

Millennium Center For Supernova Science

Mario Hamuy (Universidad de Chile)
Alejandro Clocchiatti (Universidad Católica)
Giuliano Pignata (Universidad Andrés Bello)
Franz Bauer (Universidad Católica)



79 Participants (2008-2012)

- Professors: Bauer, Clocchiatti, Hamuy, **Maza**, Pignata
- Senior/Consultant: **Bludman**, **Bustamante**, **Kubanek**
- Postdocs: Anderson, **Bersten**, Bufano, **Folatelli**, Forster, González, Katalin, **Pignata**, **Quinn**, Schulze
- PhD Students: Bersten, Cartier, Gutiérrez, Habergham, de Jaeger, **Jones**, López, Zelaya
- MSc Students: **Jones**, Marchi, **Olivares**, Palacios, **Salgado**, Silva
- Undergraduates: Apostolovski, Aros, **Becerra**, Carrasco, Cifuentes, Conuel, Farías, **Fariña**, , **A. González**, **P. González**, Hervias, **Iturra**, **P. López**, **C. López**, **N. López**, **Marchi**, **Maureira**, Meunier, **Miller**, Parra, Pérez, Ramírez, **Rivas**, **Ruiz**, Rodríguez, Salas, Salinas, P. Sanchez, **C. Sánchez**, **Silva**, Soto, **Valenzuela**, Vidal
- Research Assistants: Antezana, González, Leal, Rojas
- Outreach: **Angel**, Azócar, Gallardo, Huerta, Politis, Salinas, Solís
- Accounting: Fajardo, **Monroy**, Ramírez, Ulloa

Goals (Research lines)

Research Lines

- Distance determinations based on supernovae to understand the origin of the dark energy
- Advance our understanding of the supernova progenitors and explosion physics
- Development of robotic telescope for supernova searching

Research Key Projects

- Type Ia Supernovae (Clocchiatti)
- Type II Supernovae (Hamuy)
- Supernova/CSM Interaction (Bauer)
- Search and Followup of Supernovae (Pignata)

Supernova discoveries

CHASE-PROMPT survey (2007-2012)

Galaxies with $v_r < 6000$ Km/sec

Declination $< 10.0^\circ$

163 Supernovae

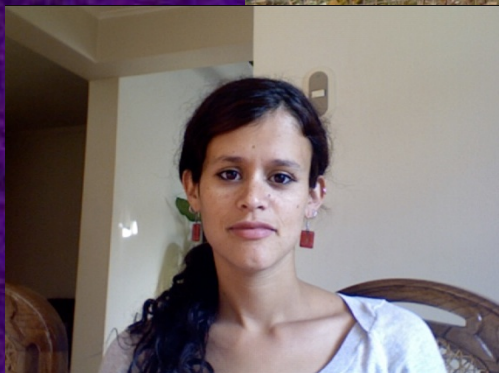


We use the 10% Chilean time



Diameter = 40 cm
Located at Cerro Tololo

The CHASE team

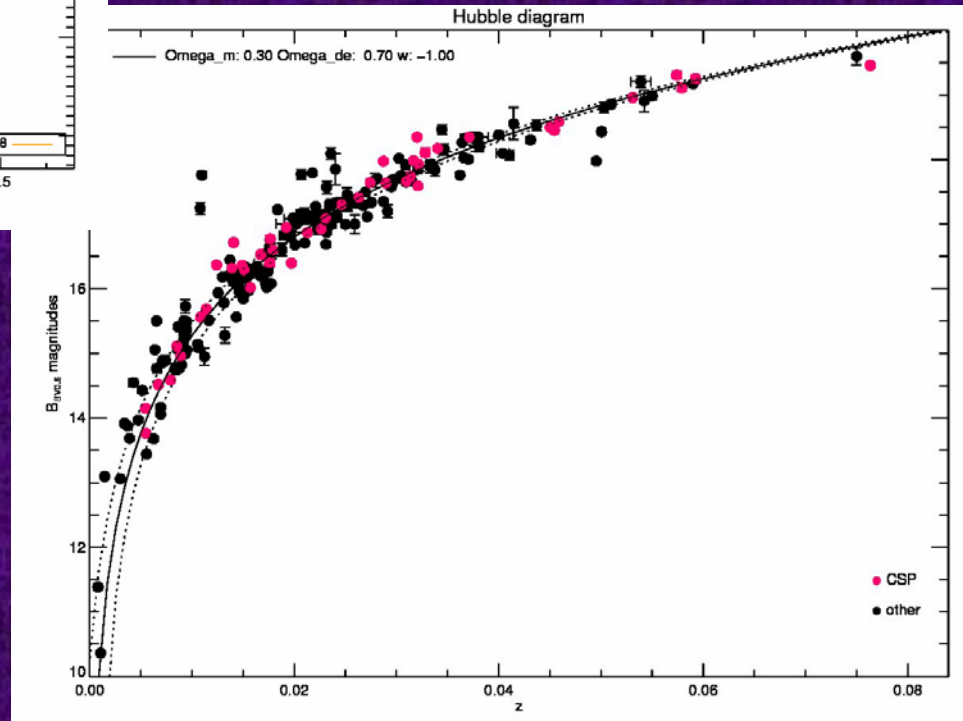
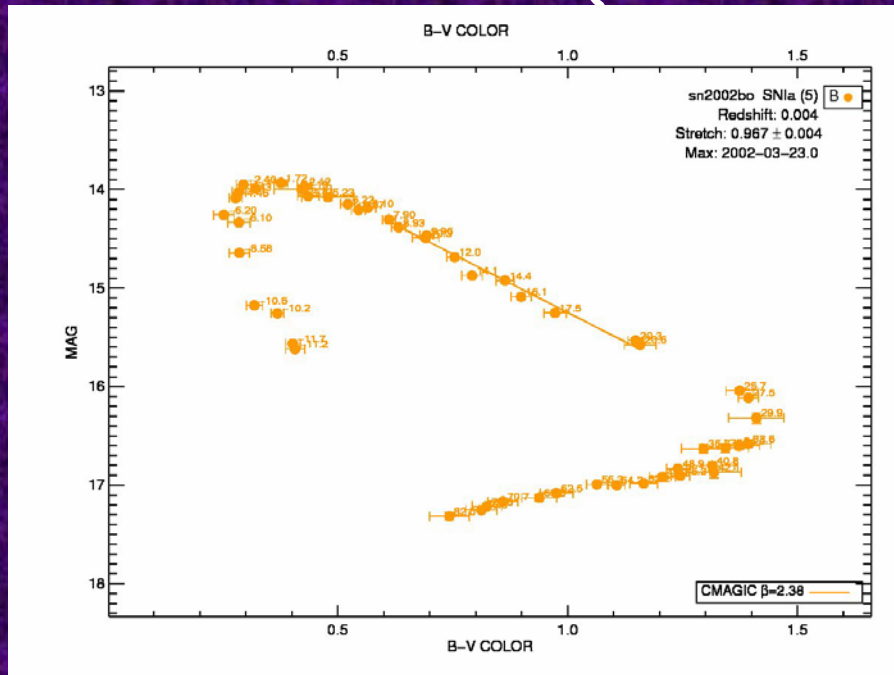


CHASE 500 !

