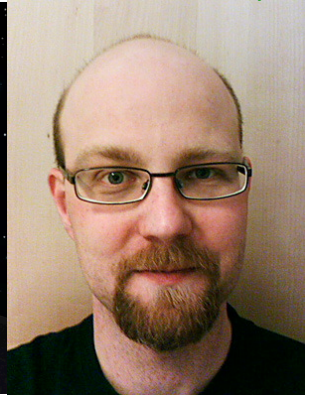


SNIa astrophysics and cosmology at OKC



physics

astronomy



+ 4 PhD students
(2 postdocs to join in the fall)

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physics

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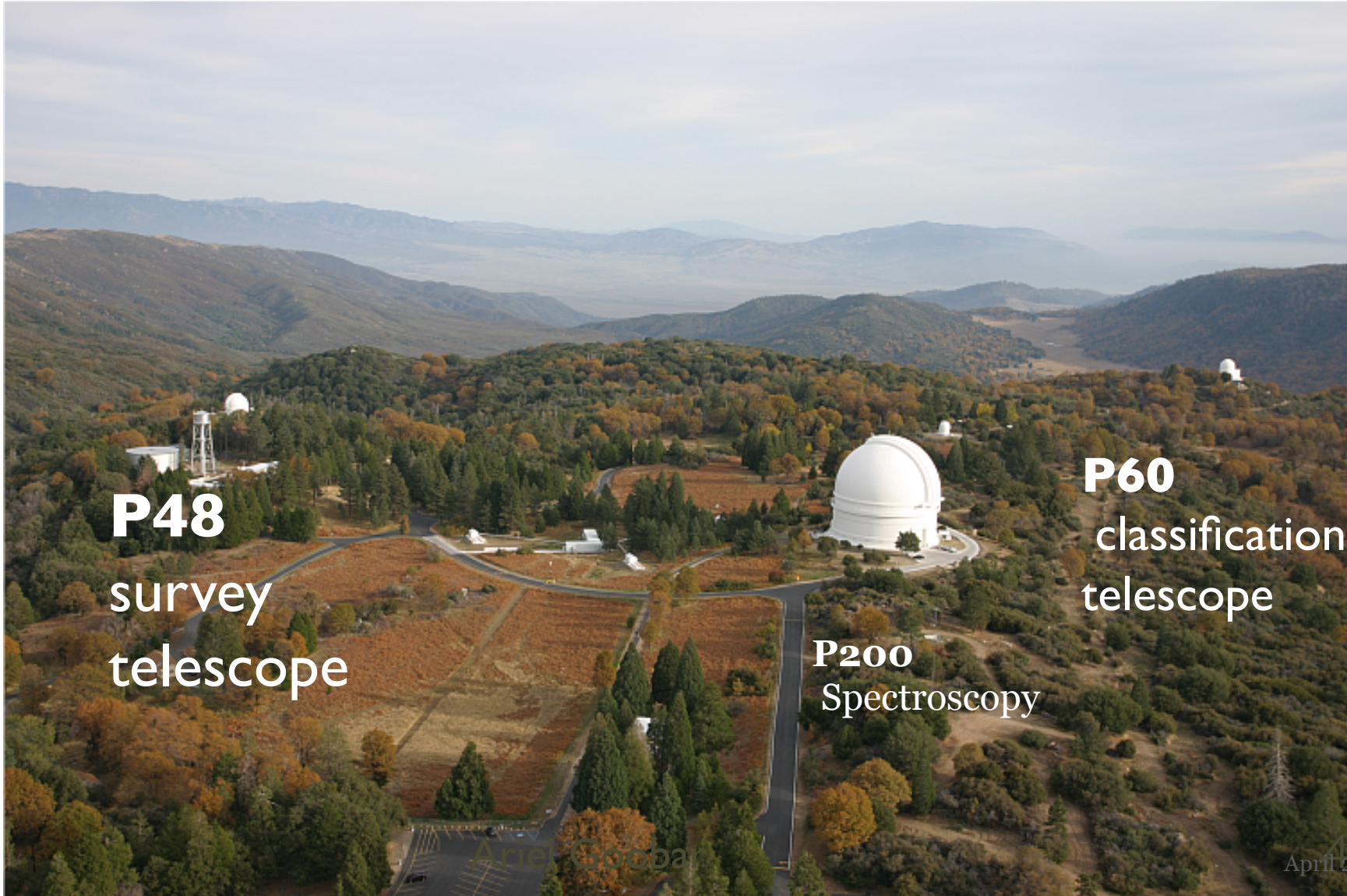
+ 4 PhD students
(2 postdocs to join in the fall)



