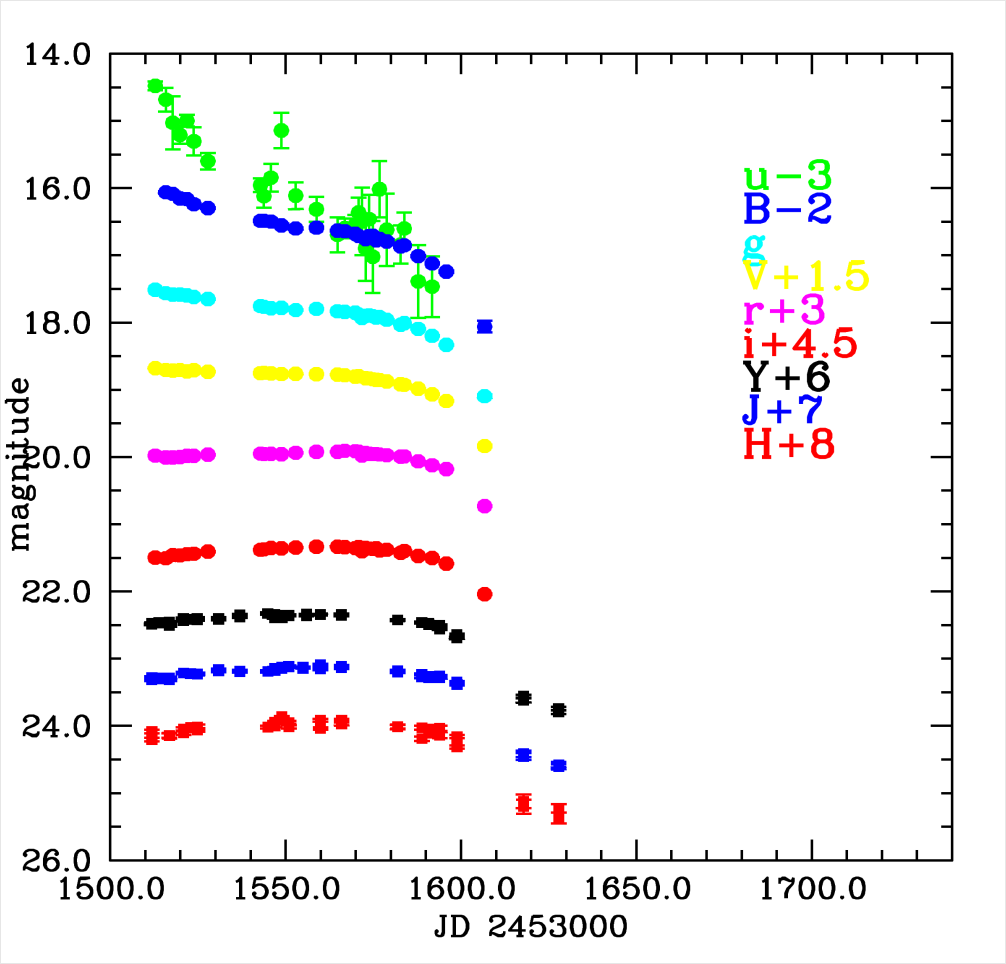
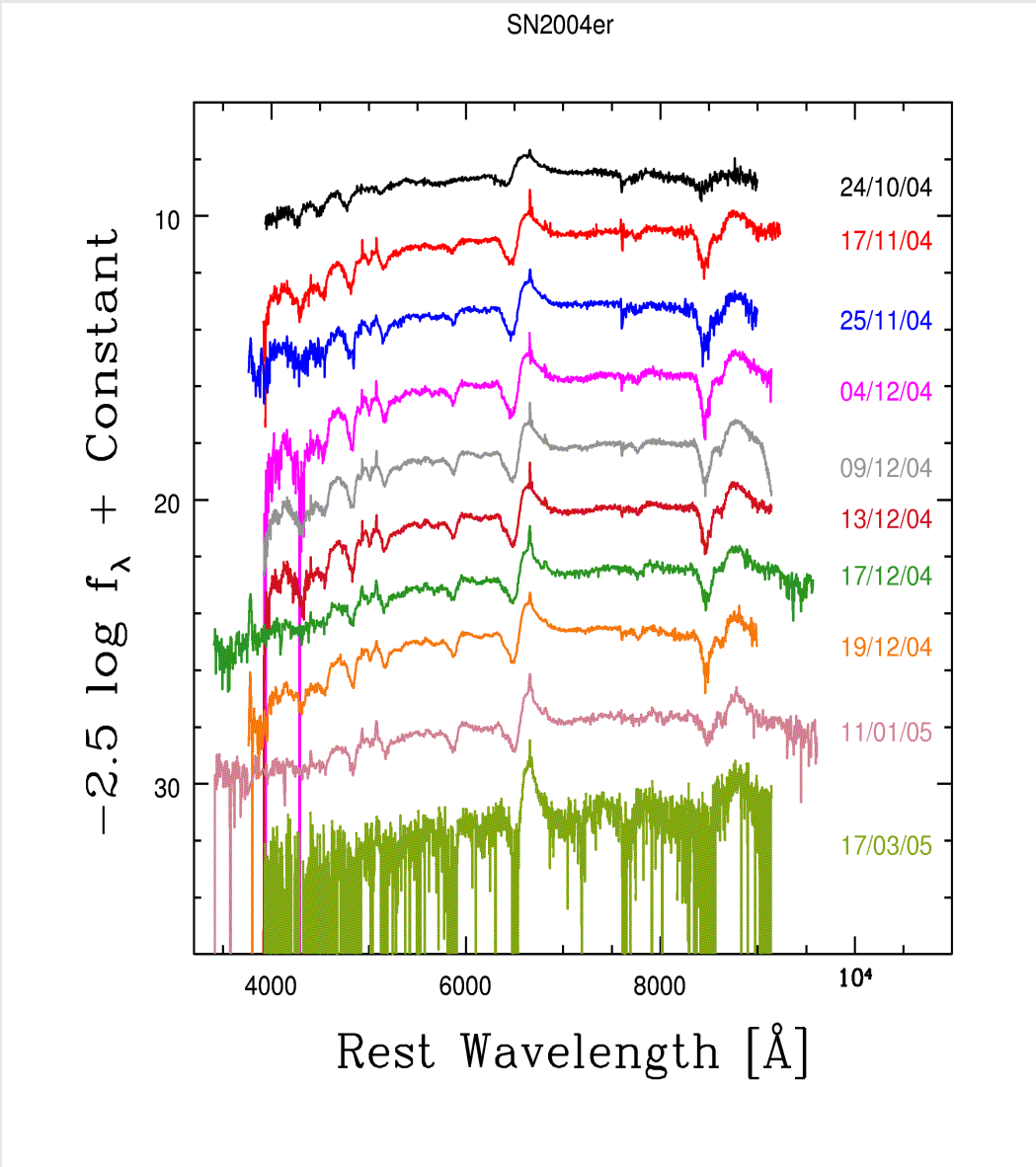
CSPI SNII light-curves and spectra

Joe Anderson, U. de Chile/MCSS (+Mario)





CSPI SNII overview

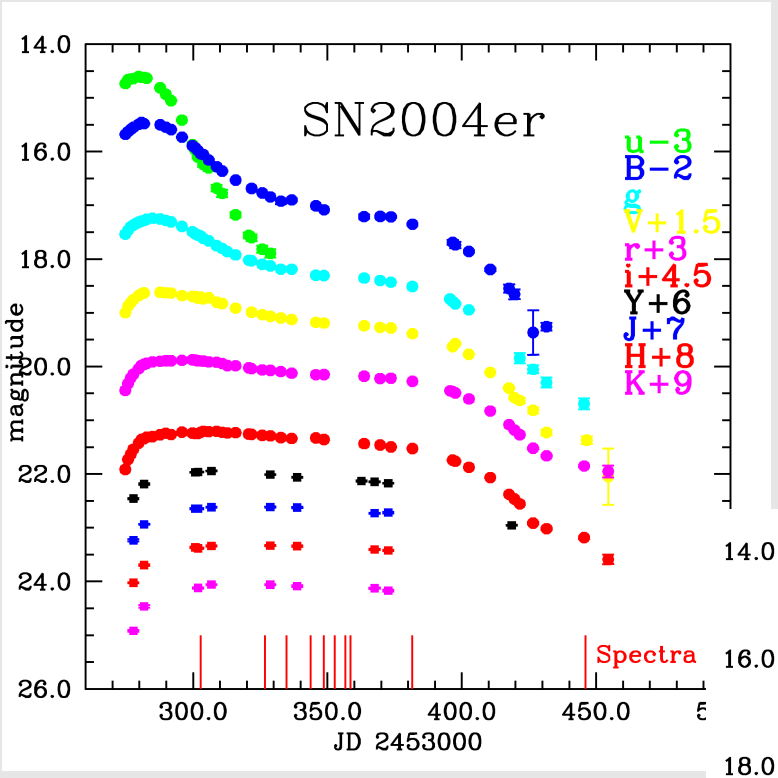
SNII sample in numbers

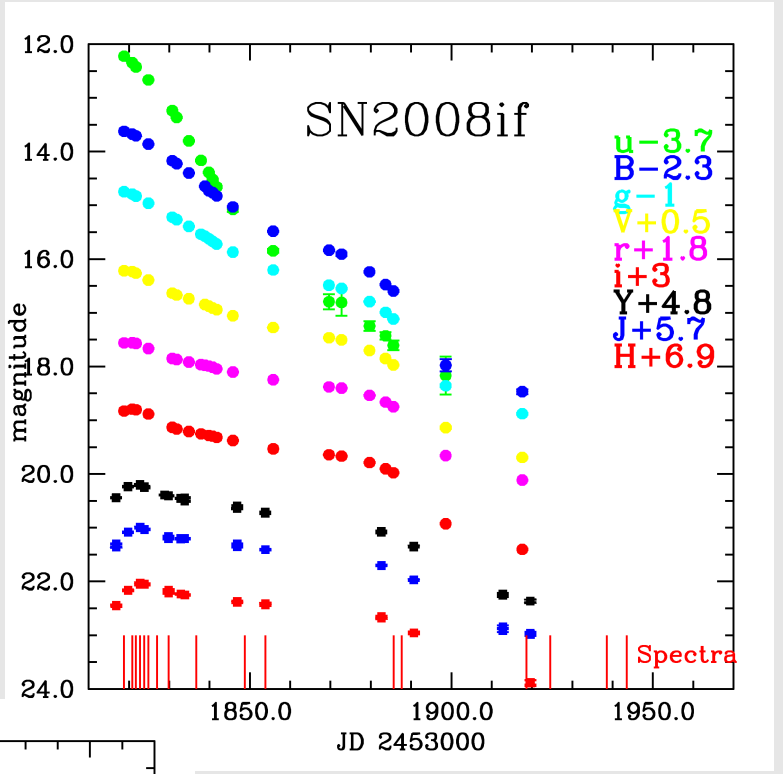
- **95 followed in optical** *(ugriBV)***; 85 in near-IR** *(YJHK)*
- **Once SNIIn (7!) and SNIIb (8) removed -> 80 SNIIP/IIL**
  - SN2008J: Ia/IIn; *Taddia et al. (2012), A&A, 545L, 7*
  - 05ip + 06jd: *Stritzinger et al. (2012), ApJ, 756, 173*
  - IIb part of 'stripped envelope' sample
- **06V and 06au: 87A-like:** *Taddia et al. (2012), A&A, 537, 140*
- **60 SNe with definitive optical photometry**
  - templates still needed in 11 cases (1 or 2 bands)
- **Majority of near-IR photometry achieved**

