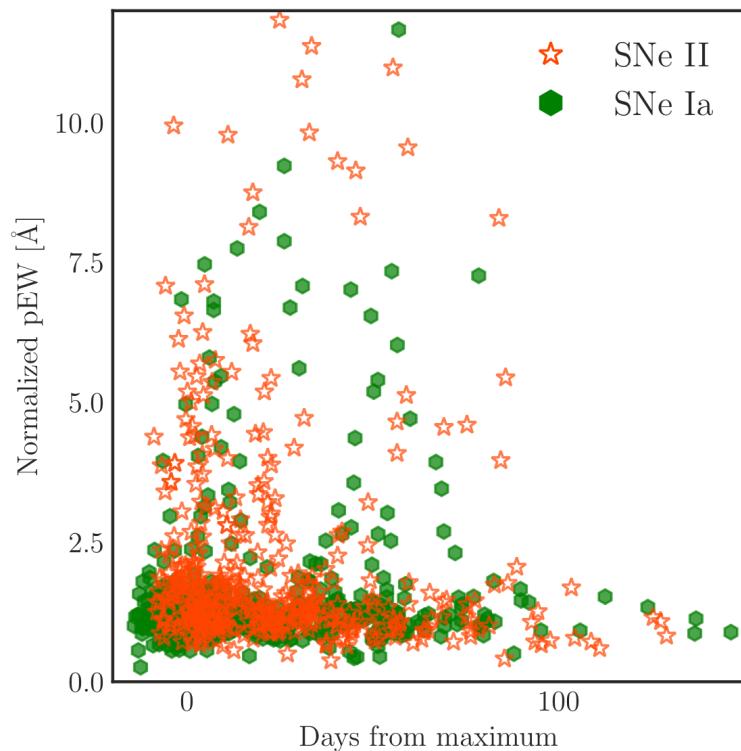
Evolution in the NaID narrow lines?



What about SNe II? Evolution: NaID P-Cygni profile? NaID narrow line?

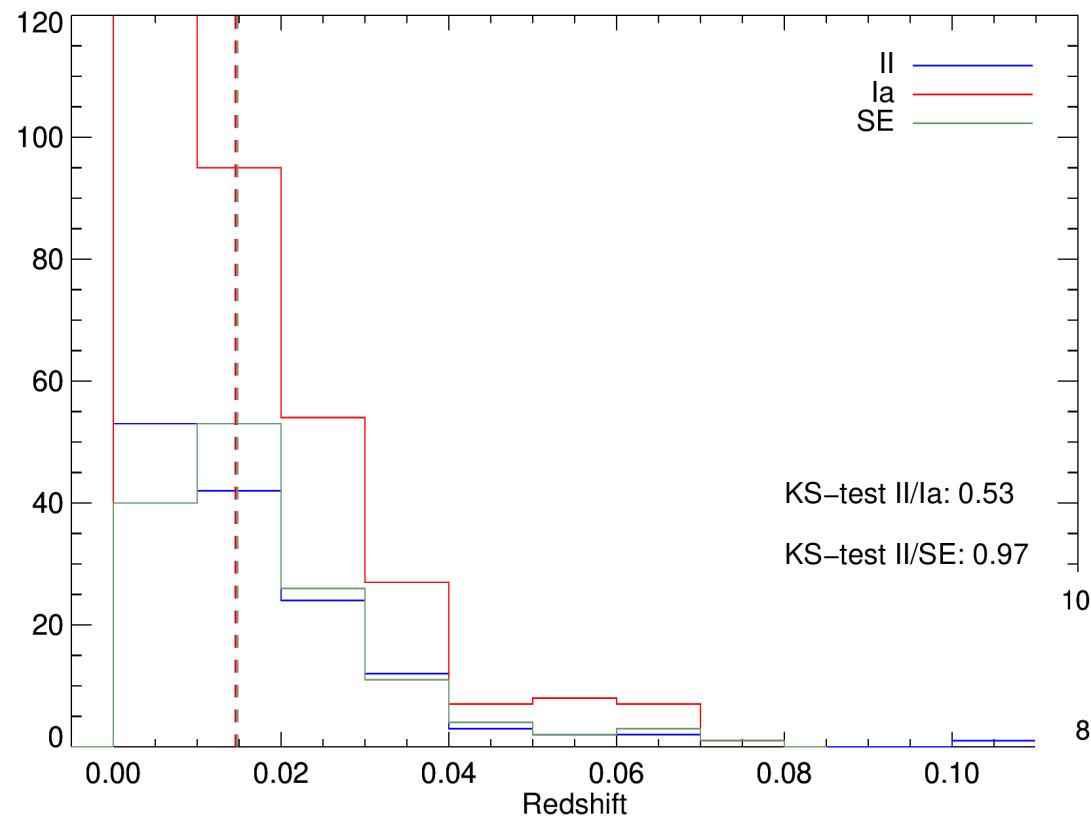
SNe II (CSP)