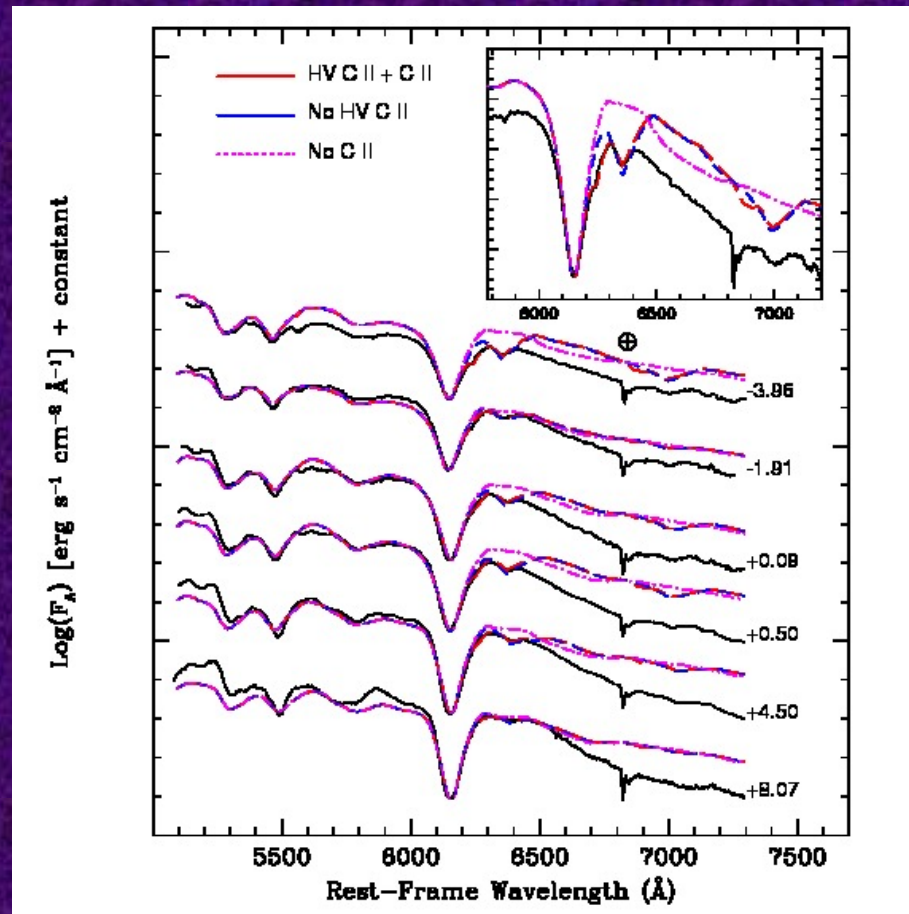


CMAGIC (González et al)

New promising route for
cosmological parameters

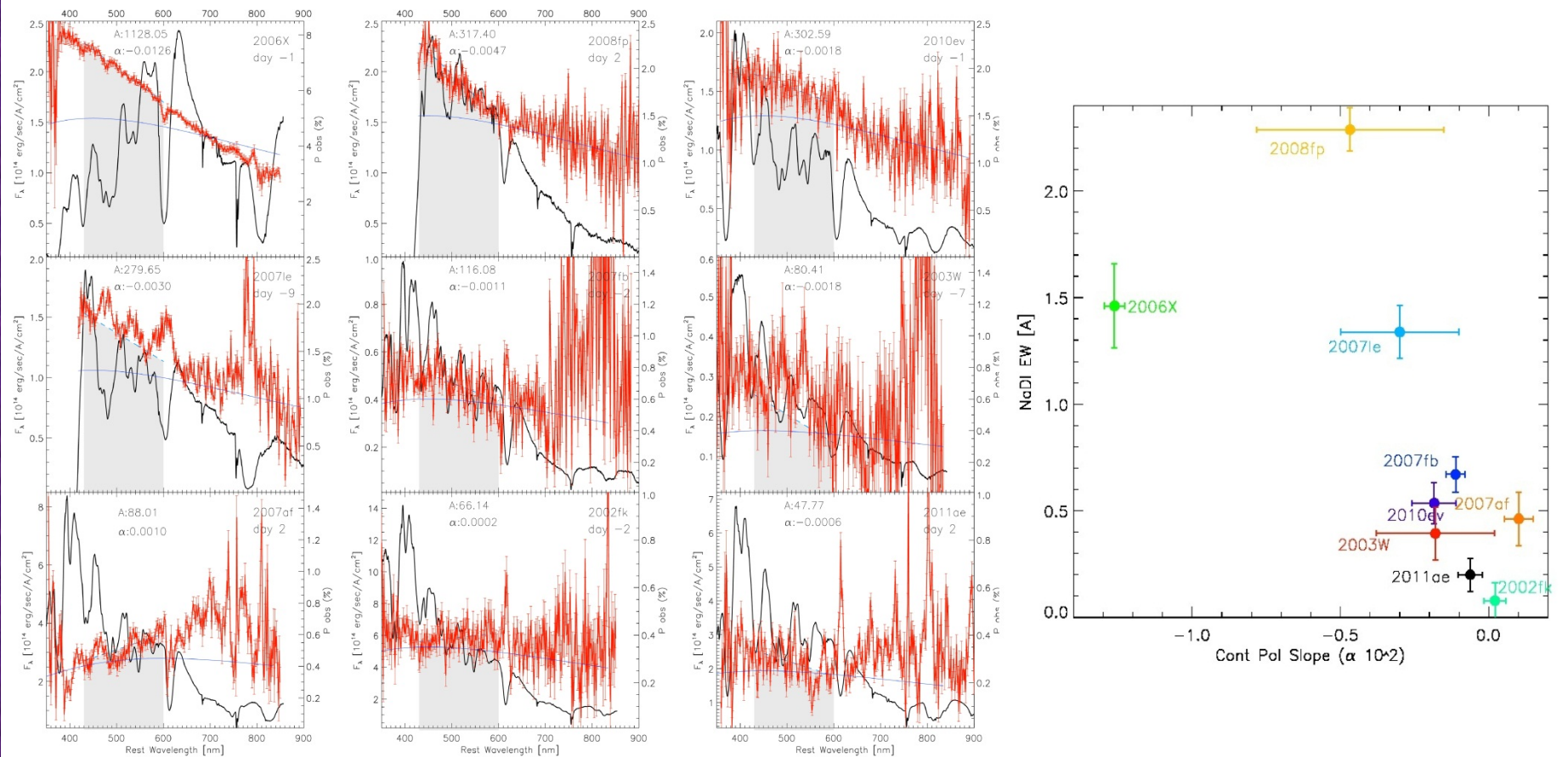


SN 2002fk (Cartier et al)