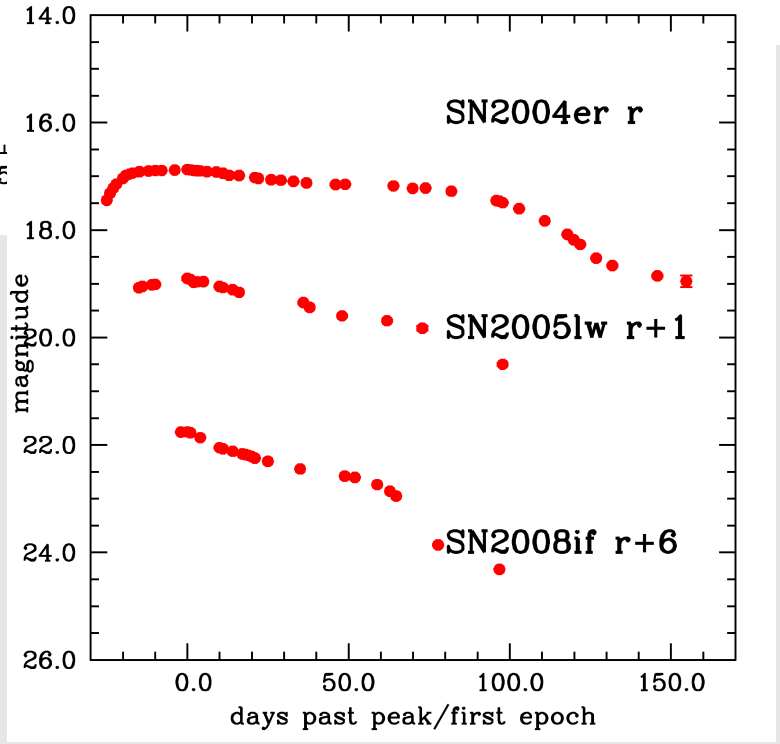
- **Total 545 spectra for 80 SNII (reduced: THANKS NIDIA!!!)**

CSPI SNII progress report

Photometry; J. Anderson

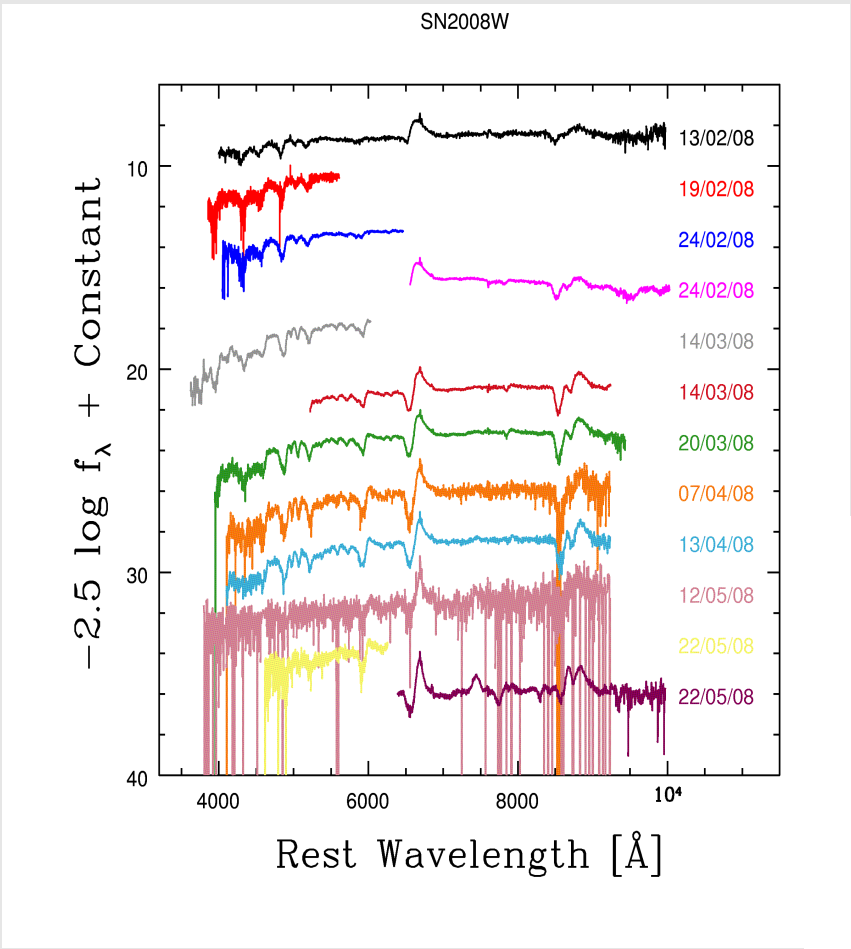


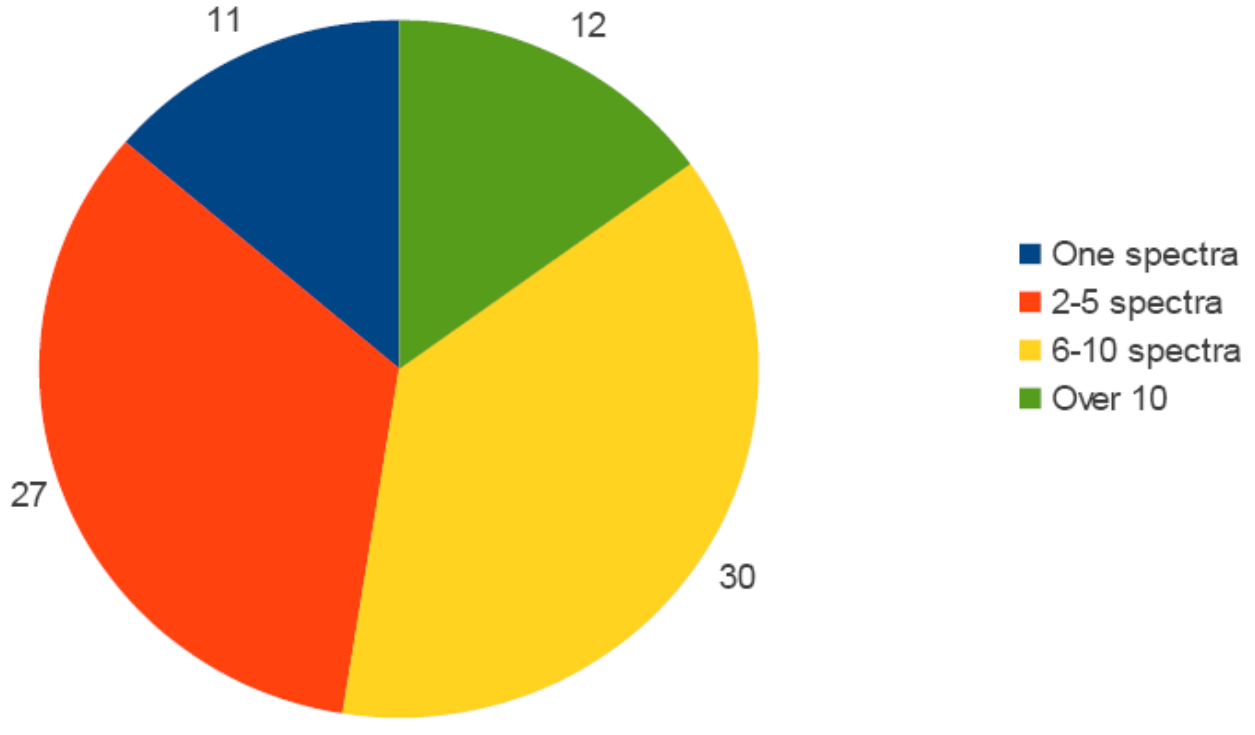




CSPI SNII progress report

Spectroscopy; C. Gutierrez





CSPI SNII current projects

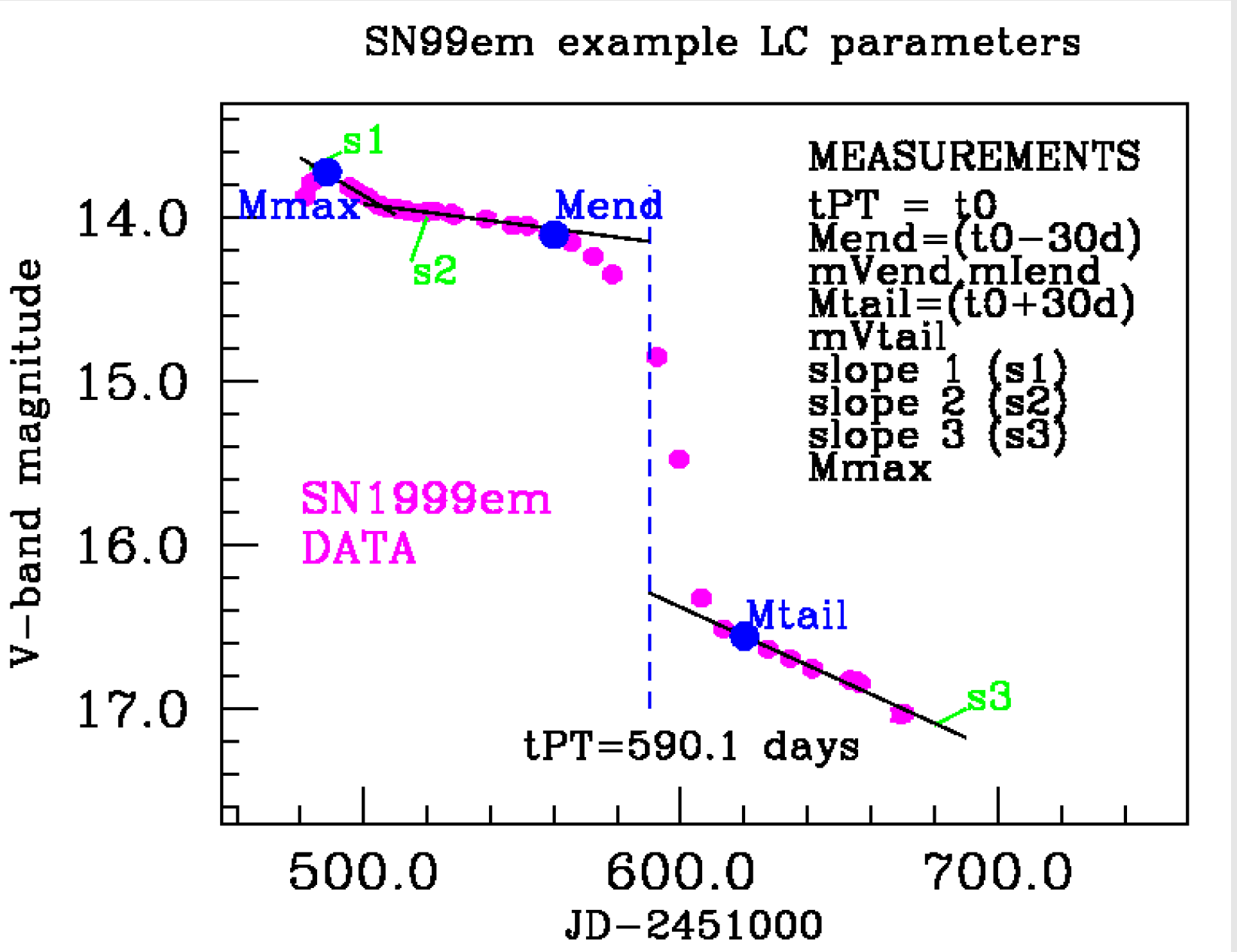
V-band LC morphologies *(J. Anderson)*
- Searching for LC correlations
- Initially concentrating on V-band

SNII spectral characteristics *(C. Gutierrez)*
- PhD thesis on SNII spectra: a statistical analysis
- Measuring spectral features and correlations with LCs

Extinction determinations for SNII *(S. Marchi)*
- Currently a pre-thesis project to determine host *Av*
- Is colour (e.g. *V-i*) really measuring extinction?