+SNe Ia to compare

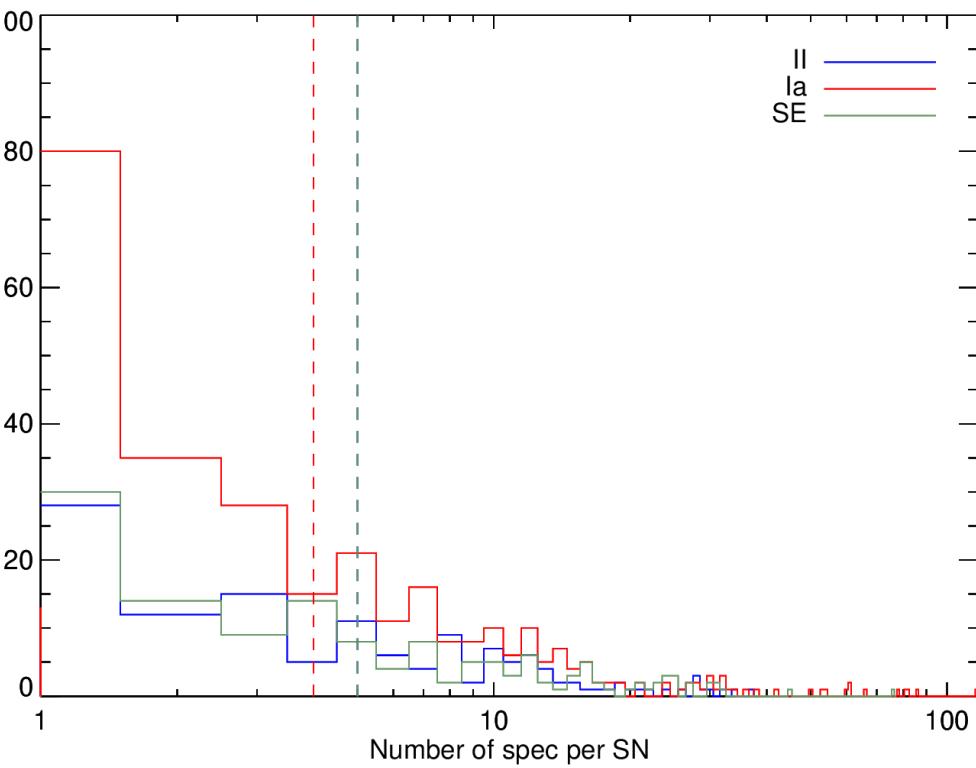


Bias? Sample selection?