SN + cosmology work@OKC includes:

- Extinction of SNe Ia and impact for cosmology
- High-resolution spectroscopy of CSM/ISM lines
- Near IR Hubble diagram
- Progenitor system
- SN host galaxies
- SNIa spectral features and correlations
- Lensing of SNe
- Bulk flows, low- z anisotropies
- + lots of work on SN physics at astronomy dept.
- + phenomenological cosmology (Edvard Mörtsell)

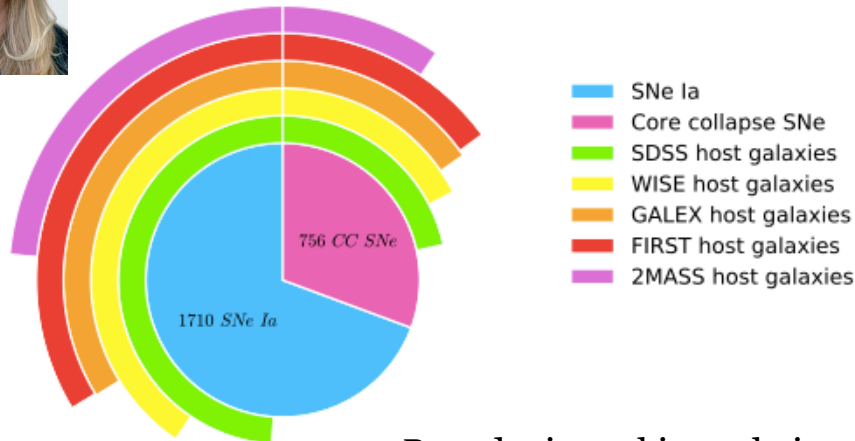
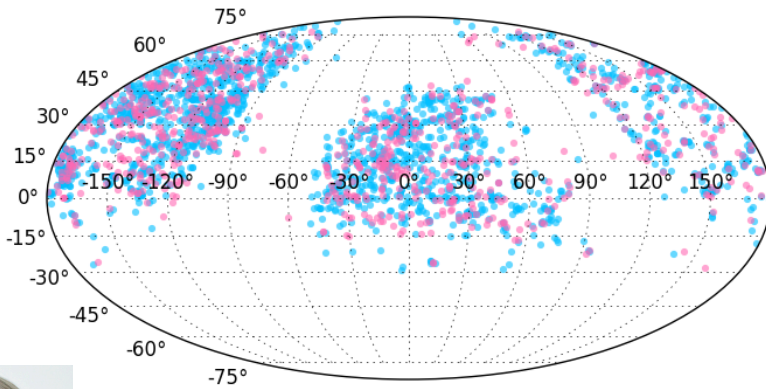
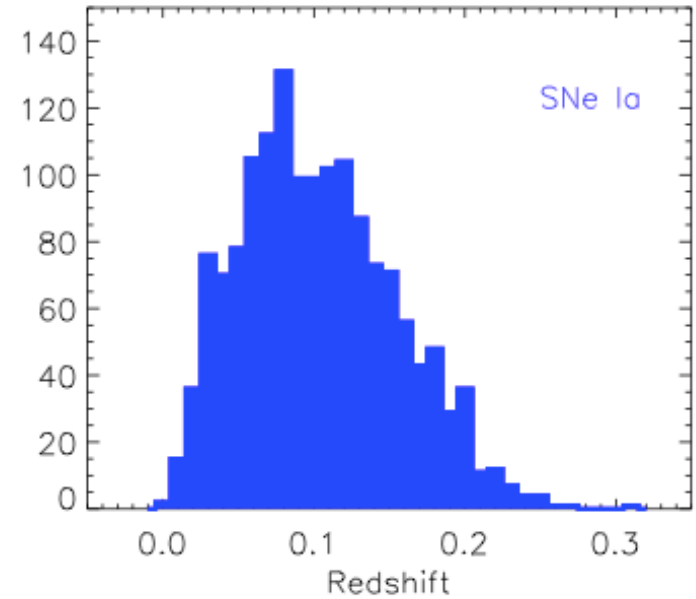
The intermediate Palomar Transient Factory (iPTF): 2013-2016 Zwicky Transient Facility (ZTF): 2017-2020