C observed through 8 days past maximum
with a high velocity component in a normal Type Ia
Using Cepheid variables - $\rightarrow H_0 = 68$

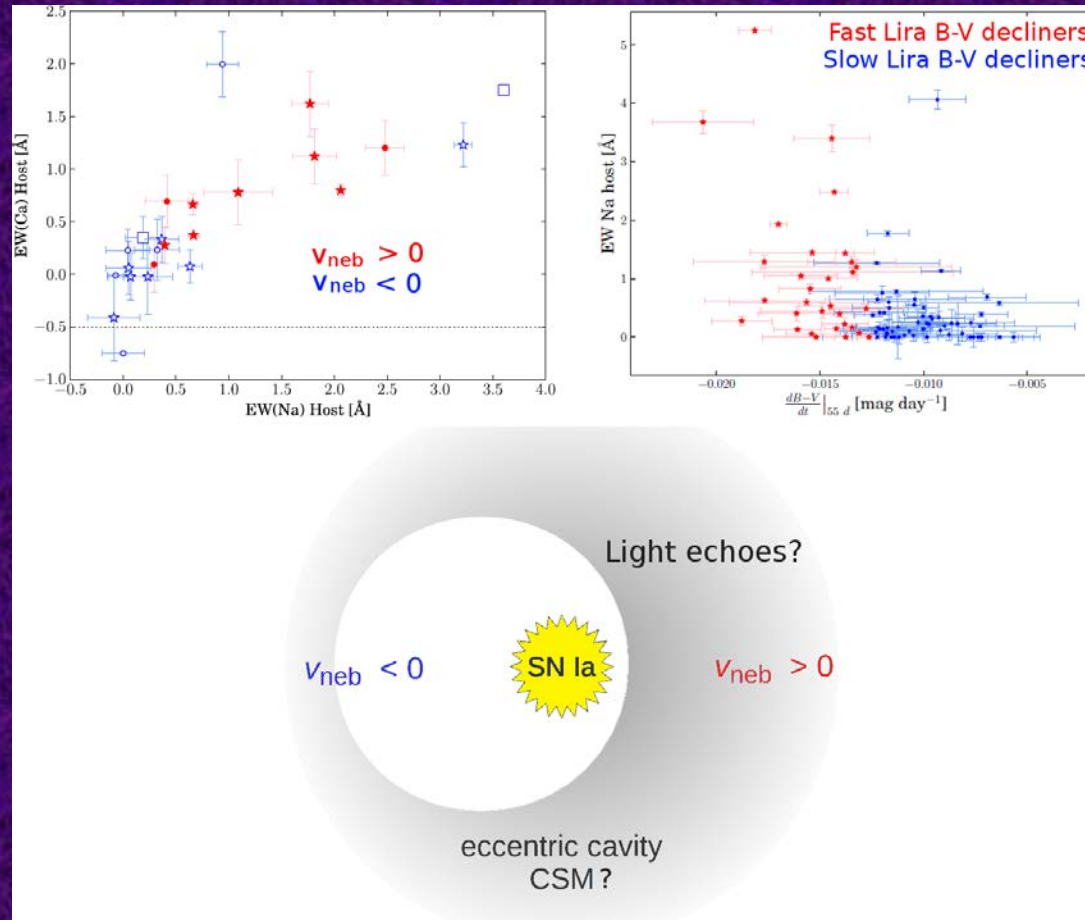
Polarization of Type Ia SNe (Zelaya et al)



Evidence for CSM polarization (light echoes)?

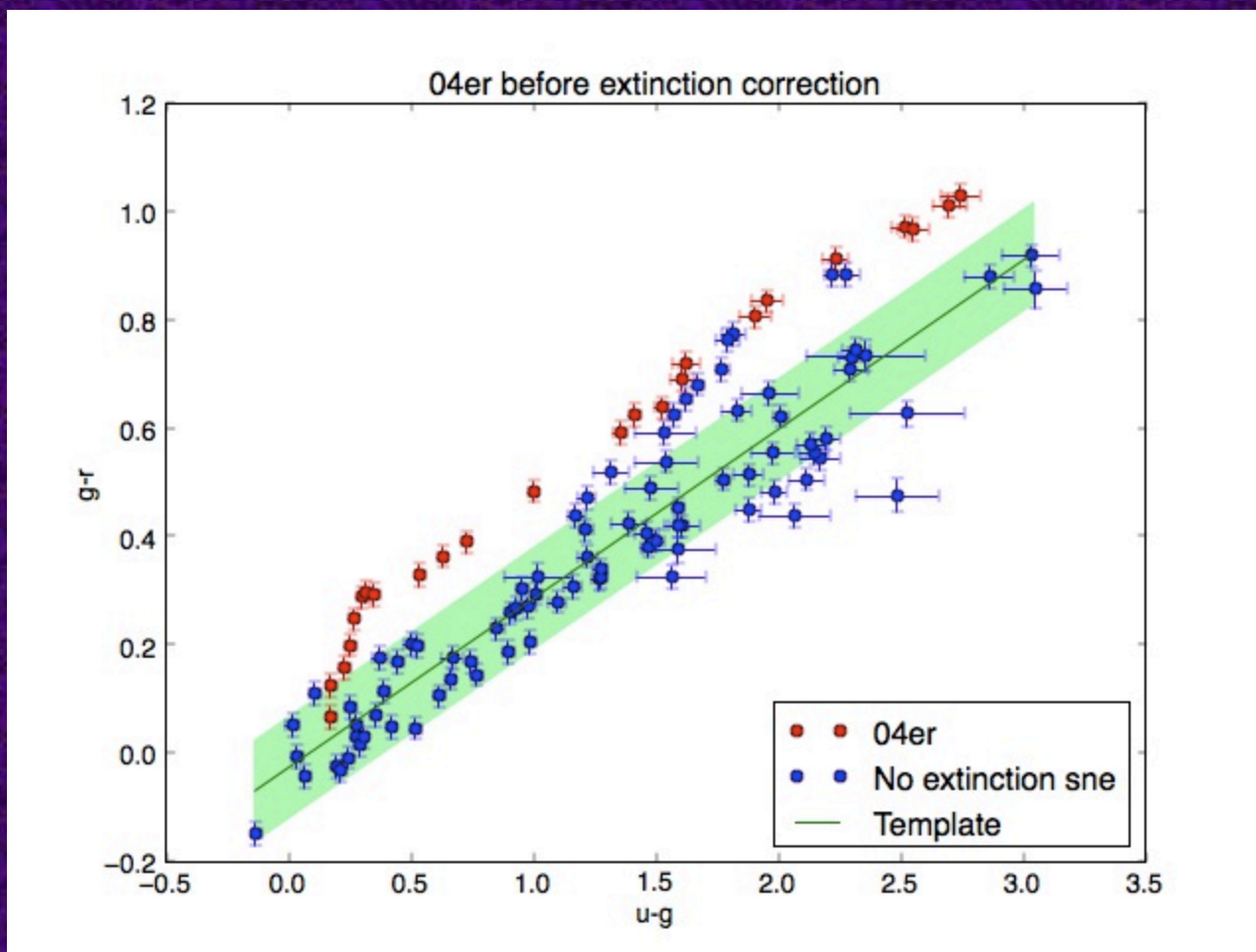
Study of SCM around Type Ia Supernovae (Forster et al)

Evidence for asymmetric CSM distribution?