V-band light-curve analysis

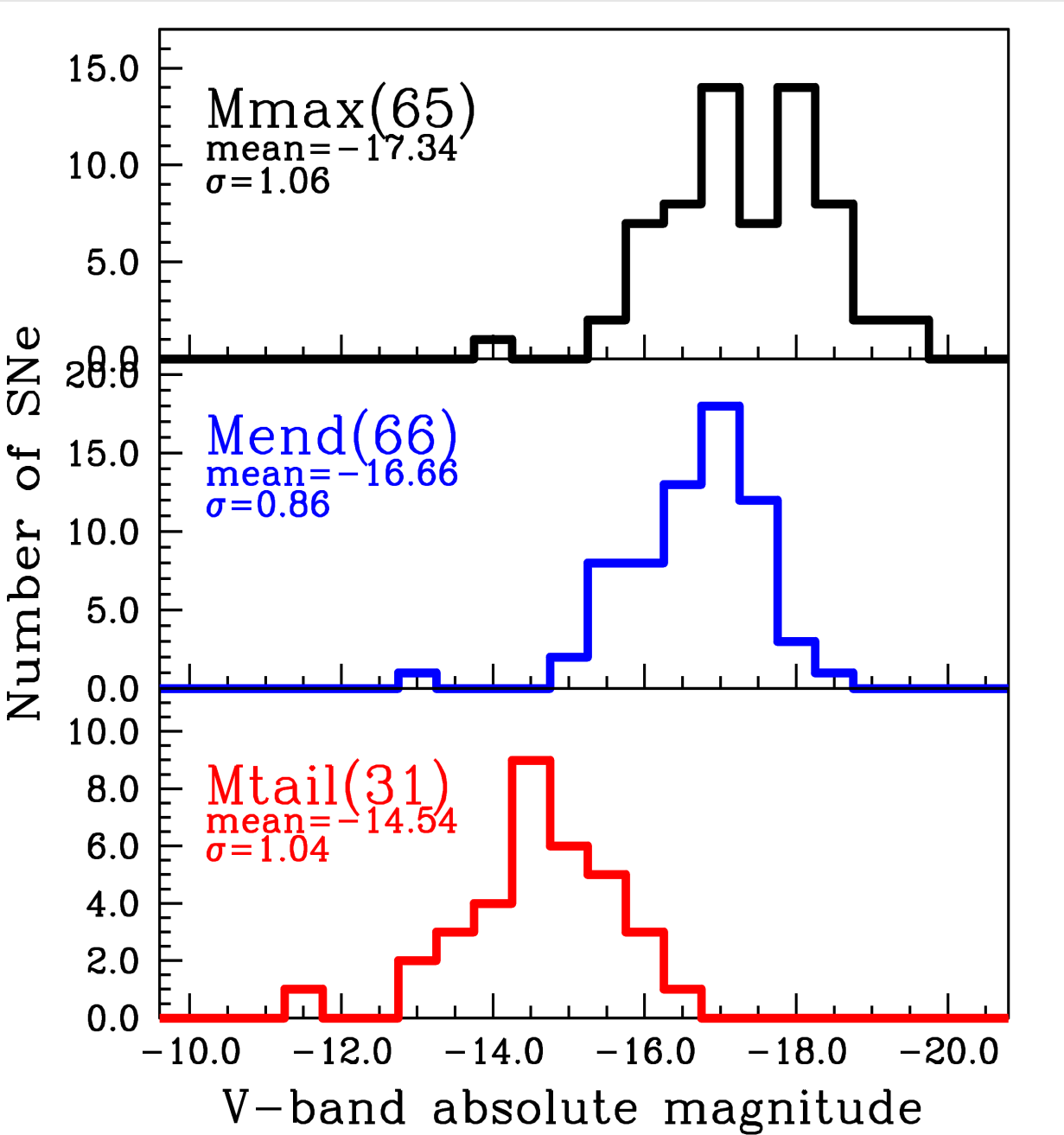
An example light-curve: SN1999em



V-band light-curve analysis

Peak, plateau, and tail magnitudes

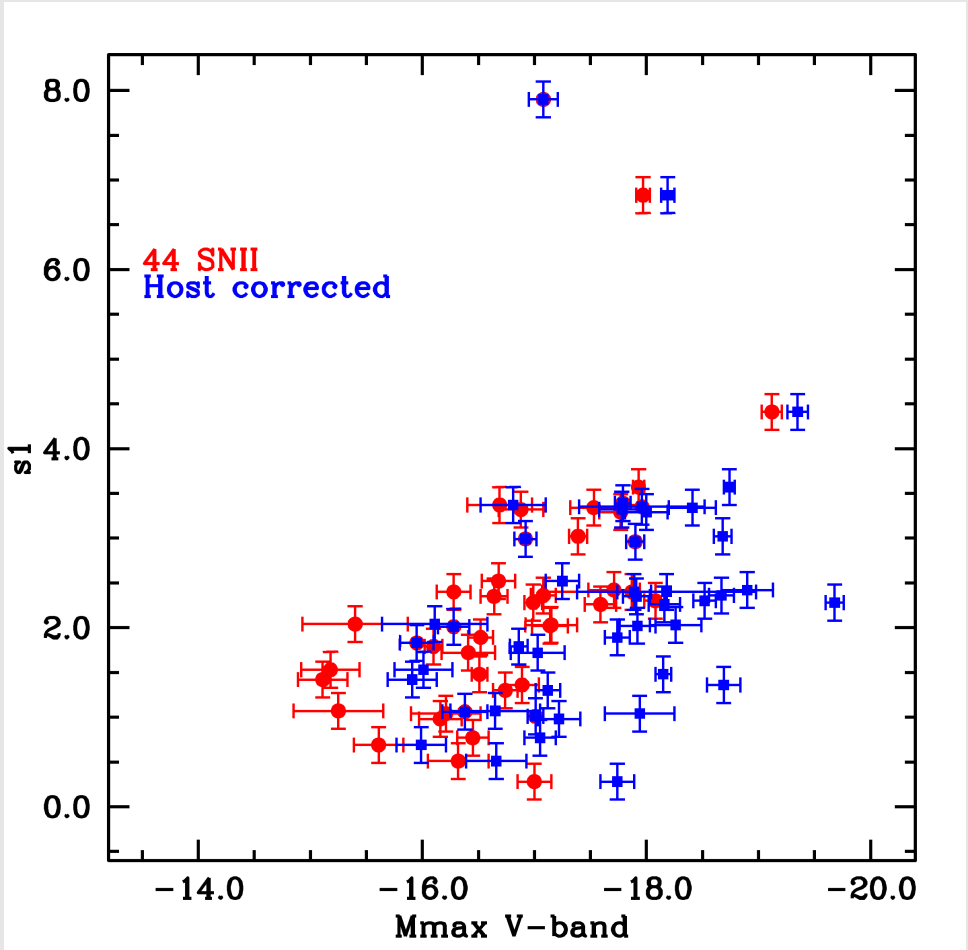
- All corrected for host extinction using *Olivares et al. (2010)*
- Stdev is smallest in M_{end}: end of P mag.
- Extinction correction makes no difference?

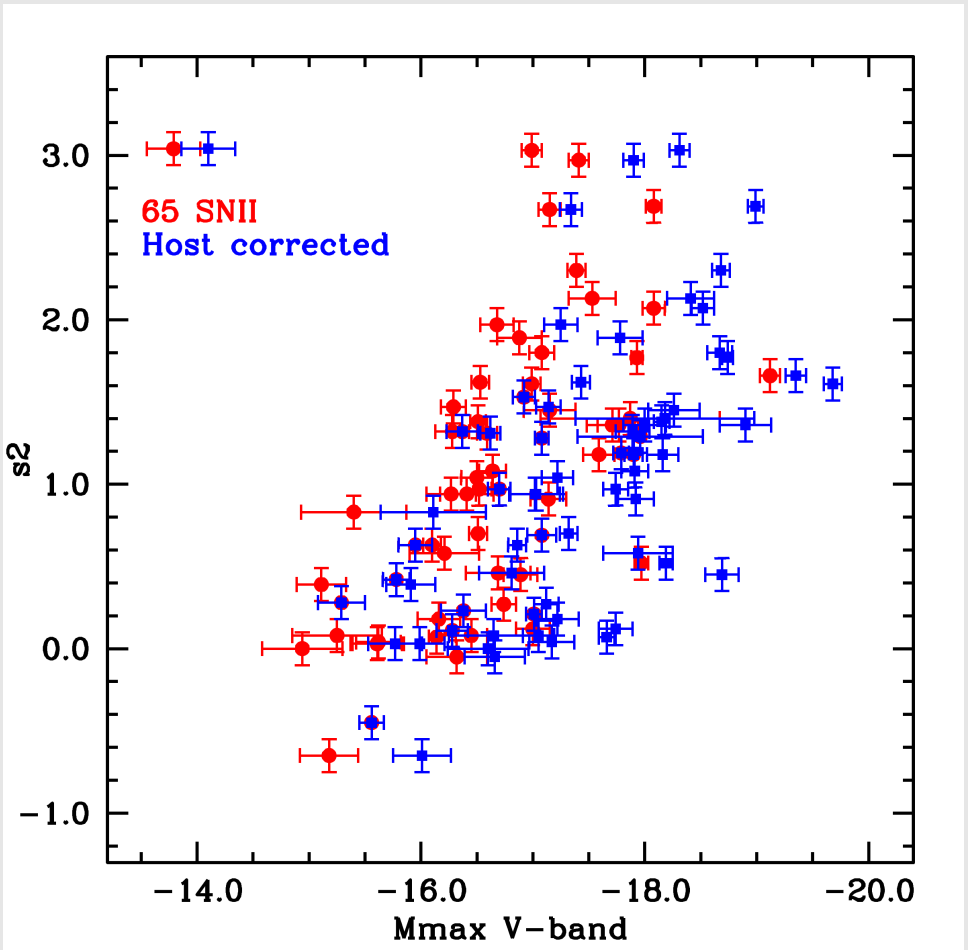


V-band light-curve analysis

Decline rate-peak mag. correlations

- Both initial decline (s1) and 'plateau' decline (s2) appear correlated with M_{max}
- Brighter SNII decline quicker: a continuum of events?