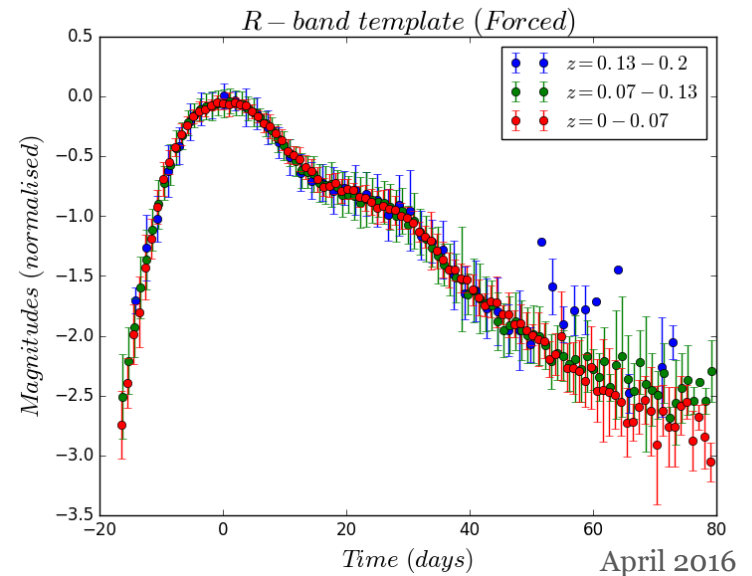
P48
survey
telescope

P60
classification
telescope

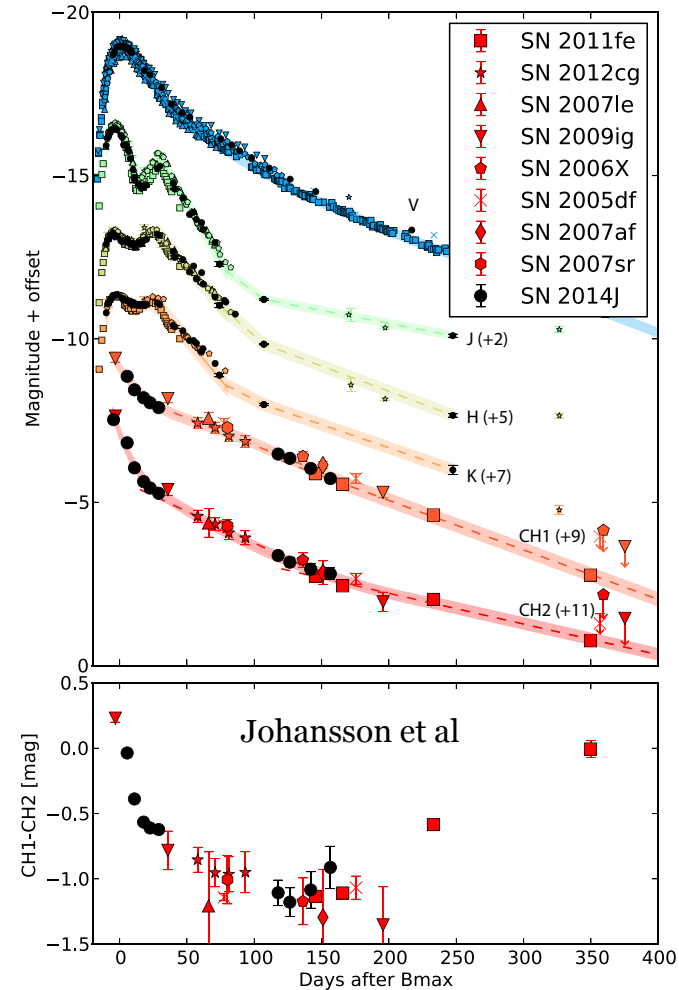