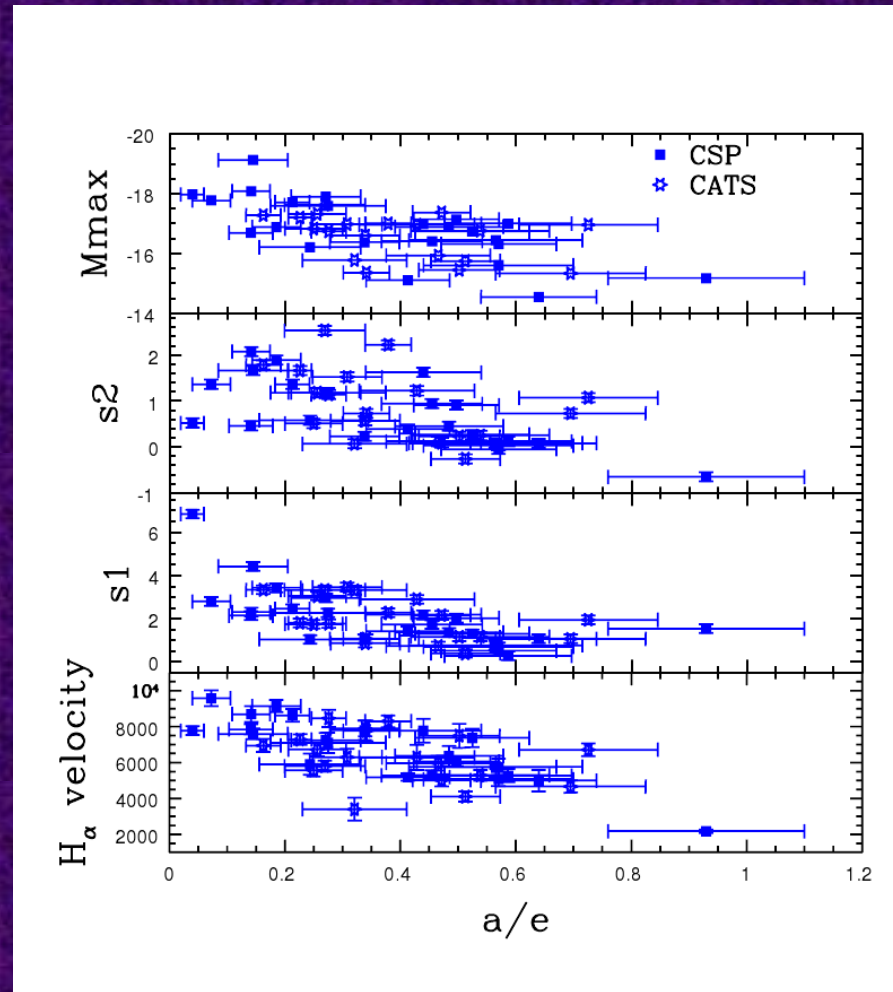


Evidence for CSM light echoes

Dereddening Type II Supernovae (Marchi et al)

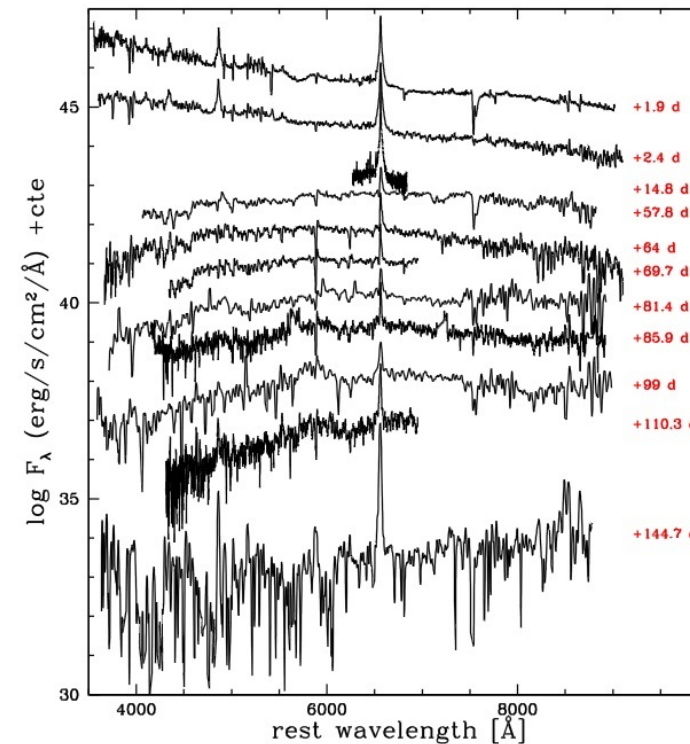
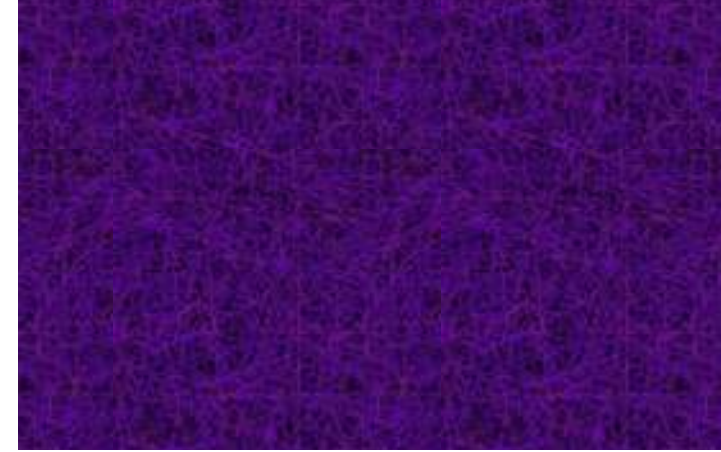
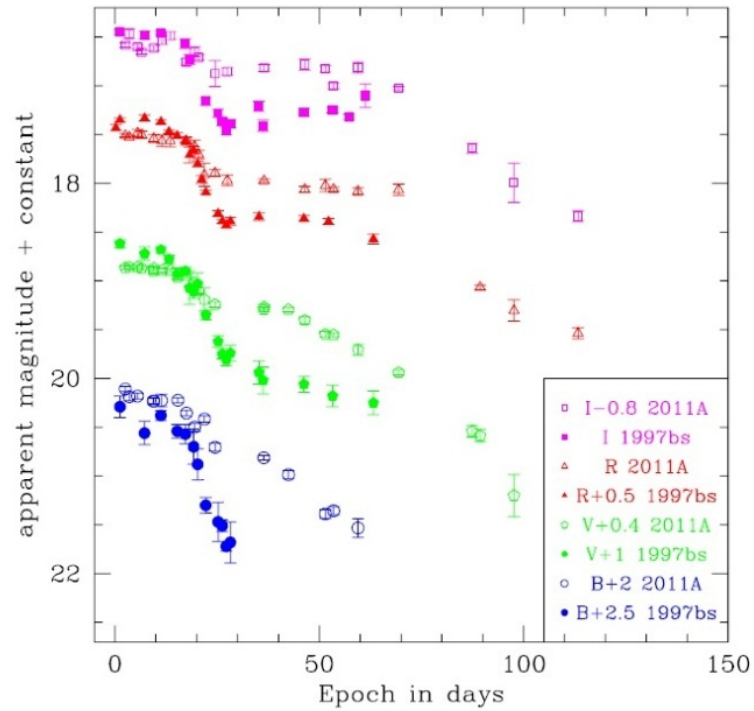