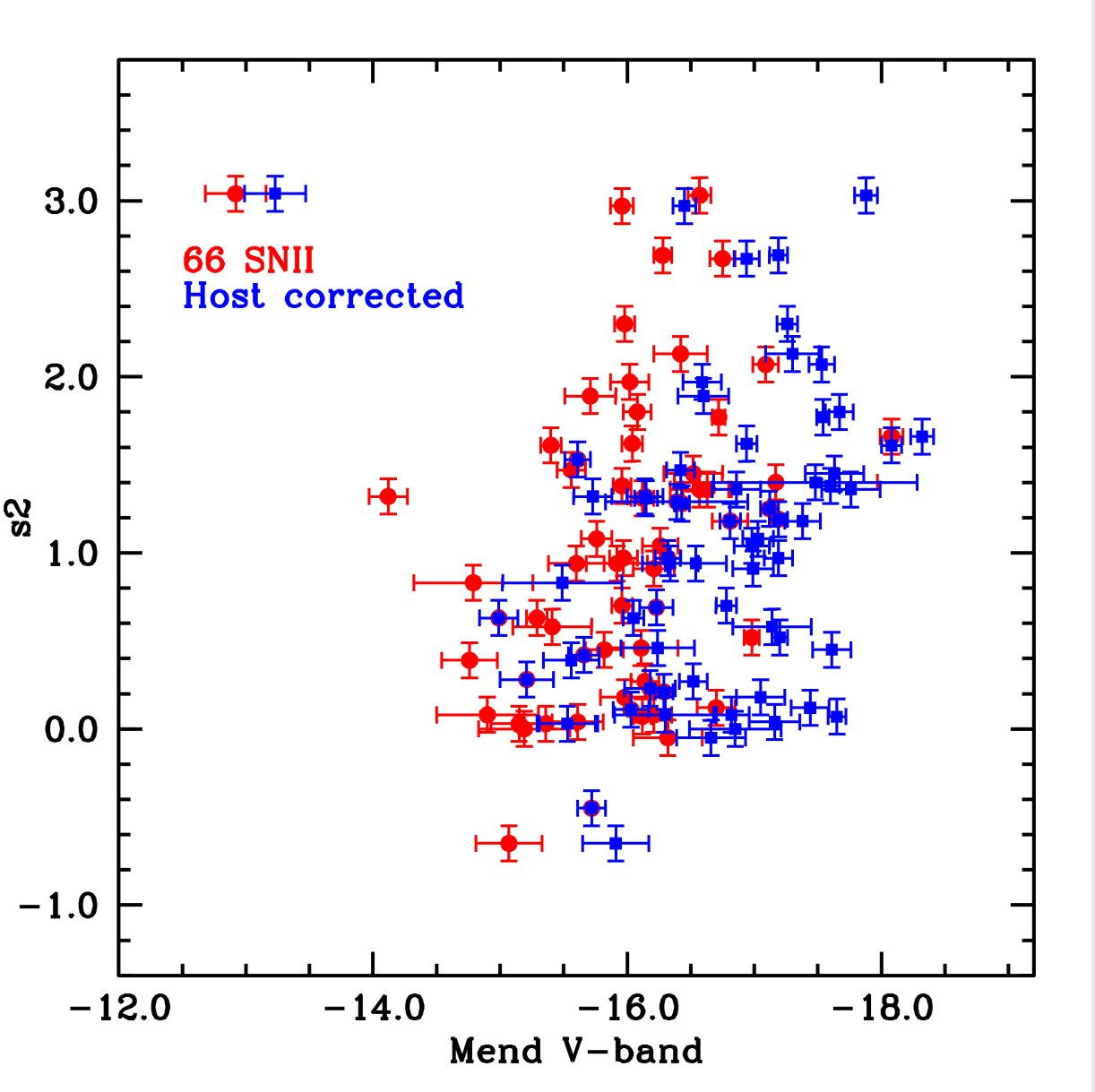




V-band light-curve analysis

Much weaker/non-existent with 'plateau' mag.!

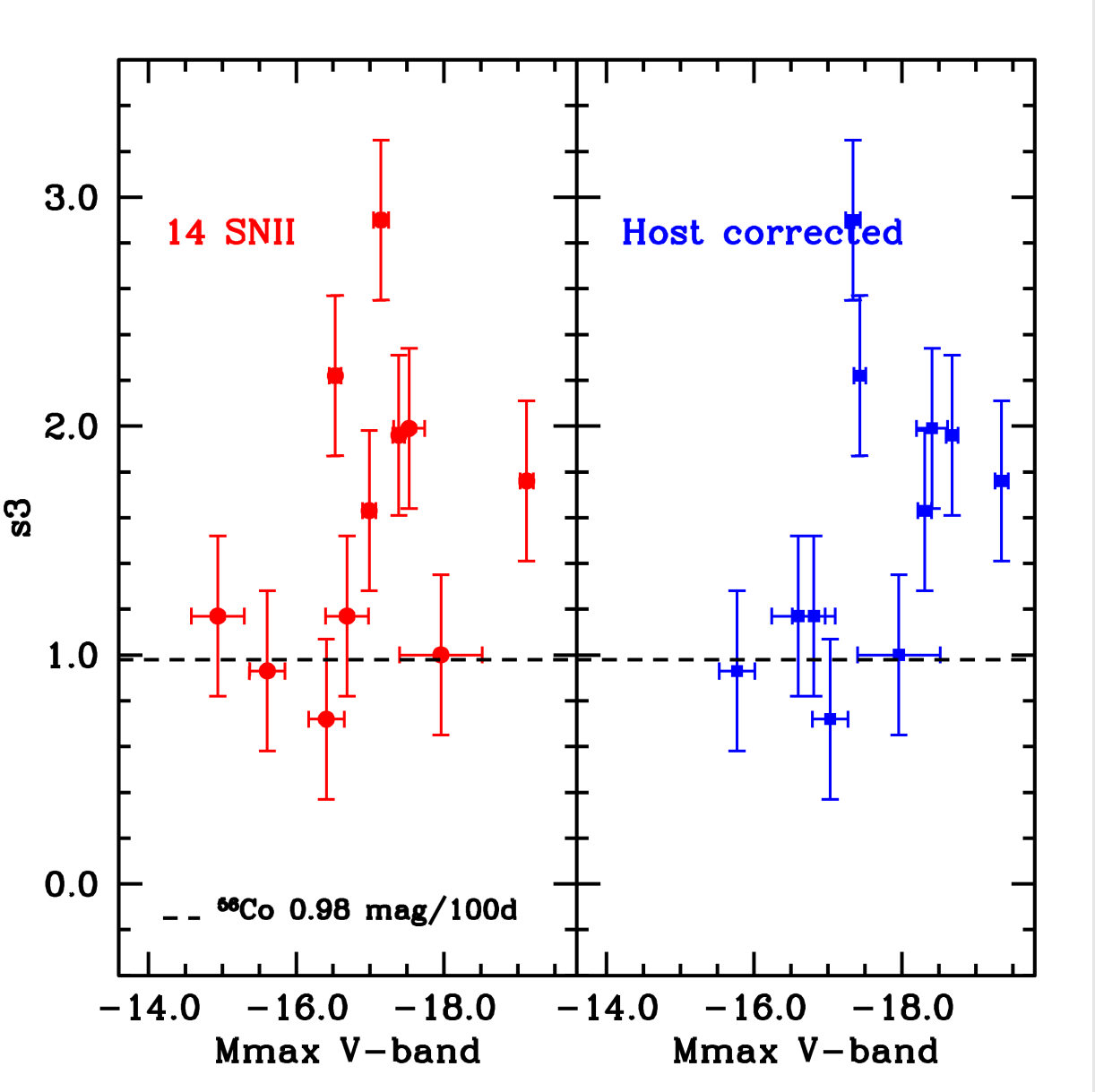
- Due to problems in defining M_{max}, M_{end} used previously
- Zero or much weaker correlation with decline rate
- M_{max} is more dominant parameter in defining a SNII?



V-band light-curve analysis

More luminous SNII have smaller ejecta masses?

- Brighter SNe at max. have faster declining radioactive tails (s3)
- Incomplete trapping due to smaller ejecta masses?
- Lots of scatter, but also seen in CATS data...