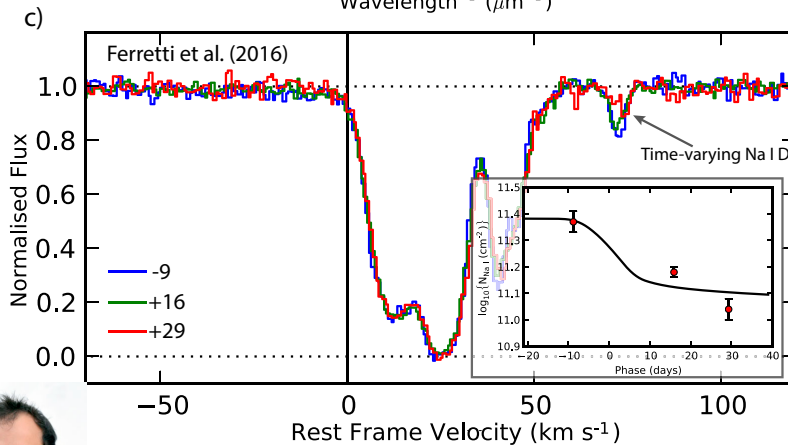
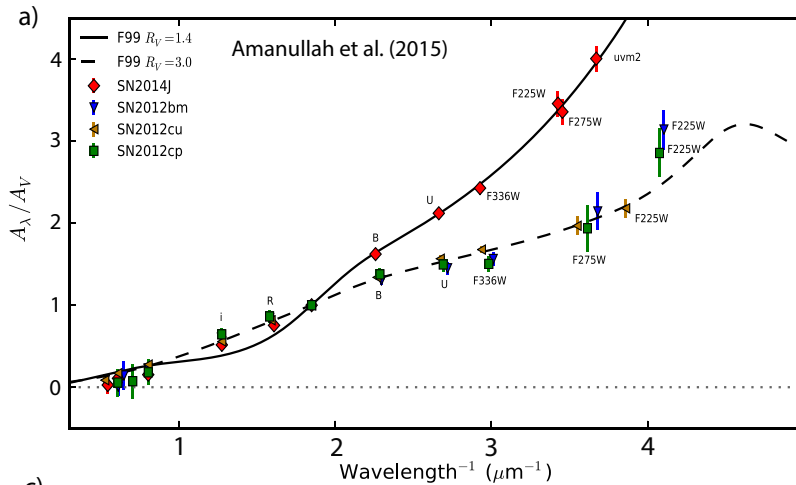
P200
Spectroscopy