Characterizing Type II Supernovae (Gutiérrez et al)



Linking Photometric and spectroscopic properties of SNe II

Study of a Type II In SN2011A (de Jaeger et al)

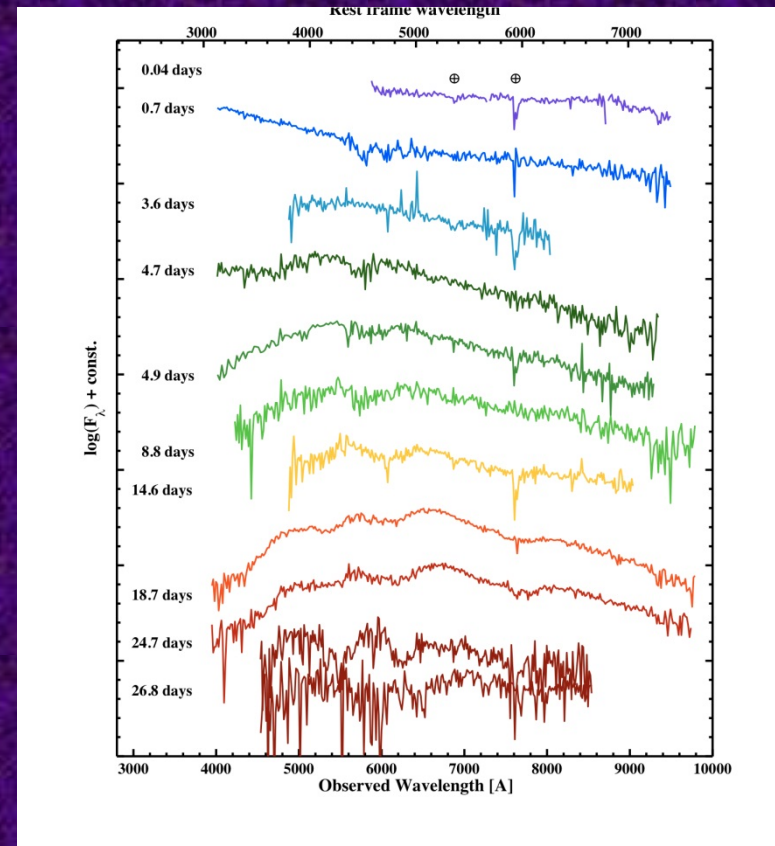
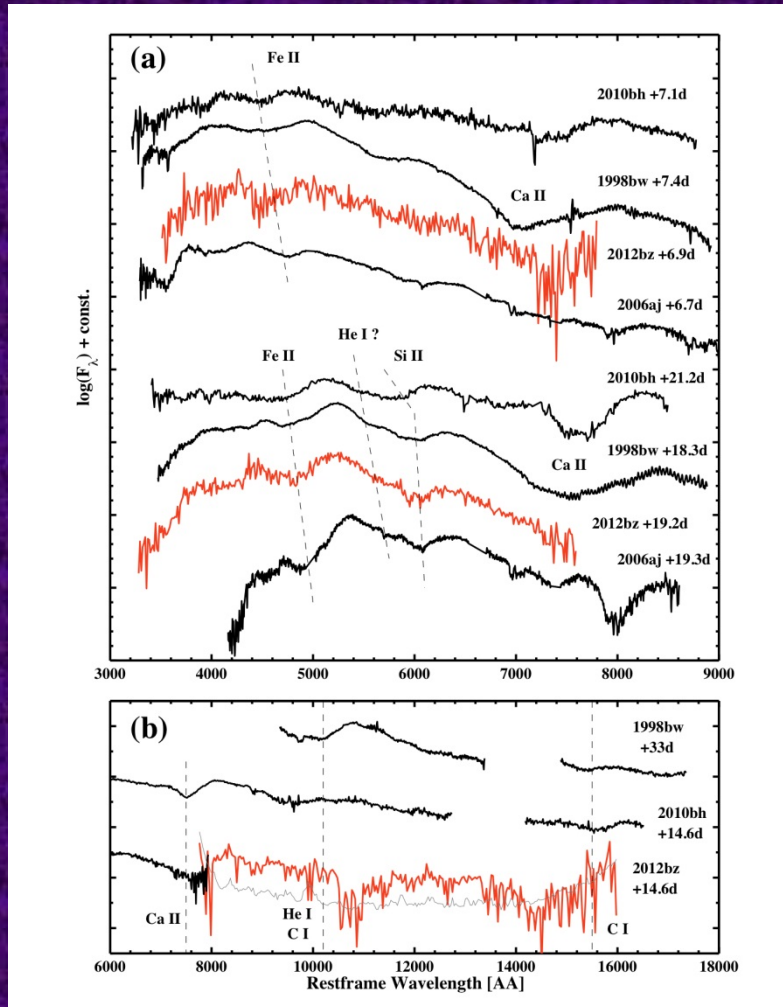


- Two plateaus
- Unprecedented variable Na I absorption

Study of GRBs (Schulze et al)

GRB120422A = SN 120422A ($z=0.28$)