V-band light-curve analysis

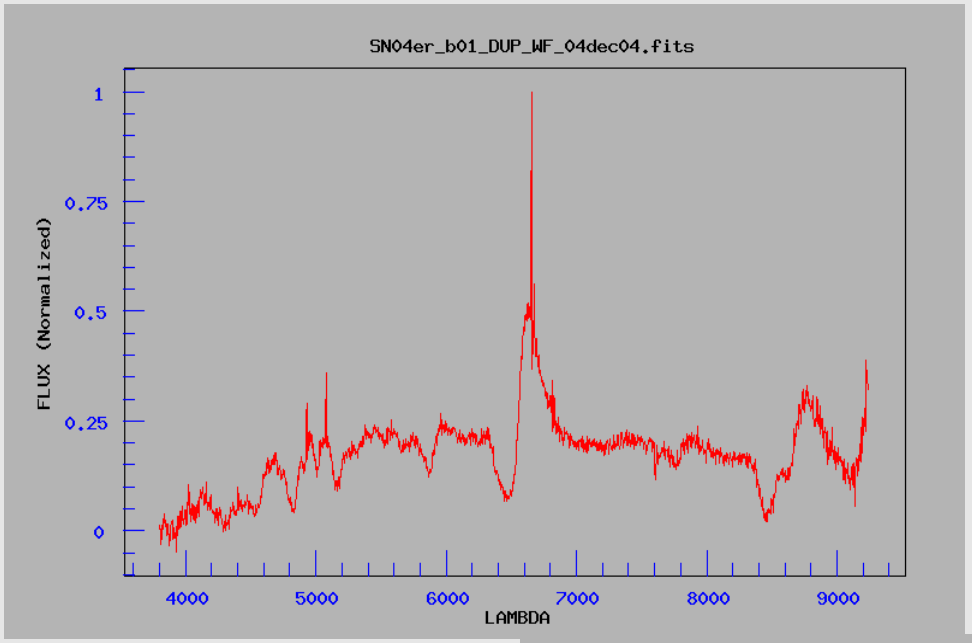
Summary

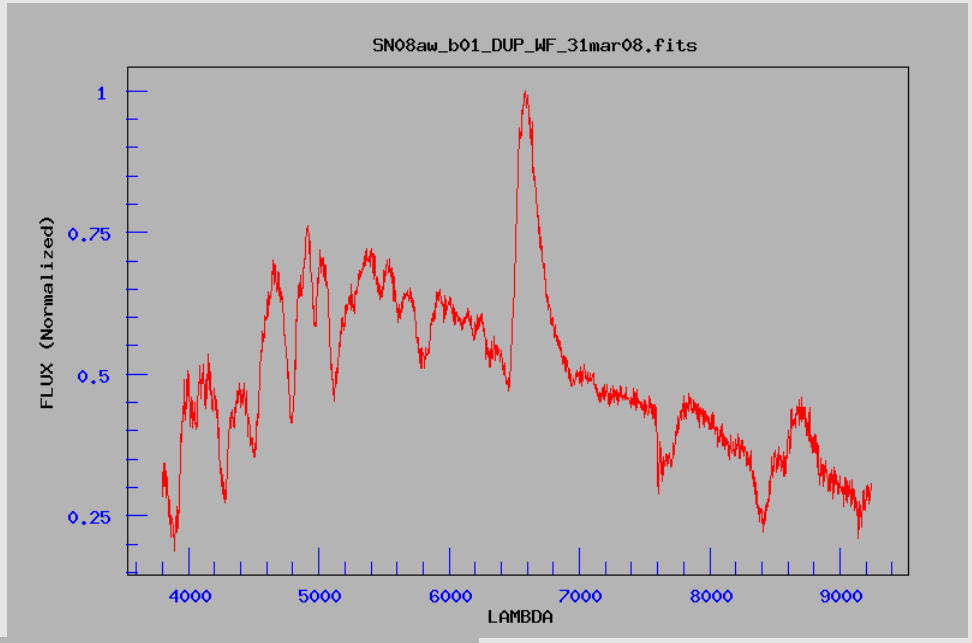
- **Many more combinations one could plot...**
- **So far concentrated on V-band, with interesting trends...**
- **BUT, we will scoop ourselves!**
  - analysis done on CATS (51 SNII from Mario)
  - data release + V-band analysis published soon...
- **How to publish first CSPI SNII light-curves?**

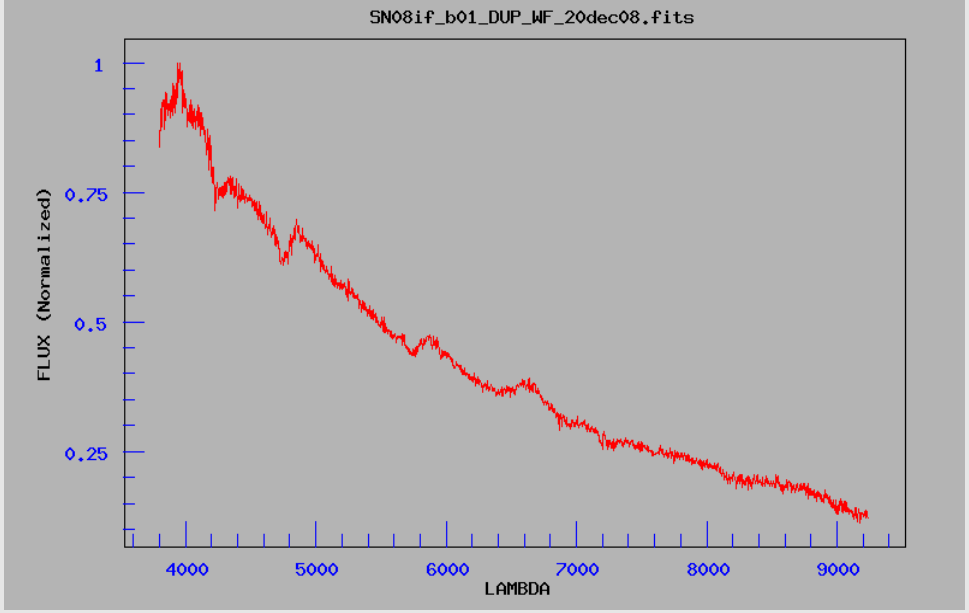
- **Different options:**
  - do same as above, following same template?
  - similar paper, but add e.g. length of plateau etc?
  - much more involved analysis: multi-colour LCs?
  - do distance analysis with first data release?
  - something else?

SNII light-curve and spectral correlations

(Claudia Gutierrez: PhD thesis project)



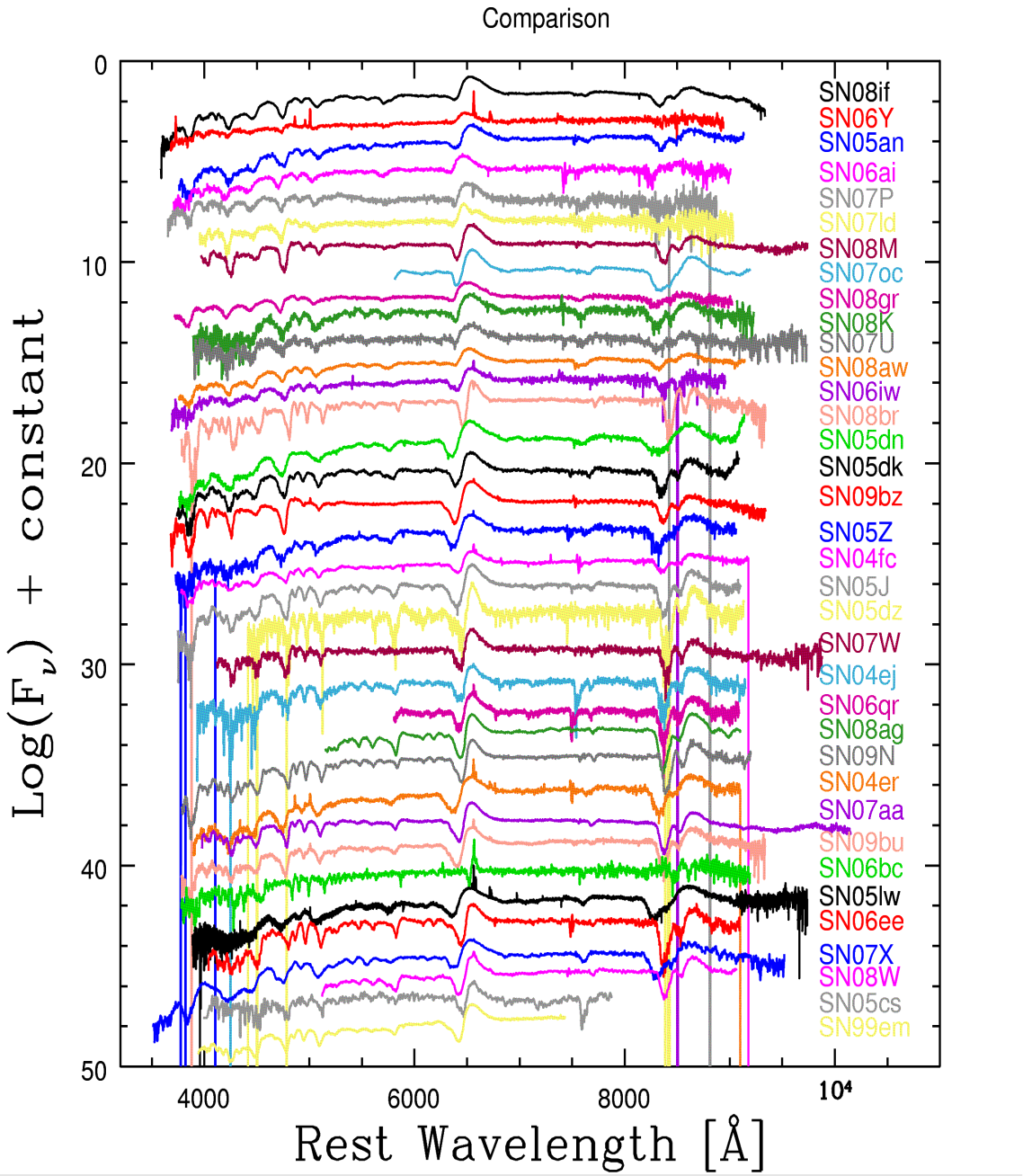




SNII light-curve and spectral correlations

Spectral measurements: Hα a/e, velocities

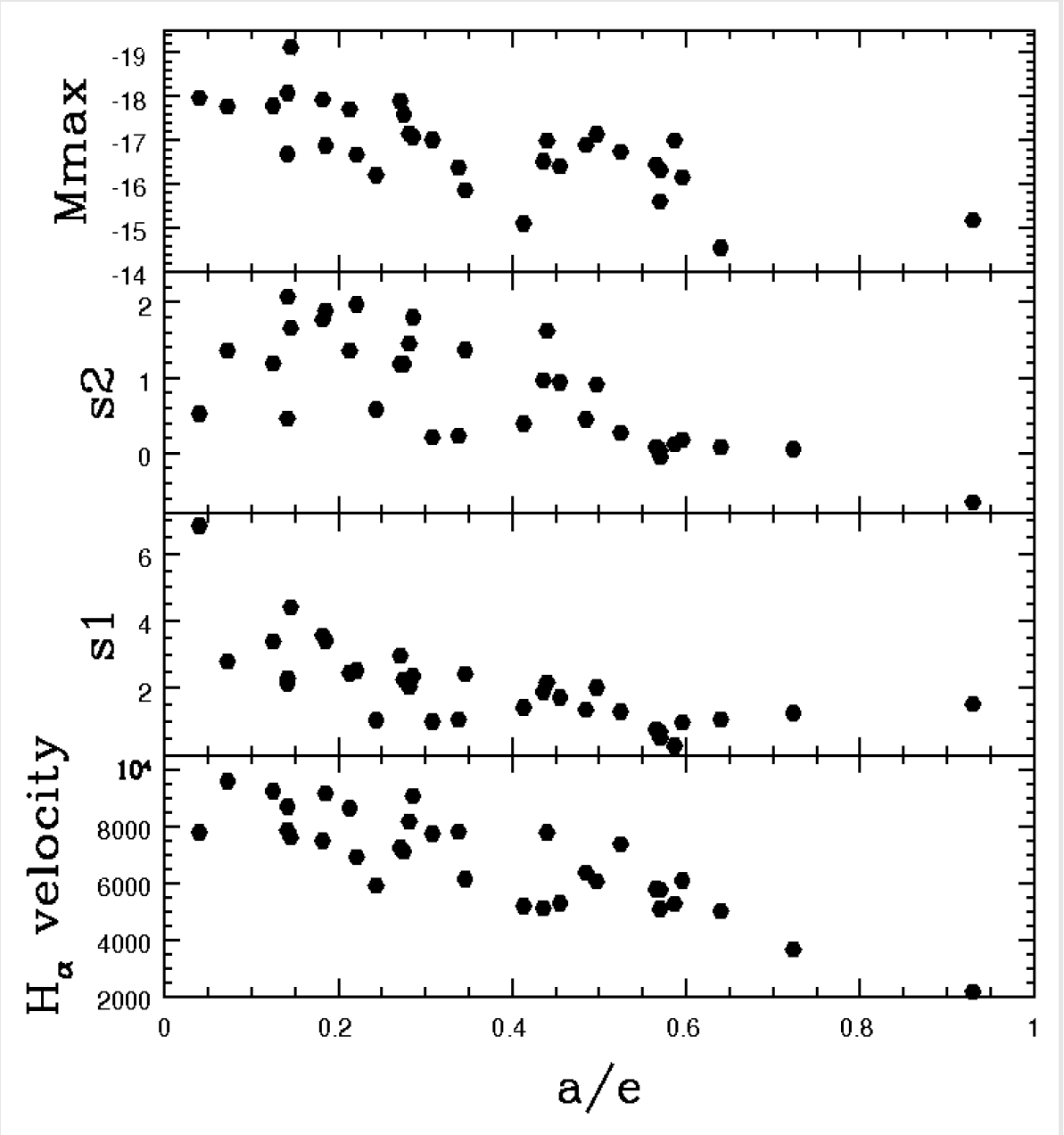
- Spectral measurements made at time of B-band 'inflection': s1-s2
- EW of absorption to emission: a/e
- Velocity of Hα from FWHM of emission



SNII light-curve and spectral correlations

a/e as the dominant characteristic?