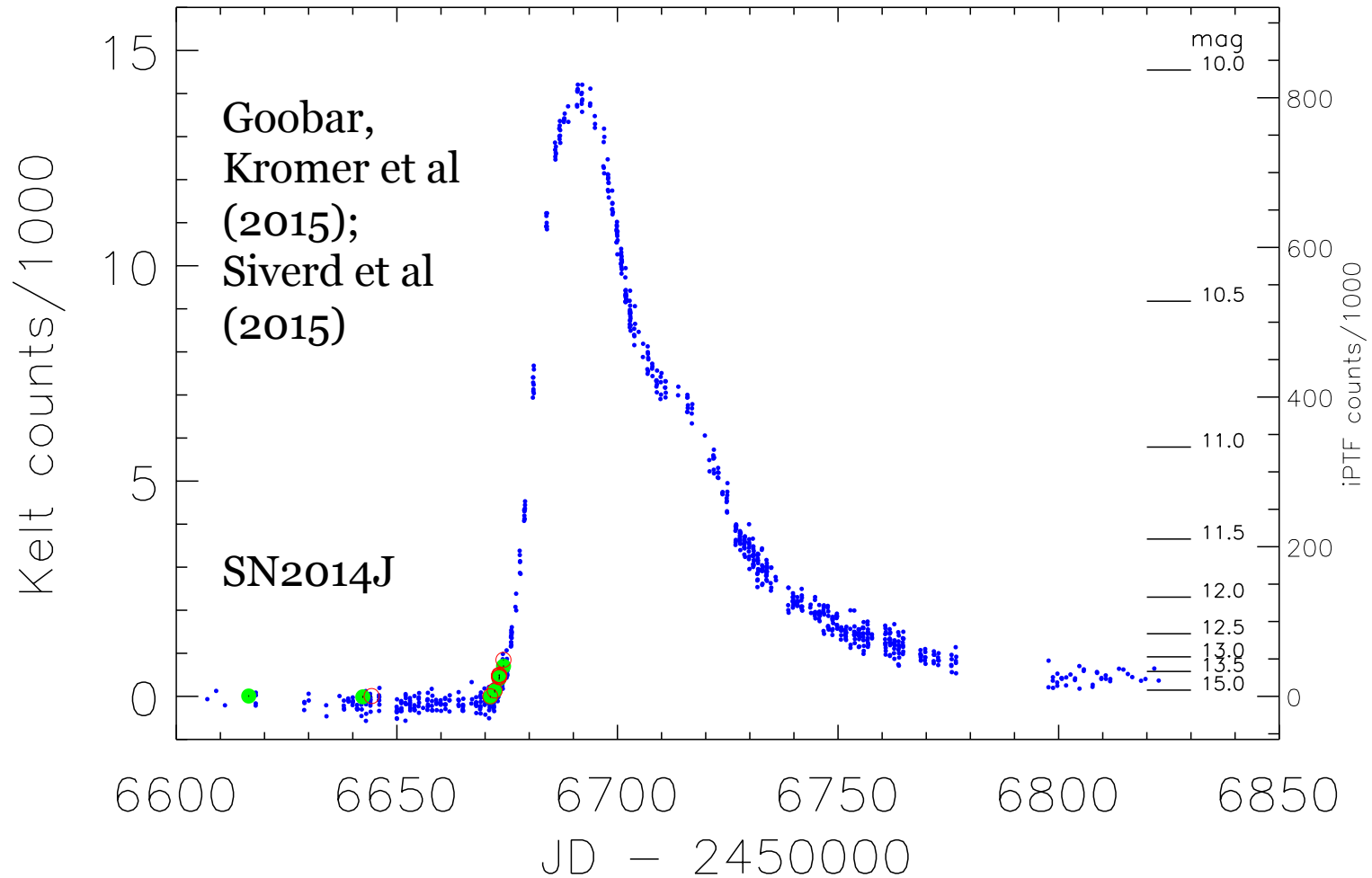
Papadogiannakis et al., in prep
Hangard et al., in prep