among the most distant GRBs with a spectroscopically confirmed SN

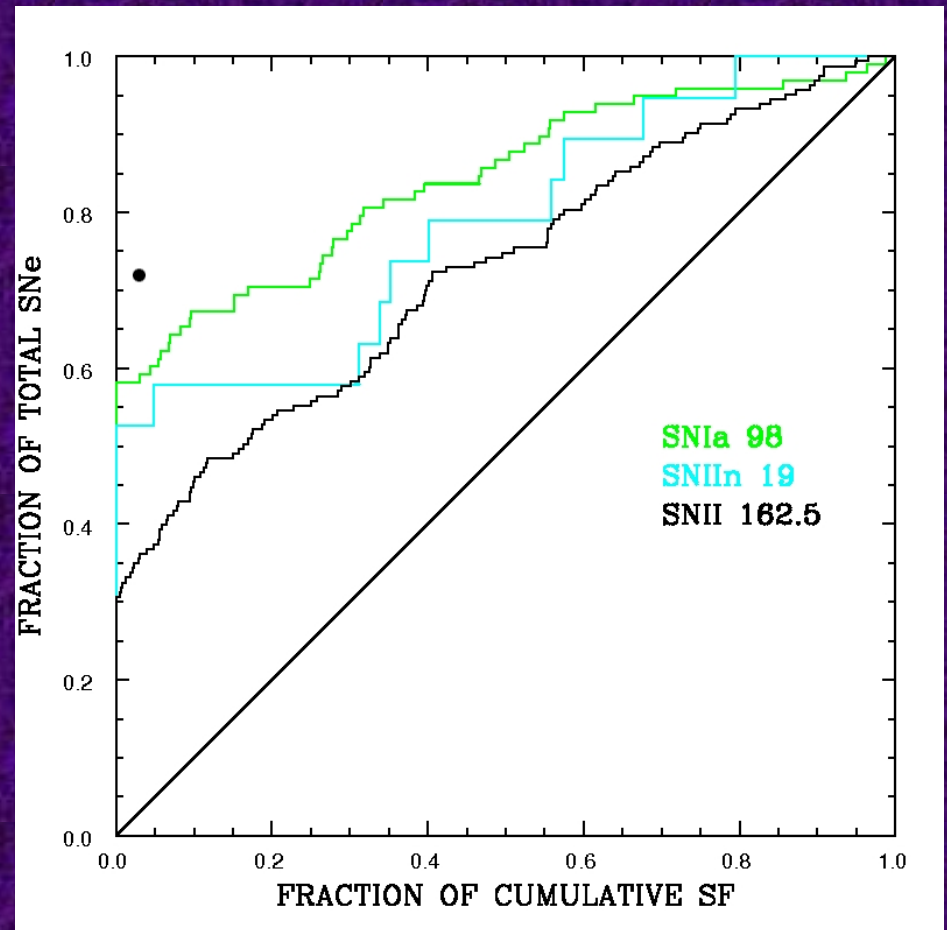
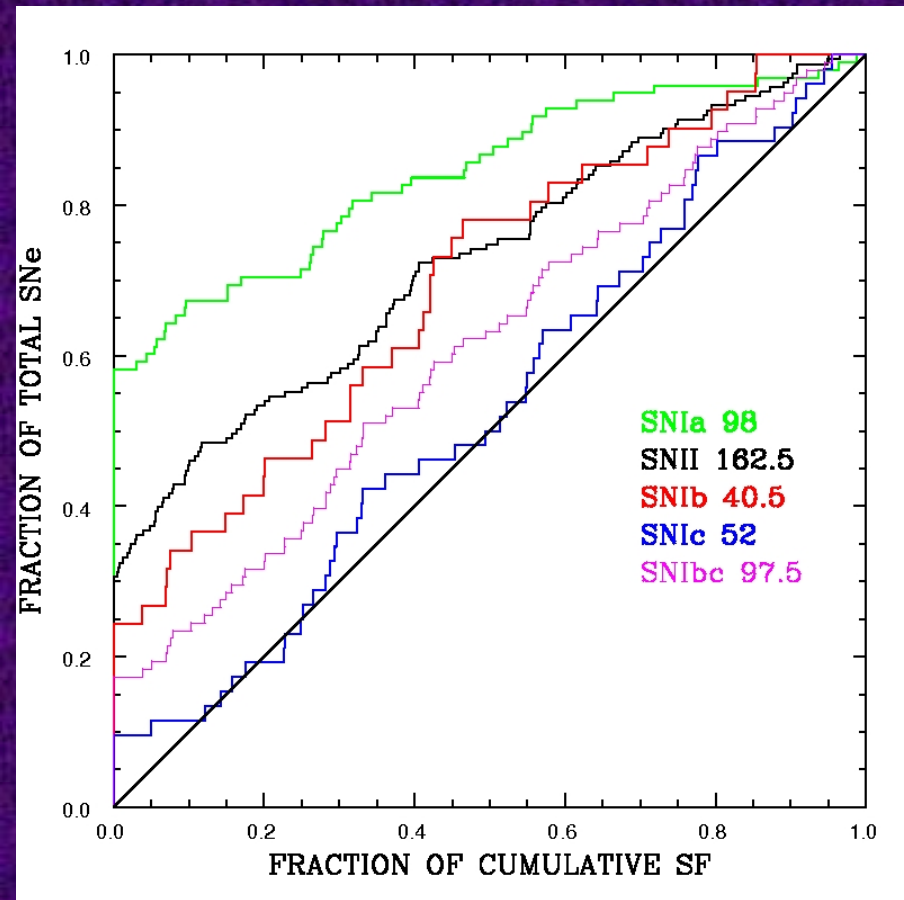


Excellent Spectral Coverage
Favoring a broad line Type Ic

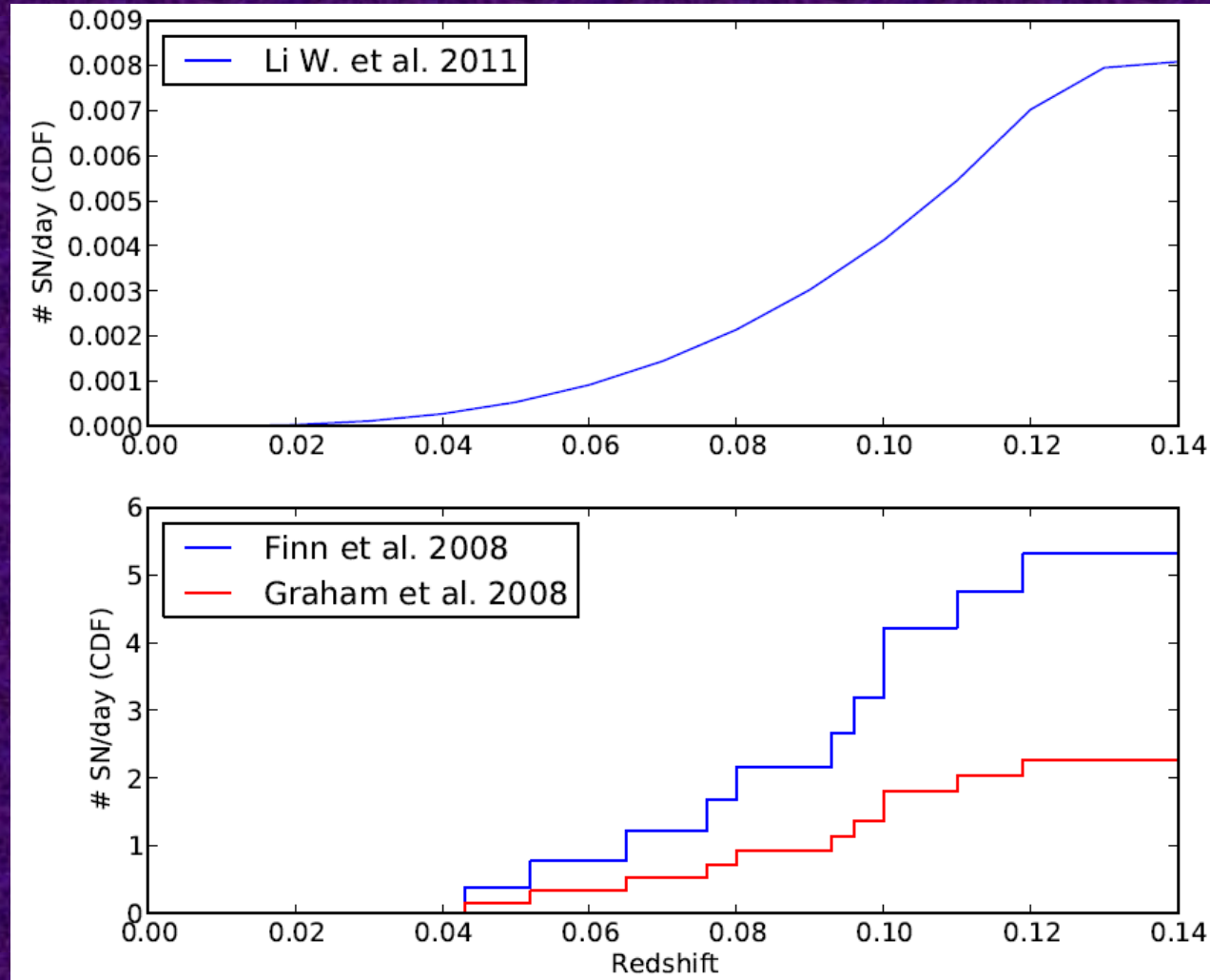
Pixel Statistics (Anderson et al)