- Strength of Hα a/e in P-cygni profile: correlates with M_{max}, decline rates and ejecta velocities
- Patat et al. (1994) similar correlation



SNII light-curve and spectral correlations

Connecting correlations to intrinsic properties and physics...

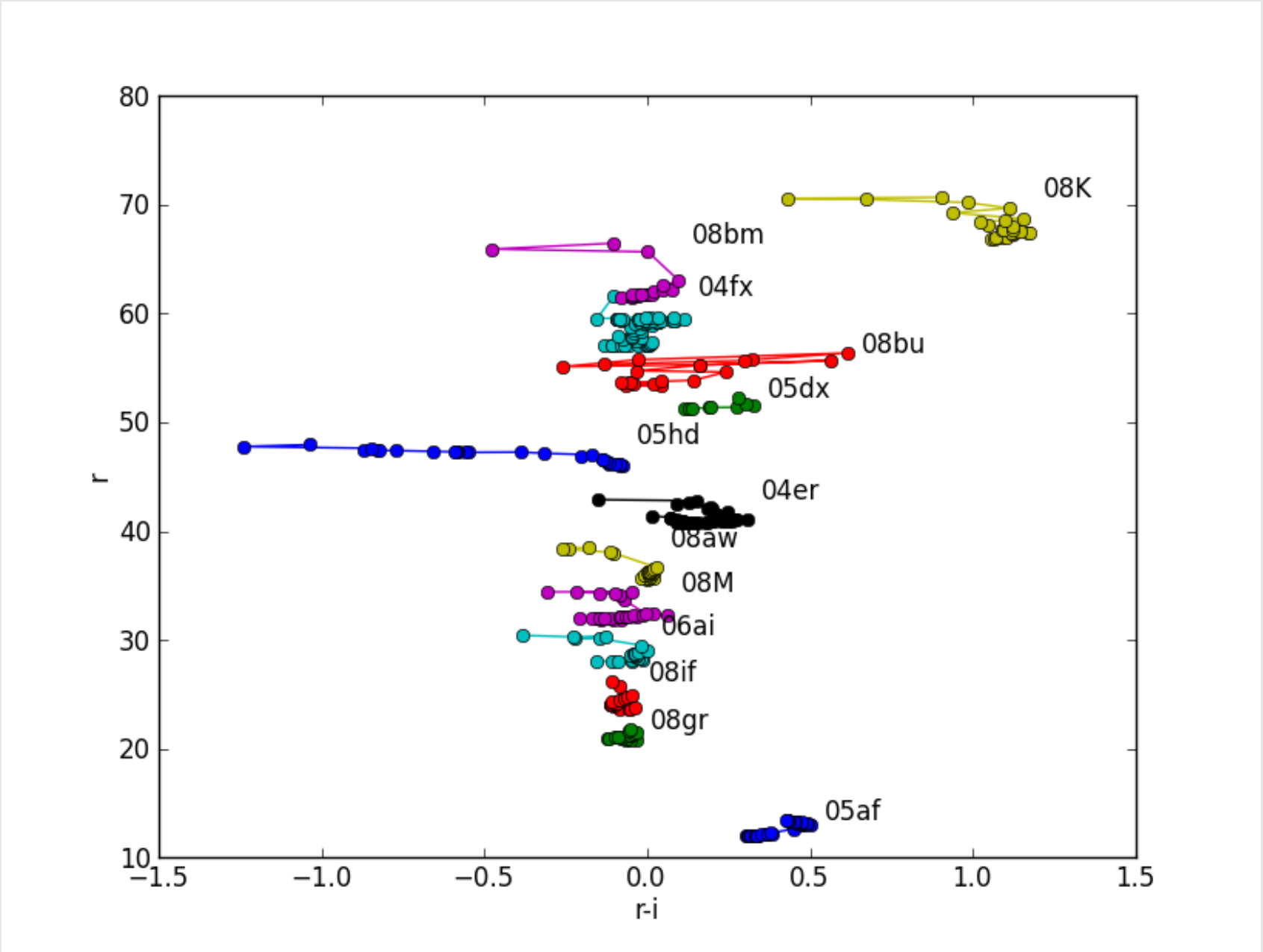
- **Which physical explosion properties are these related to?**
  - ejecta mass?
  - energetics of explosion?
  - temperature?
  - nickel mass?
  - progenitor mass/metallicity?
- **Collaboration with Luc Dessart has been started to help with this understanding**
  - later we will model specific LCs/spectra to obtain explosion parameters/progenitor characteristics

SNII extinction estimations

(Sebastian Marchi: pre-thesis project)

- **Using CSPI optical and near-IR LCs to investigate how to determine host galaxy extinction for SNII**
  - include IIL?
  - tPT and Vend method from Olivares?
  - CSPI data has better early data, but worse late time data: harder to fit tPT accurately
  - is *V-i* at end of plateau good indicator? OR just reduces scatter in distance measurements?
  - magnitude-colour diagrams? Turning points?
- **Will later incorporate spectral analysis...**