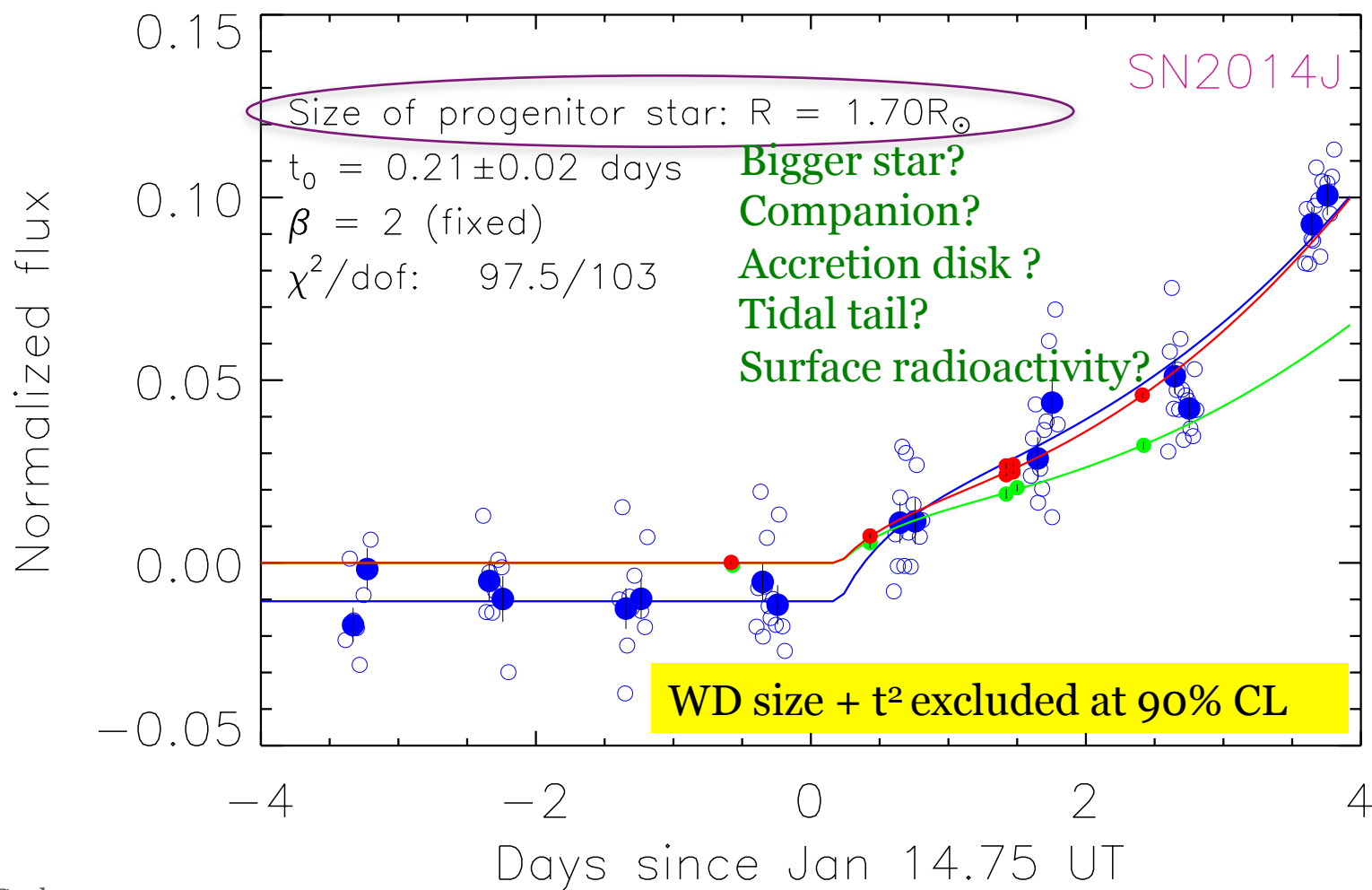
Expanding the set of observables (I)



Expanding the set of observables (II)