Progenitor mass sequence

Link between IIn and Ia



Detection of Schock Break Outs with DECam (de Jaeger et al)



Comparing SN rate in Optical and NIR

- 1) Optical rate correction
- 2) Ratio between different rate of different SN types that could be biased by extinction
- 3) Study the dust properties using reddened SNe

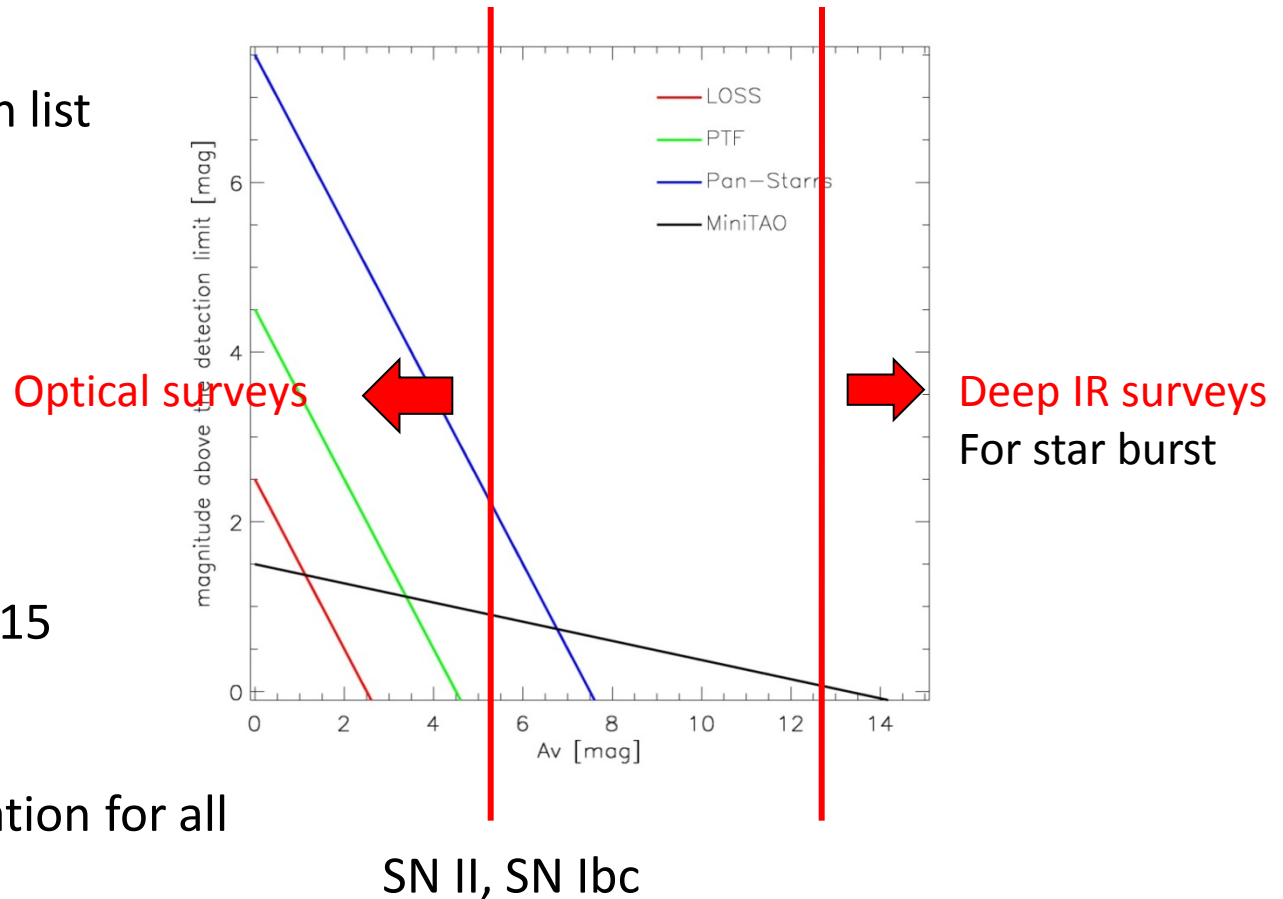
Sample = CHASE golden list

Opt => PROMPT
Every day (unfiltered)

NIR => MiniTAO
Every two weeks

We can probe $5 < A_v < 15$

Spectroscopic classification for all
SNe



Field =COSMOS (there is a twin survey on CDFS)

Opt => SUDARE (VST)

$z < 0.6$

r every 3 days gi every week

42 SNe discovered during the first season

15 hours of GMOS for spectroscopic classification

NIR => ULTRAVISTA (VISTA)