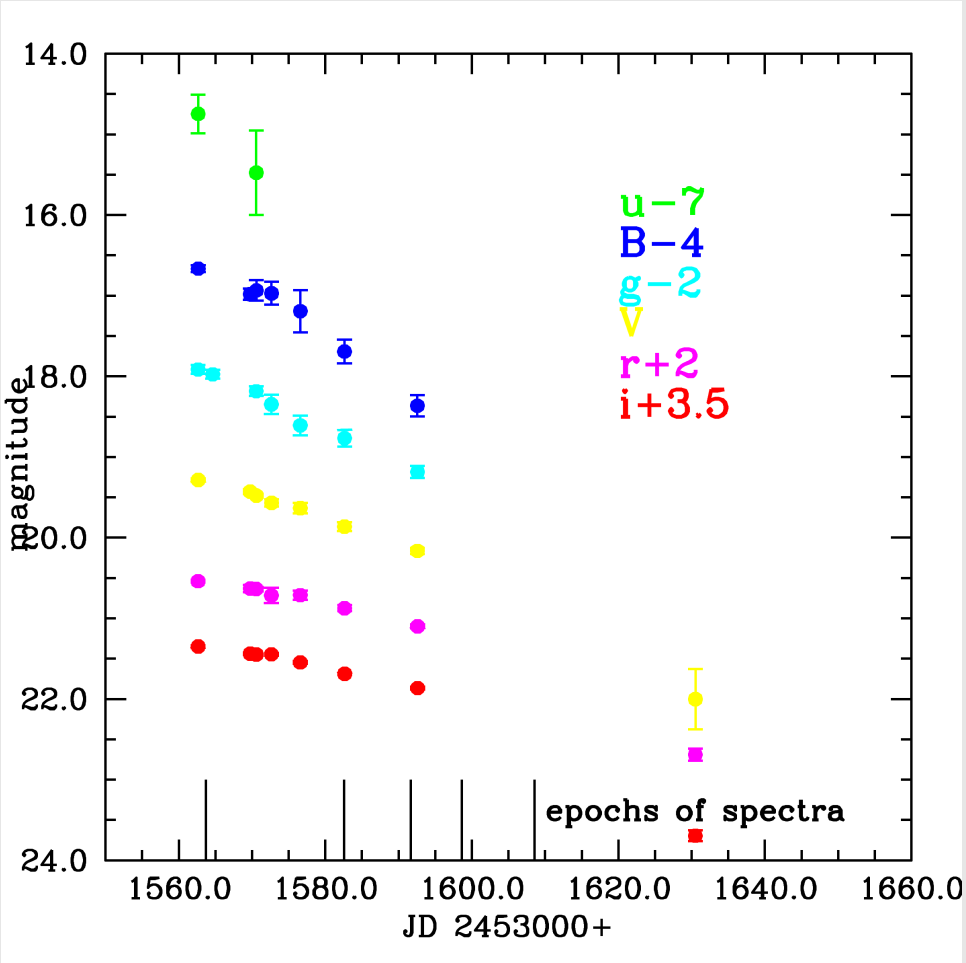
SNII extinction estimations

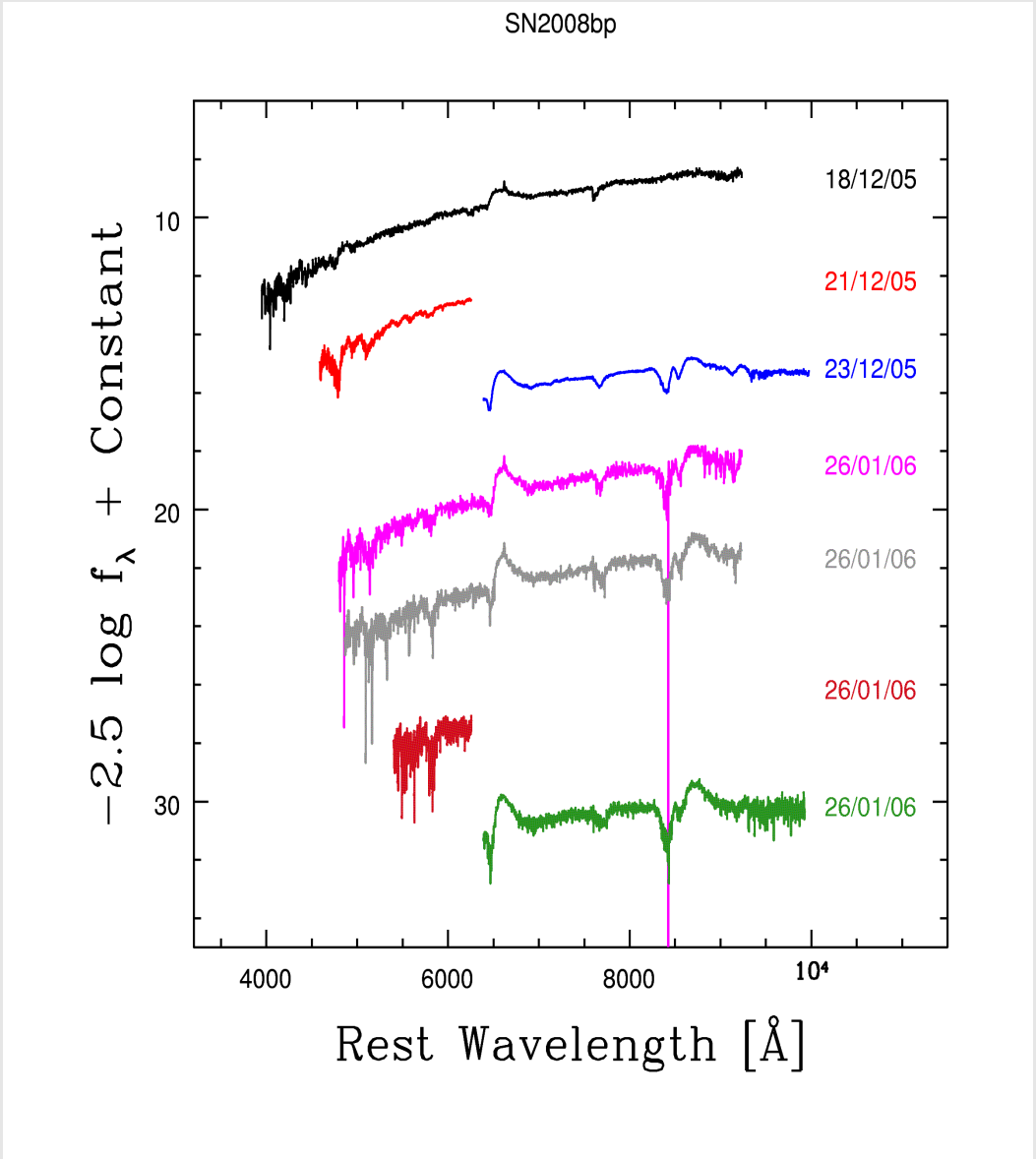


Future projects

- **Many other colours: *ugriB*, *YJHK*, and parameters**
  - plateau lengths (comparison to Arcavi et al. 2012)
  - early time LC analysis?
- **Fitting to LCs: can we find an e.g. stretch?!**
  - using Olivares approach?
- **Distances**
  - refinement of SCM/EPM
  - inclusion of near-IR will be key
- **Individual events: extremes, outliers**
  - many where could do individual analyses...
- **CC SNe hosts/environments**
- Full spectra analysis
- Modeling of all of above
- Late time light-curves

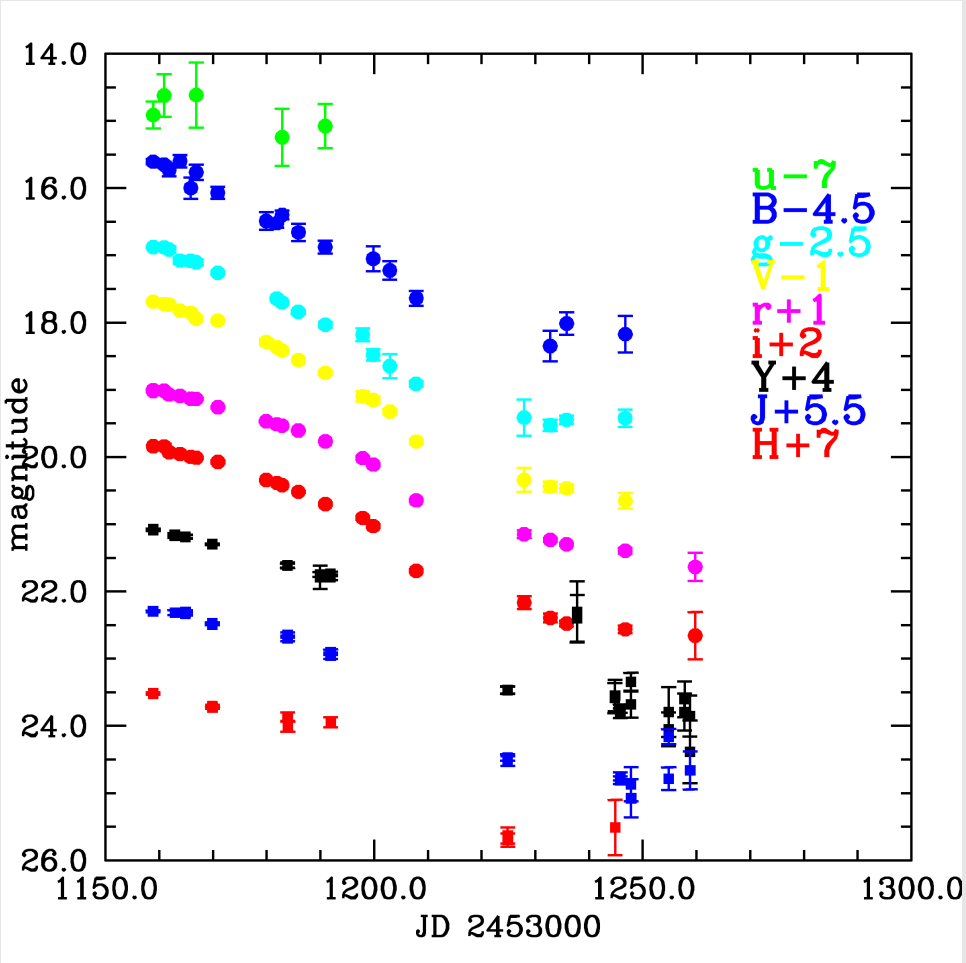
A few weirdos!

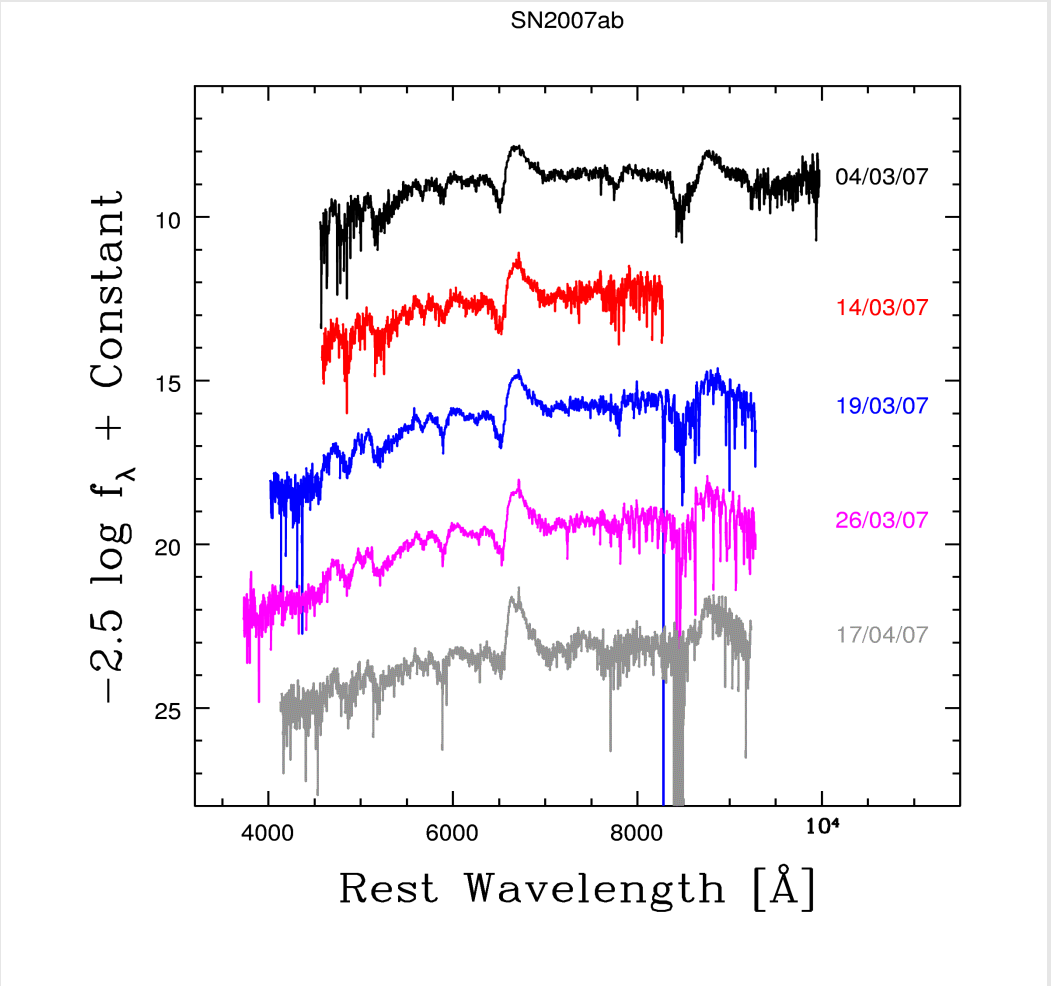




- **SN2008bp; the lowest luminosity event, BUT also one of the fastest decliners... very red: high extinction?**

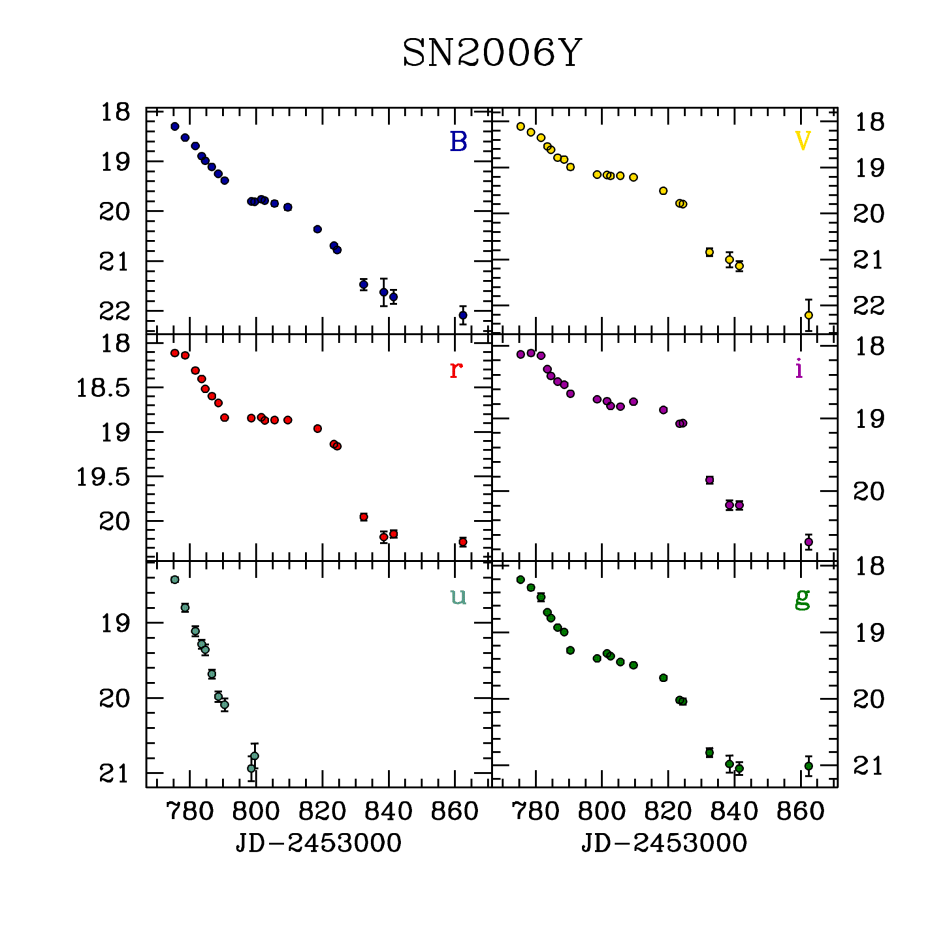
A few weirdos!