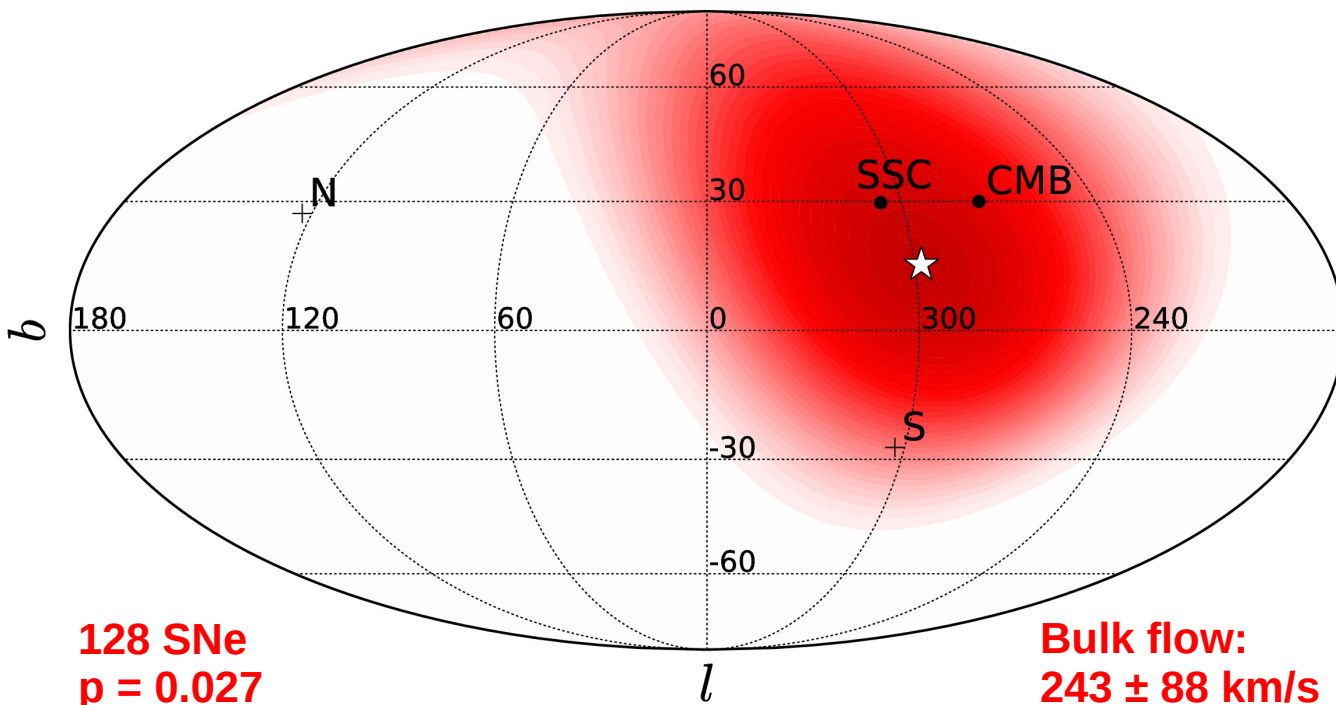
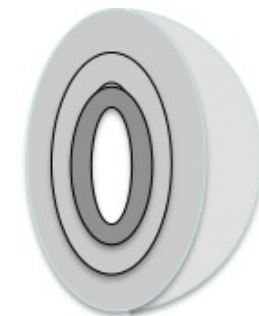


Signs of shock-heated material in 14J?



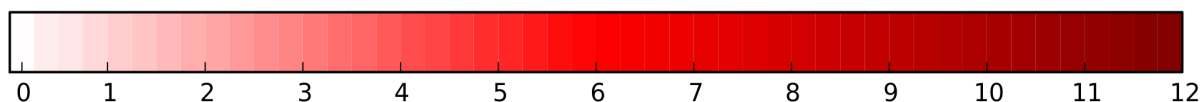
Bulk Flow Analysis

Dipole fit: $0.015 < z < 0.035$



128 SNe
 $p = 0.027$

Bulk flow:
 243 ± 88 km/s



Bulk flow modeled as velocity dipole

Best fit direction consistent with direction to Shapley

Result dominated by Union2 data

→ Amplitude matches previous studies

Feindt et al (2013) (SNFactory collab.)

ZTFx15 faster than iPTF



Precursor for LSST in time-domain astro

Target SNIa sample with ZTF



- 1800 spectroscopically ID:ed SNe Ia in galaxies in the DESI footprint and within PTF H-alpha survey.
- Redshift range $z \leq 0.08$; with up to 1 mag reddening discovered 2 mag below peak.
- High galactic latitude, $E(B-V)_{MW} < 0.1$
- **P48 photometric coverage:** gR + (some I?)
- 2-filter lightcurves (gR) with 3-day cadence, $SNR > 10$ (TBD), ≥ 15 points. Minimal coverage to day +40
- High-cadence sample, single band (~ 2000 sq.deg), for *very early* discoveries
- **Multi-band (+ spectroscopy) follow-up from better site?**

ZTF SNIa science goals



- Cosmological sample: new low-z anchoring set
- Bulk-flow measurement, precision TBD
- Systematics study: set floor for LSST, WFIRST: Host environment dependencies, dust
- Feasibility of photometric ID for e.g., LSST
- Sample to trigger NIR SNIa Hubble diagram
- Rates as a function of galaxy types and Ia-subtypes.
- Interaction and surface radioactivity, dark phase of SNIa (first 4 days).
- Late time lightcurves and spectra to understand nebular physics and interaction (>100 d).
- High-resolution spectroscopy: CSM and ISM studies.
- Progenitor systems vs Ia properties
- Lensed SNe