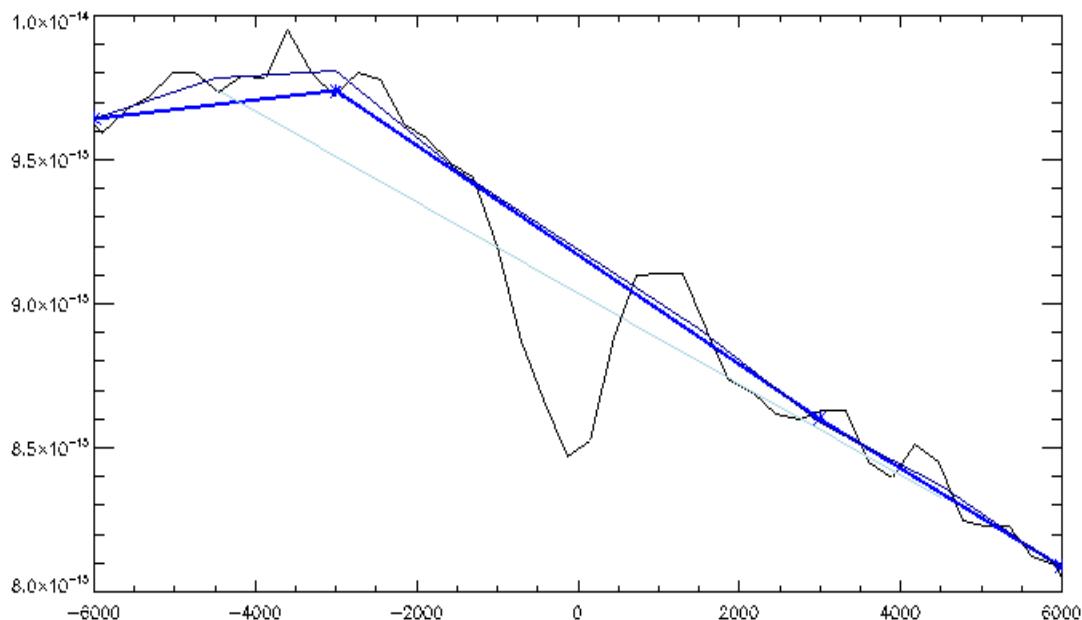
Sample



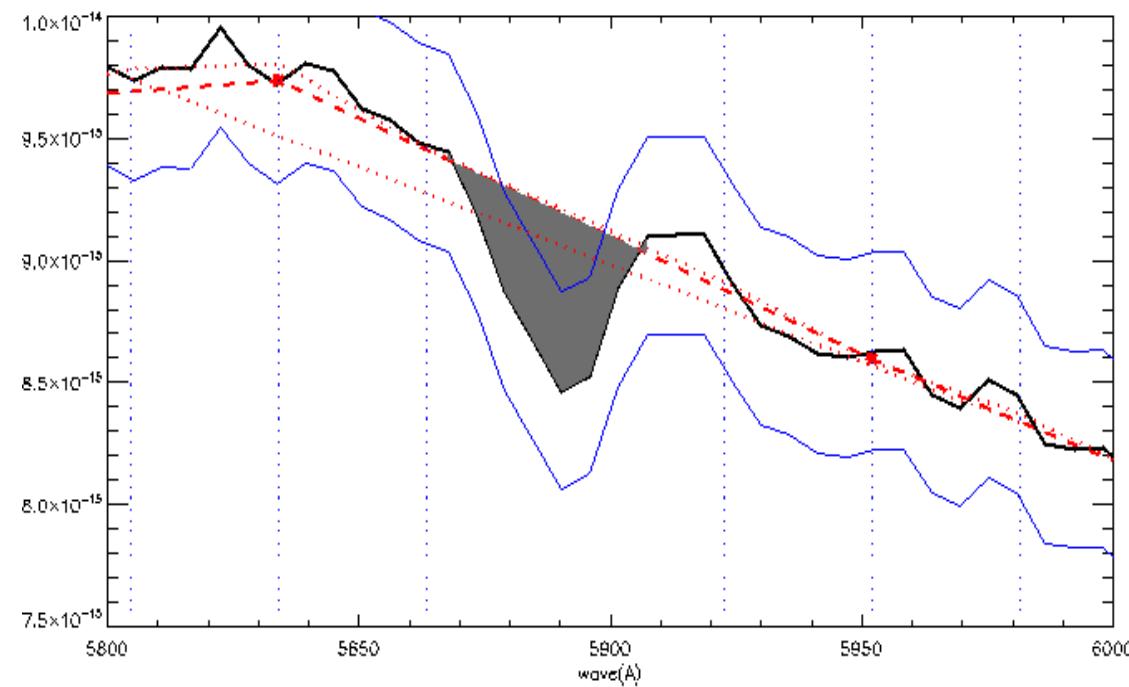
>400 SNe!