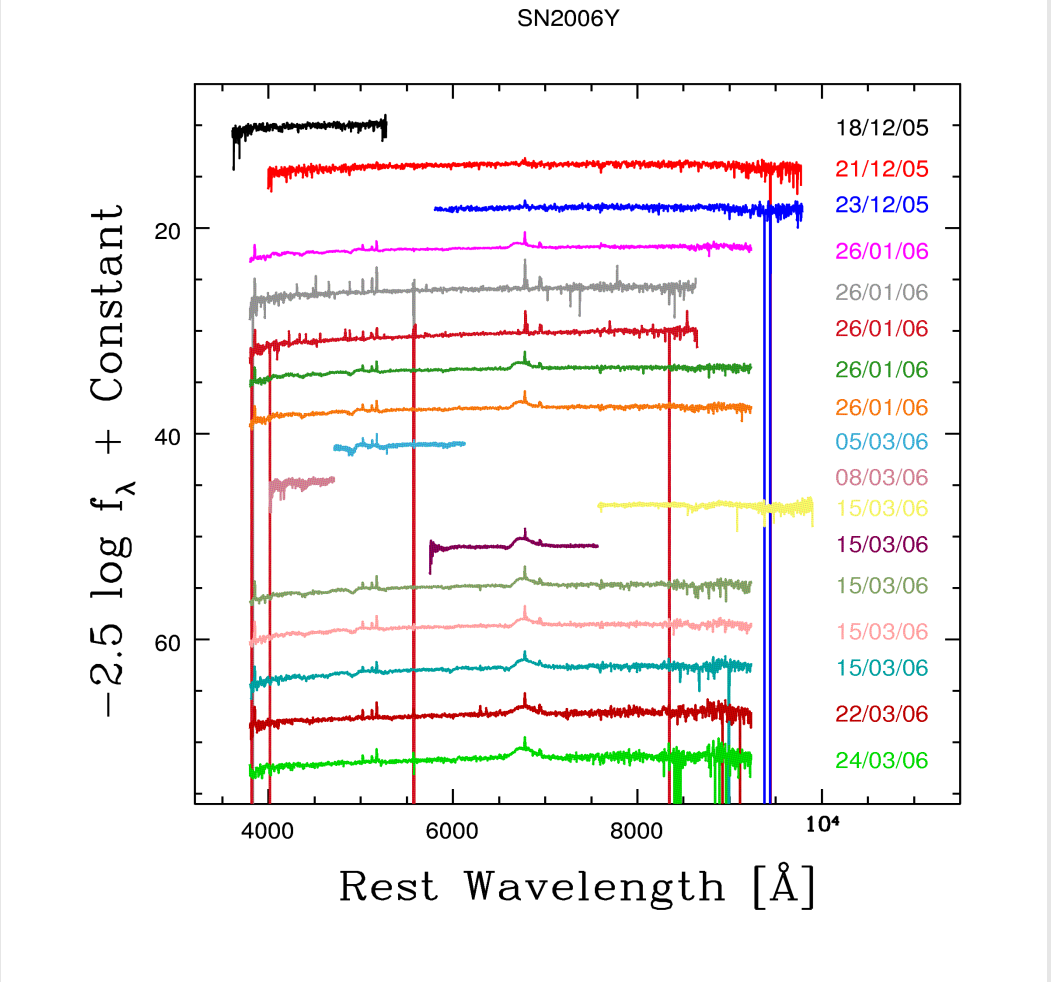




- SN2007ab; v. fast decliner (s2), also quite luminous
- Transition between 'Plateau' and tail barely visible...

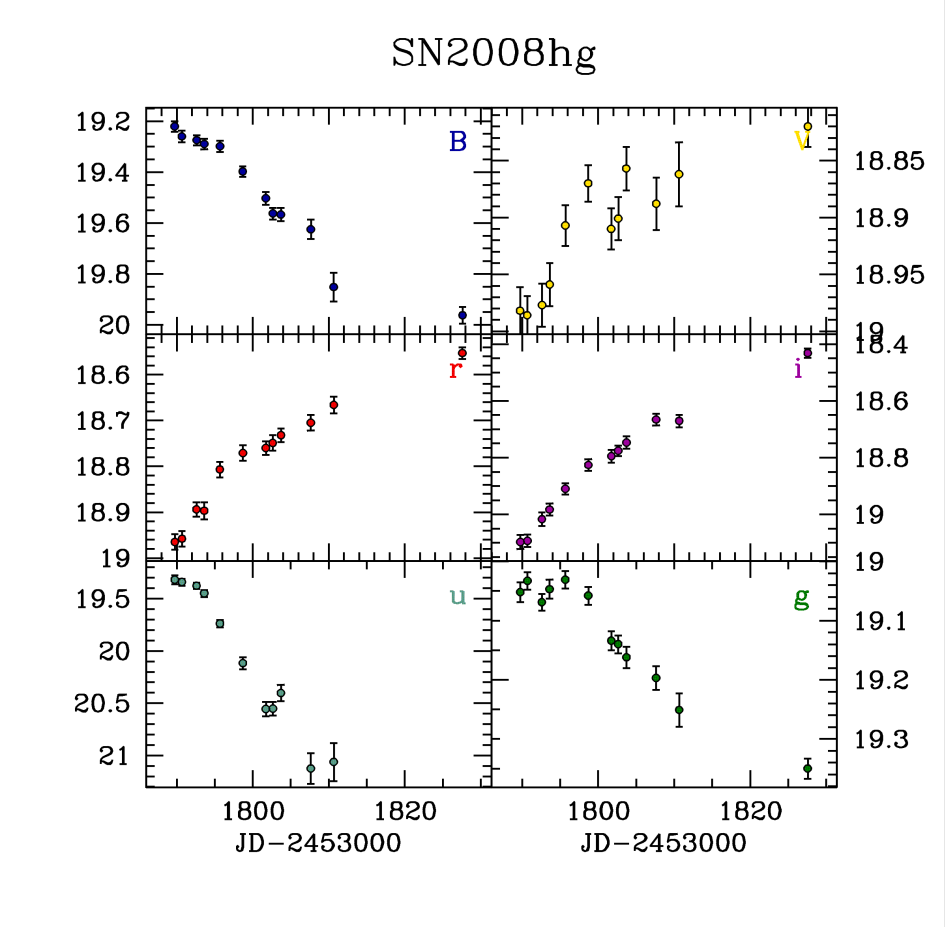
A few weirdos!

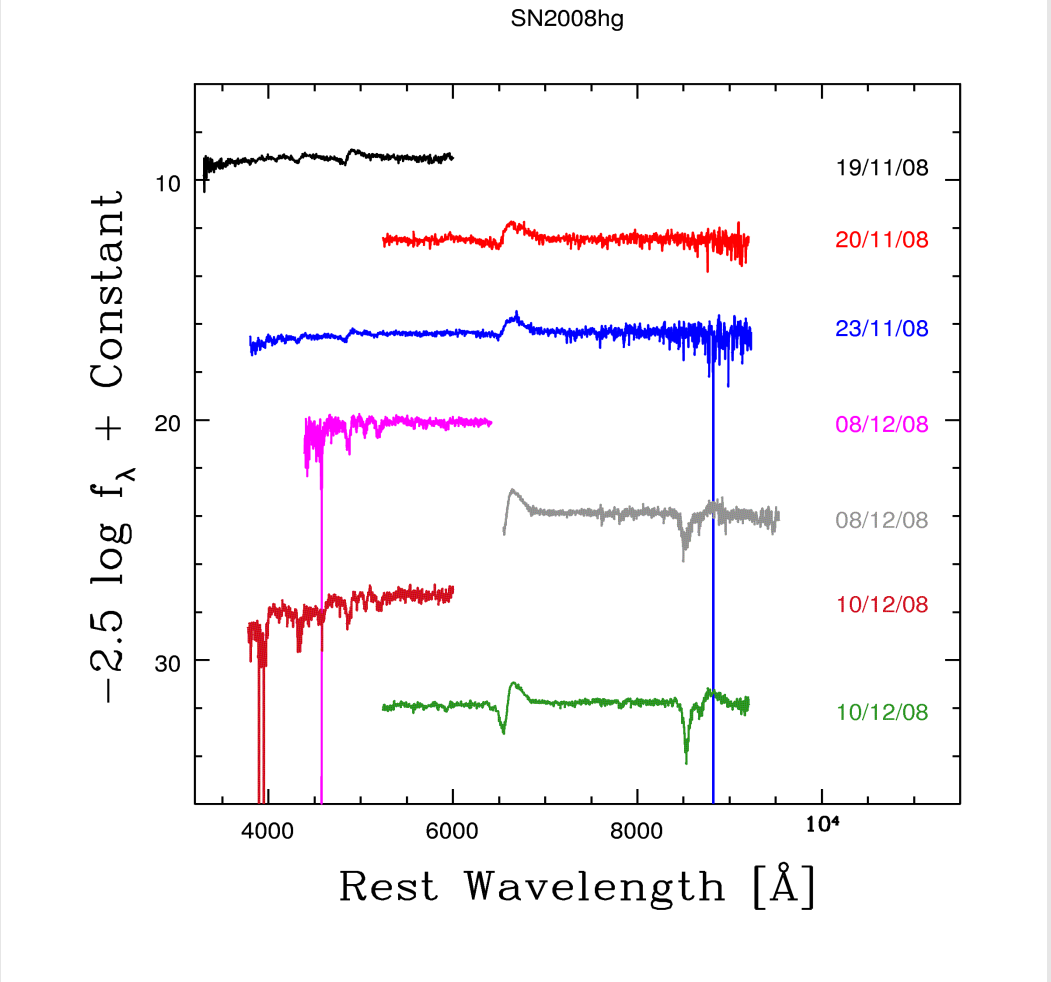




- **SN2006Y; difference between s1, s2: v. steep initial decline followed by very flat, short plateau (also luminous)**

A few weirdos!





- **SN2008hg: rising light-curve in redder bands, low luminosity: ~-15.5 in V-band**

Summary/conclusions

- **Majority of data now ready for full analysis**
- **Initial analysis has found LC/spectral correlations**
  - brighter SNII decline quicker, and have weaker Hα absorption, and faster ejecta velocities
- **Much to be done on both LCs and spectra, now have a number of people (staff, postdocs, students) working to complete these projects**

Questions

- **What, when, how to publish data?**
- **What are priorities for SNII sample?**
- **Useful to put data on e.g. WISeREP?**
- **A future for SNII in CSP?**