Y and J < 0.4 , H < 0.3 K < 0.1

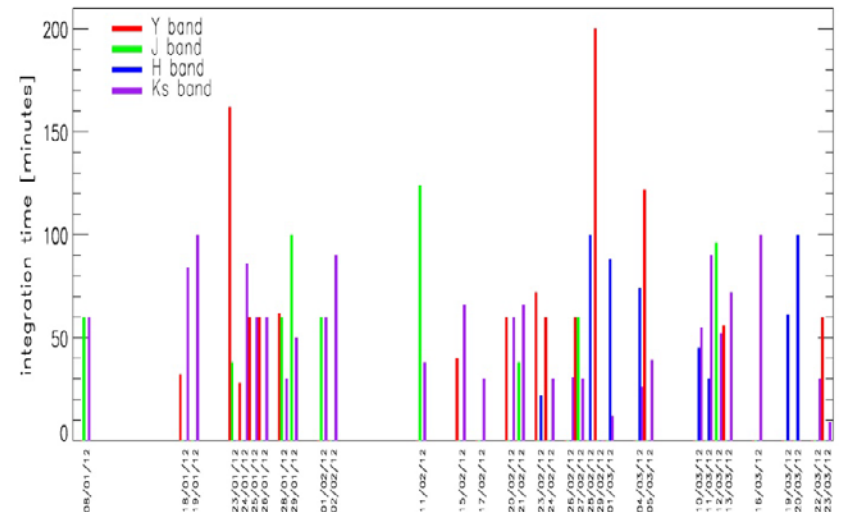
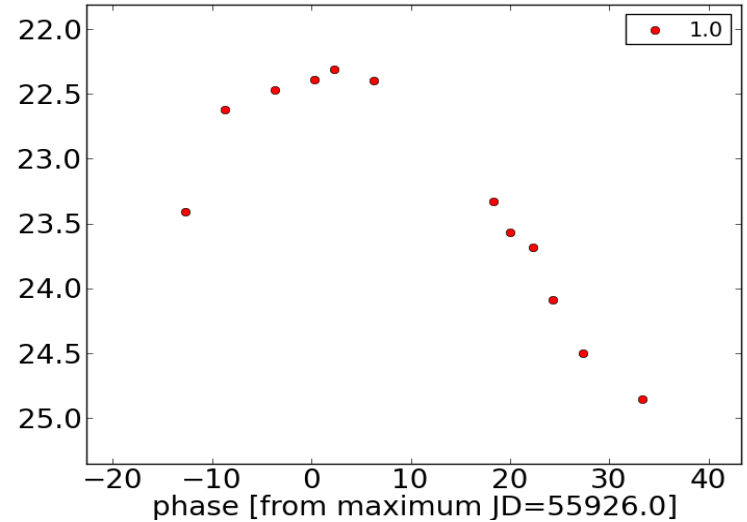
Observations only when the seeing $< 0.8''$

Data redaction is work in progress....

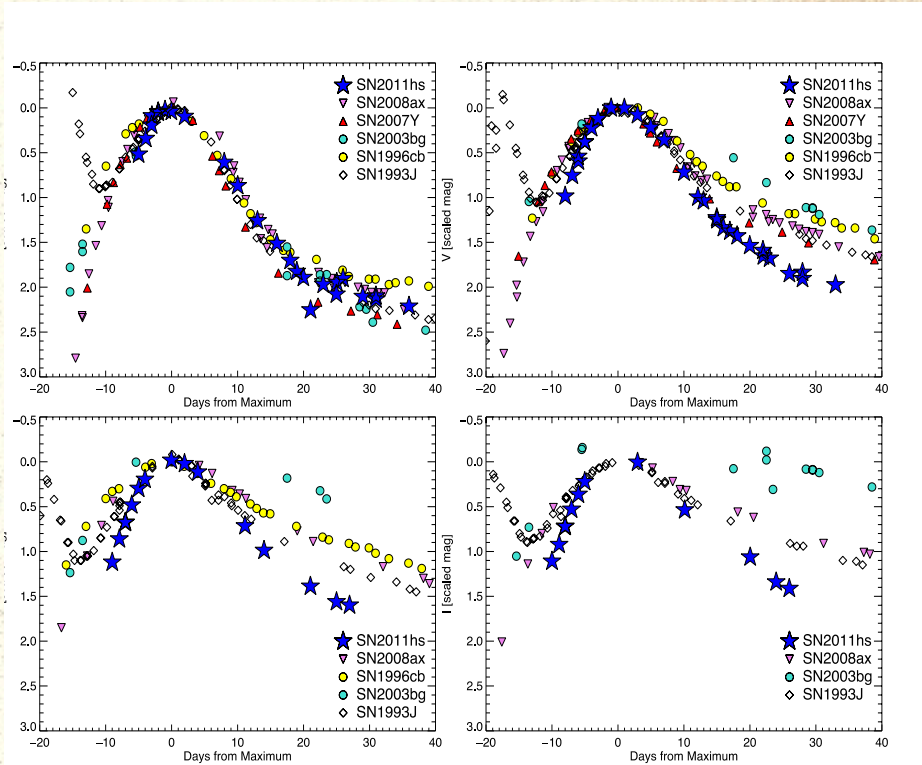
Spectroscopic classification for all the SN < 0.3 (~ 15% of the sample)

For the rest we plan photometric classification

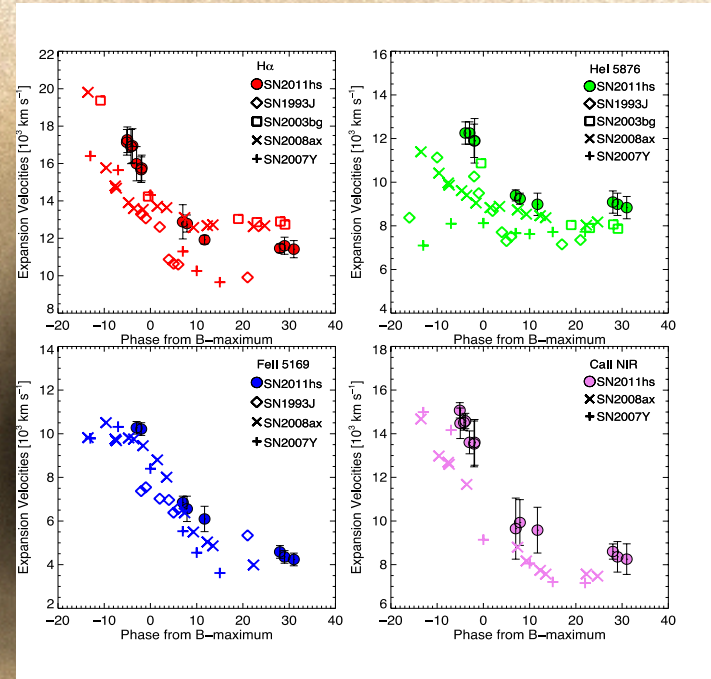
SUDARE



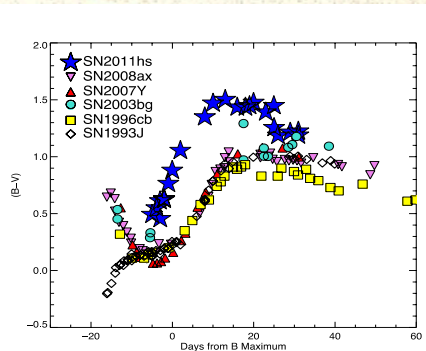
Unveiling SNe Type IIb progenitors: the peculiar case of SN 2011hs (Bufano et al.)



Narrow light curve shape



High expansion velocities
Narrow light curves



Red color curve:
color excess intrinsic
or absorbing dust?

What's the Progenitor nature?
Extended low mass star?
Modelling is needed



Núcleo Milenio de Estudios de Supernovas