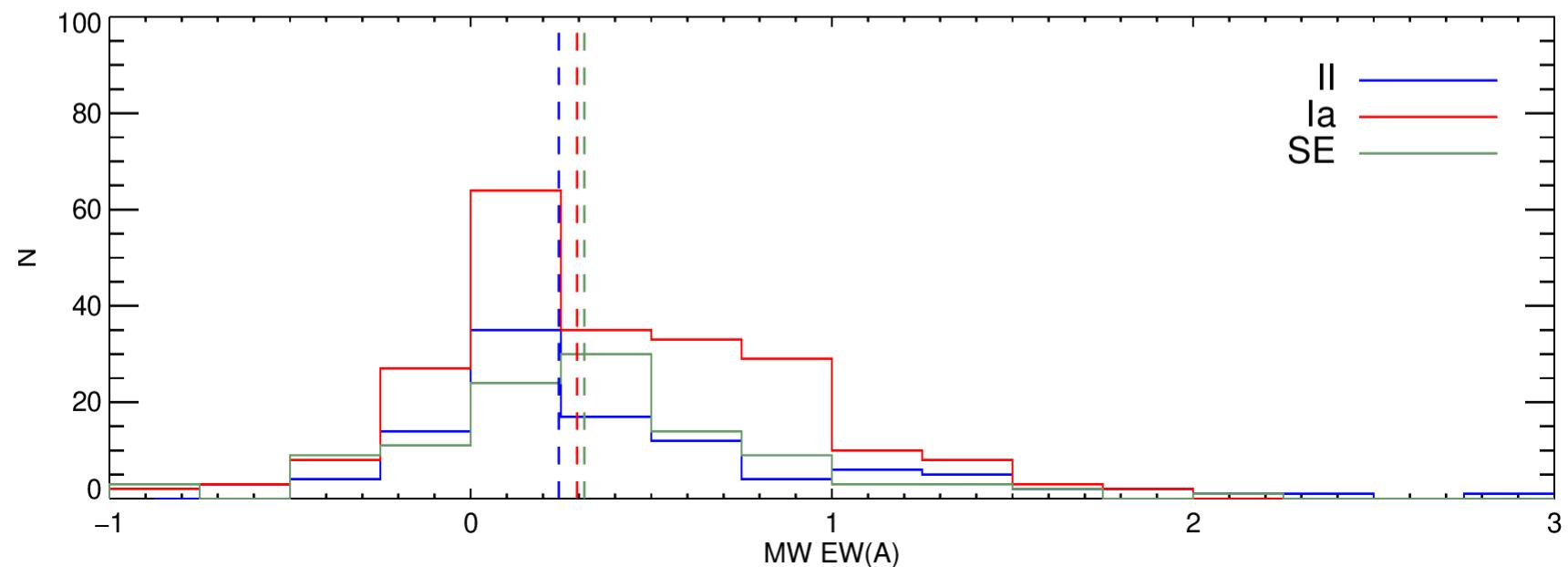
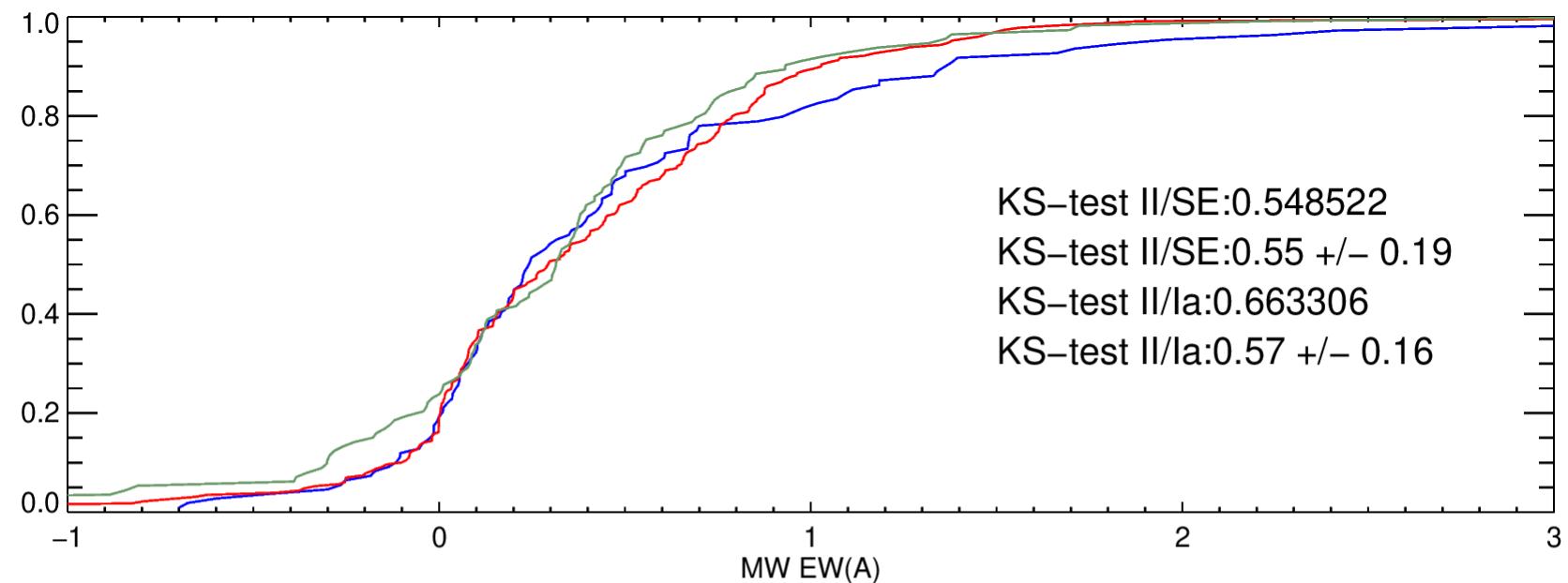
Method