ZTF Summary

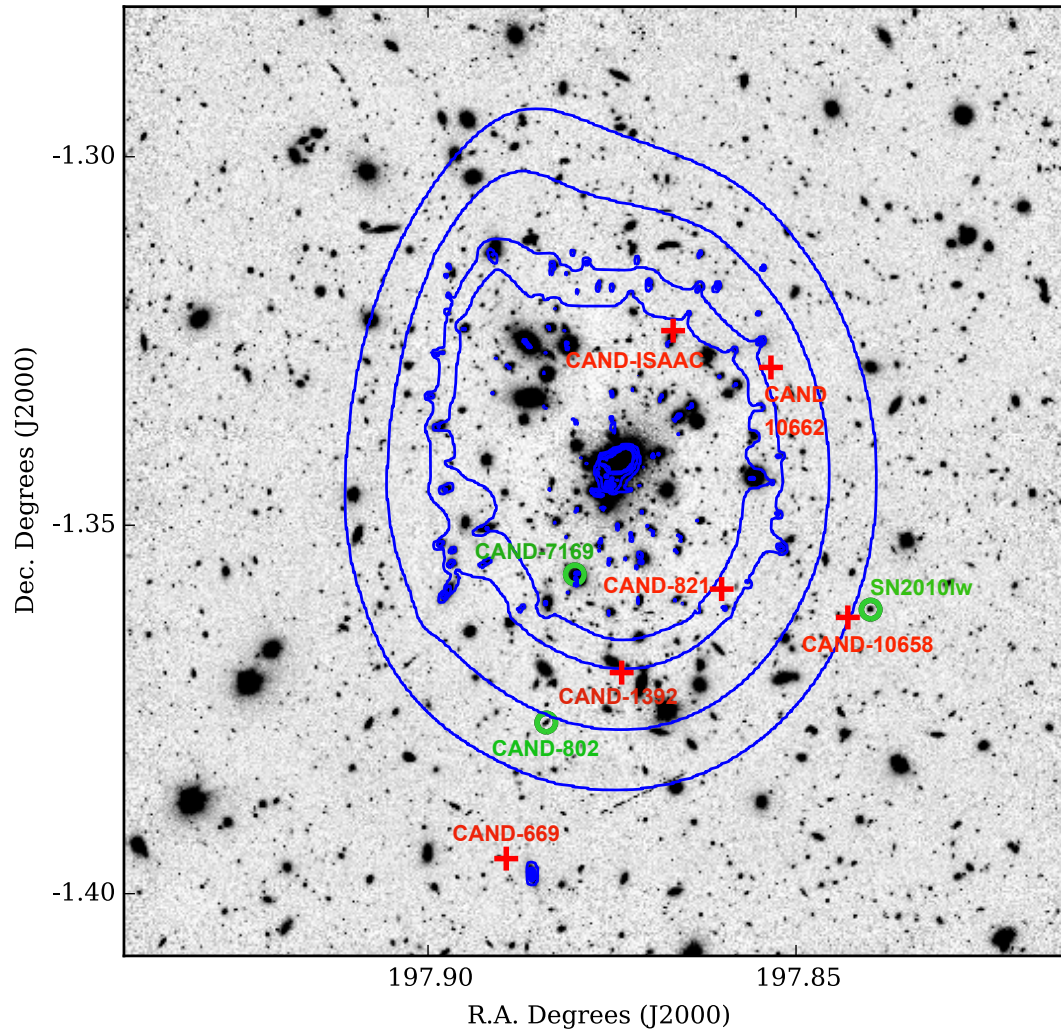
- ZTF excellent discovery machine for low-z SNe
- Spectroscopic screening of “young” transients on P60 SEDM
- But(!), not a good site for precision photometry
- Follow-up instruments in good locations could add significant value to the SNIa program for cosmology: ugriz + NIR + multi-epoch spectroscopy
- Great warm-up for LSST!



Quick detour...

VLT NIR Survey of lensing
cluster A1689

Six lensed CC SNe + 3 SNIa in cluster members



CC high-z rate & SNIa cluster rate