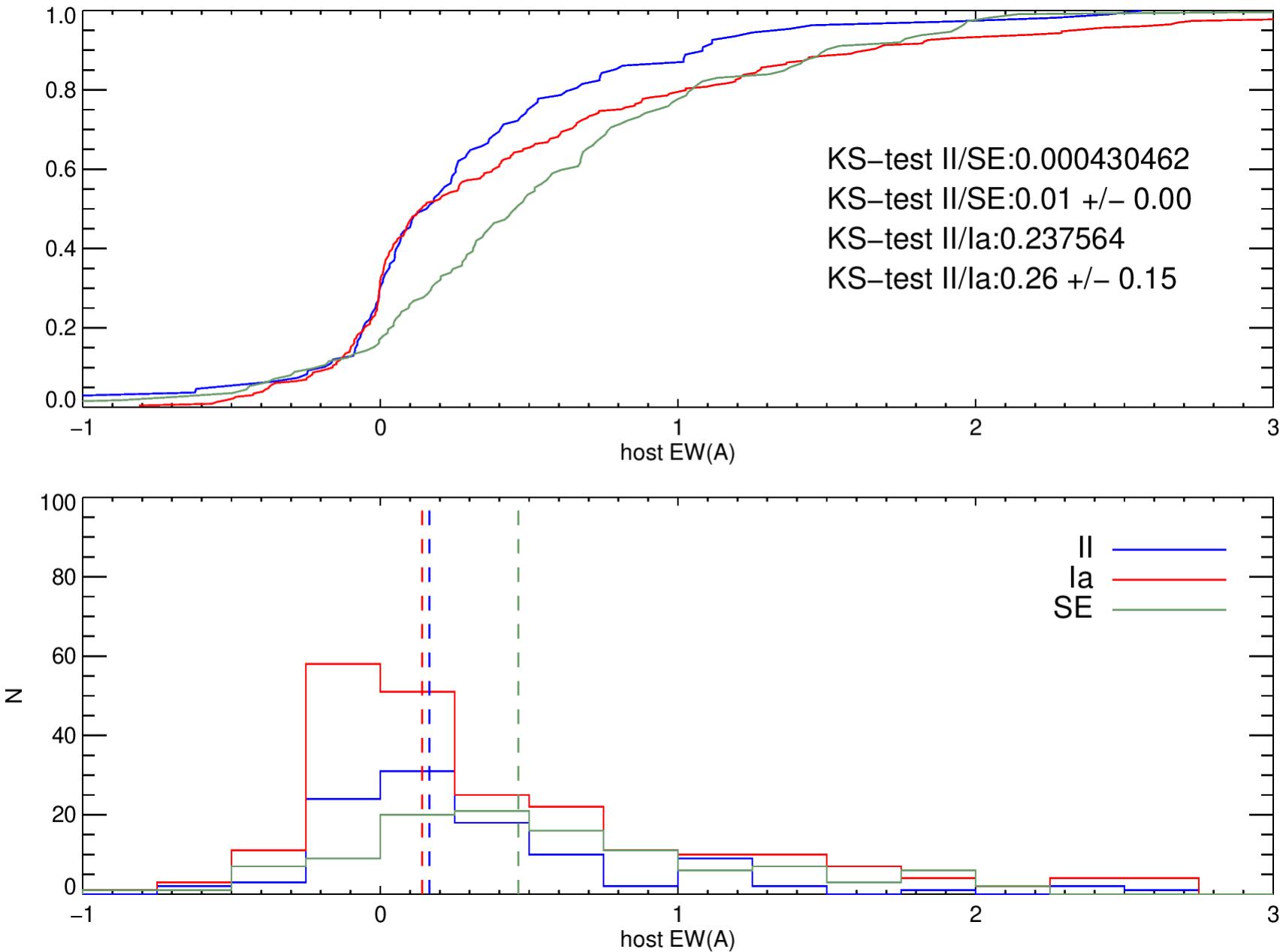
**>2000 spectra
analysed**



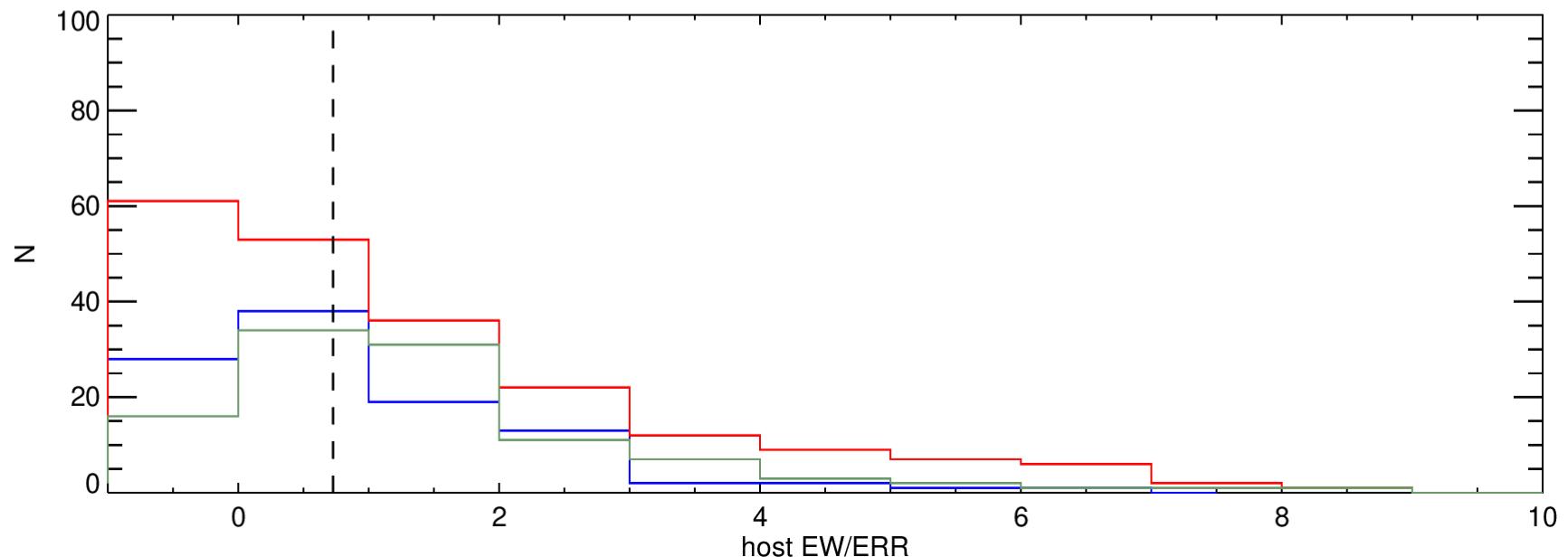
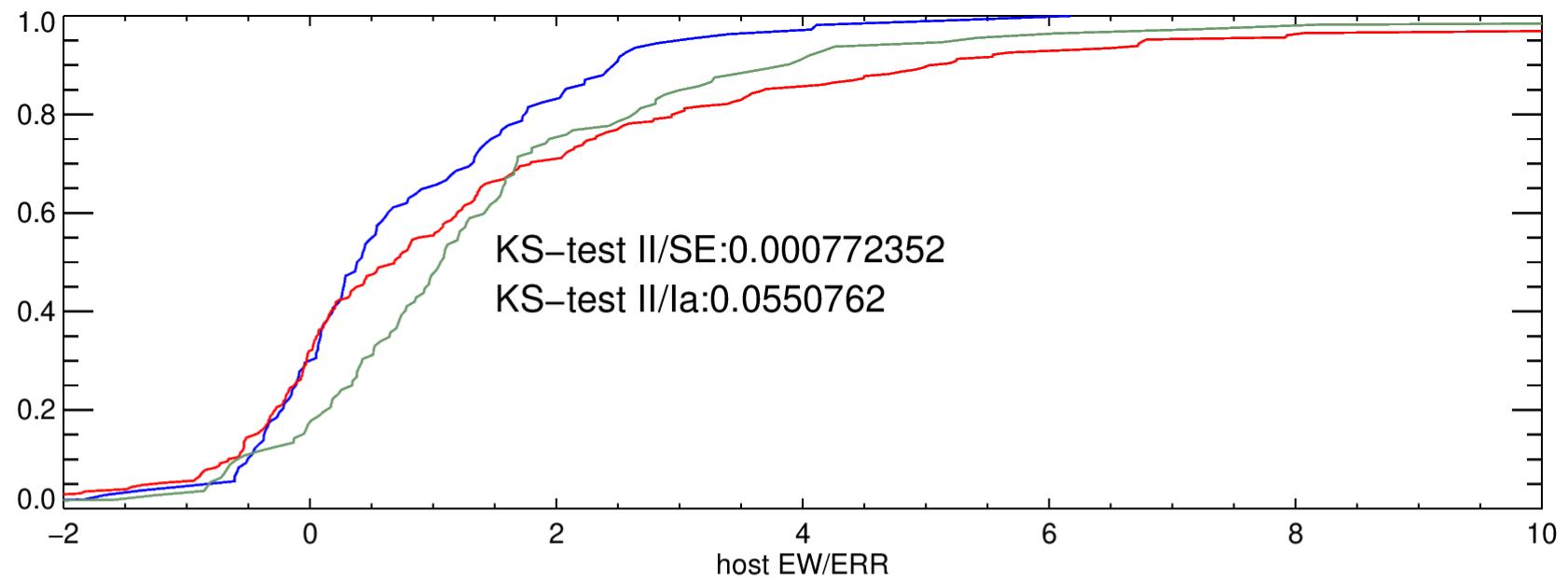
Milky Way pEW



Host galaxy pEW



Host galaxy pEW



Summarising

- We observed a temporal evolution of the narrow NaID lines in SNe II.
→ Bias effect?

- In general, the narrow NaID lines are larger in SESNe.

→ ISM? CSM?

To do:

- Analysis of velocities (blueshifted, redshifted).
- Determine the origin of the temporal variation in SNe II.