



SNIa astrophysics and cosmology at OKC



physics



astronomy



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

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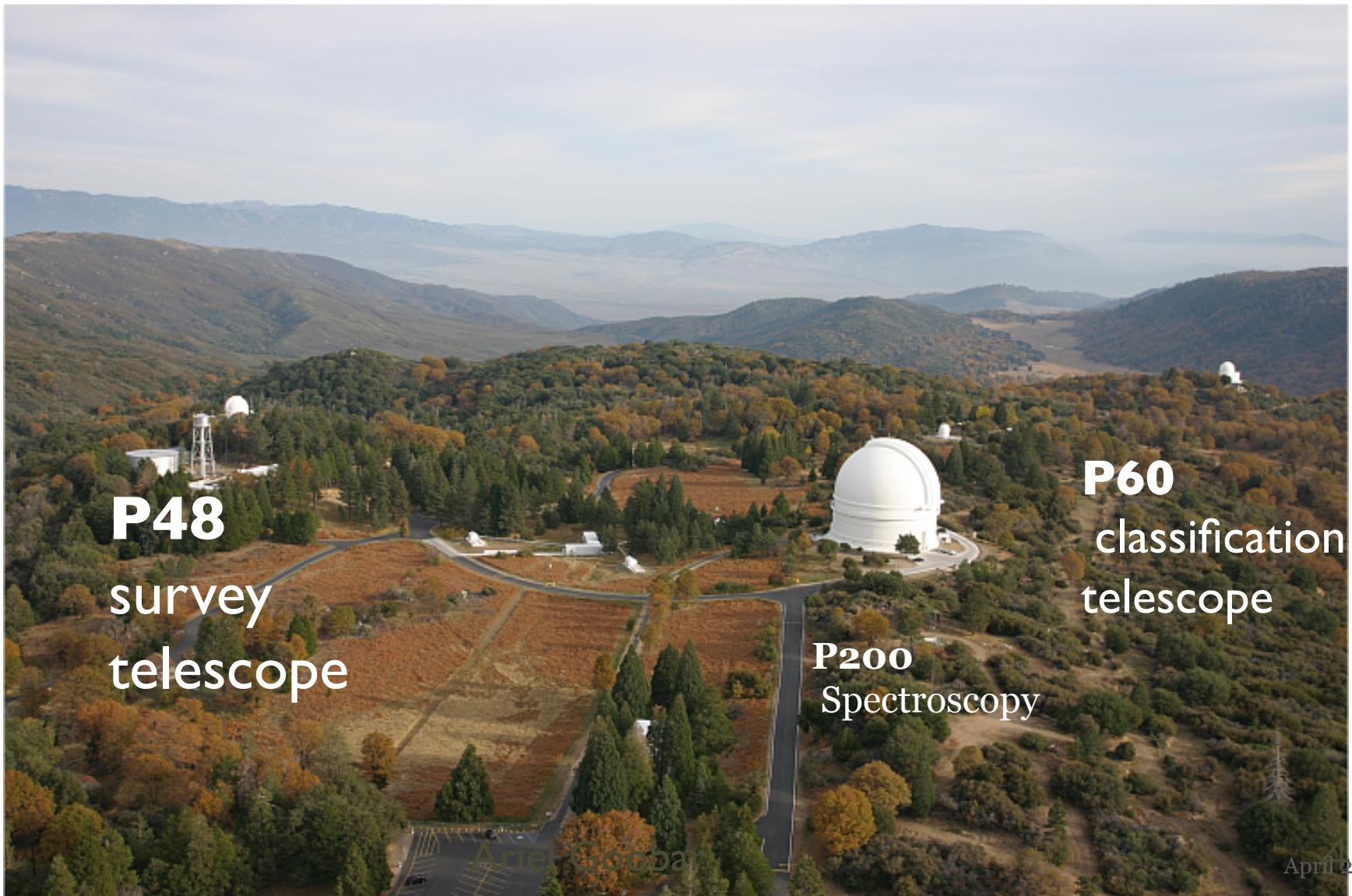
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SN + cosmology work@OKC includes:

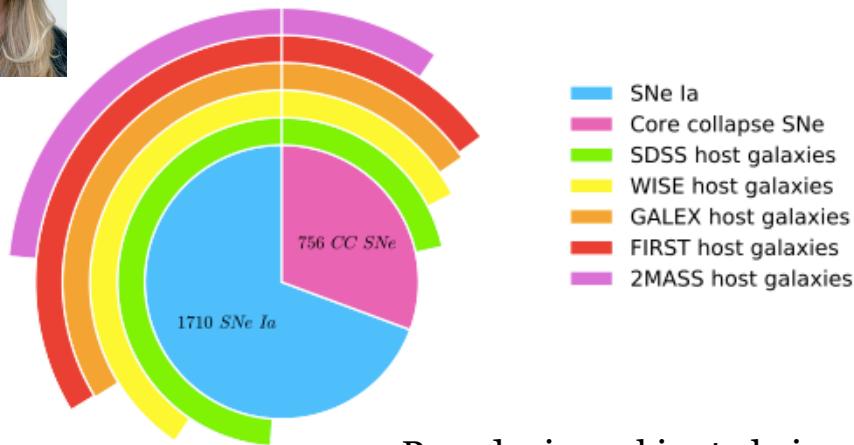
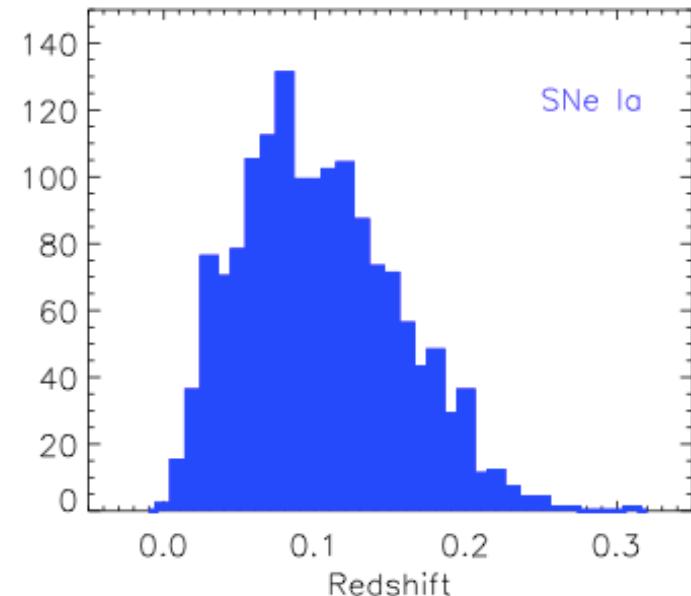
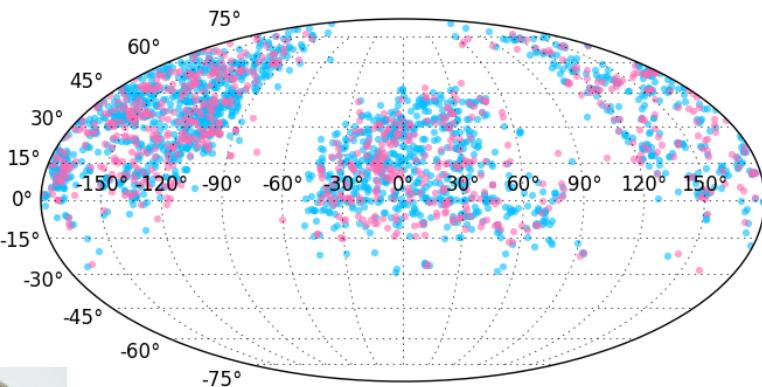
- Extinction of SNe Ia and impact for cosmology
- High-resolution spectroscopy of CSM/ISM lines
- Near IR Hubble diagram
- Progenitor system
- SN host galaxies
- SNIa spectral features and correlations
- Lensing of SNe
- Bulk flows, low-z anisotropies
- + lots of work on SN physics at astronomy dept.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

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

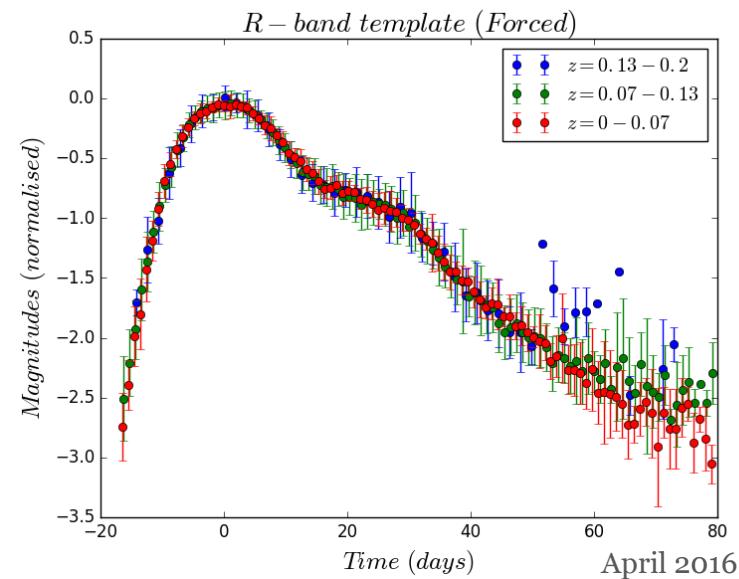




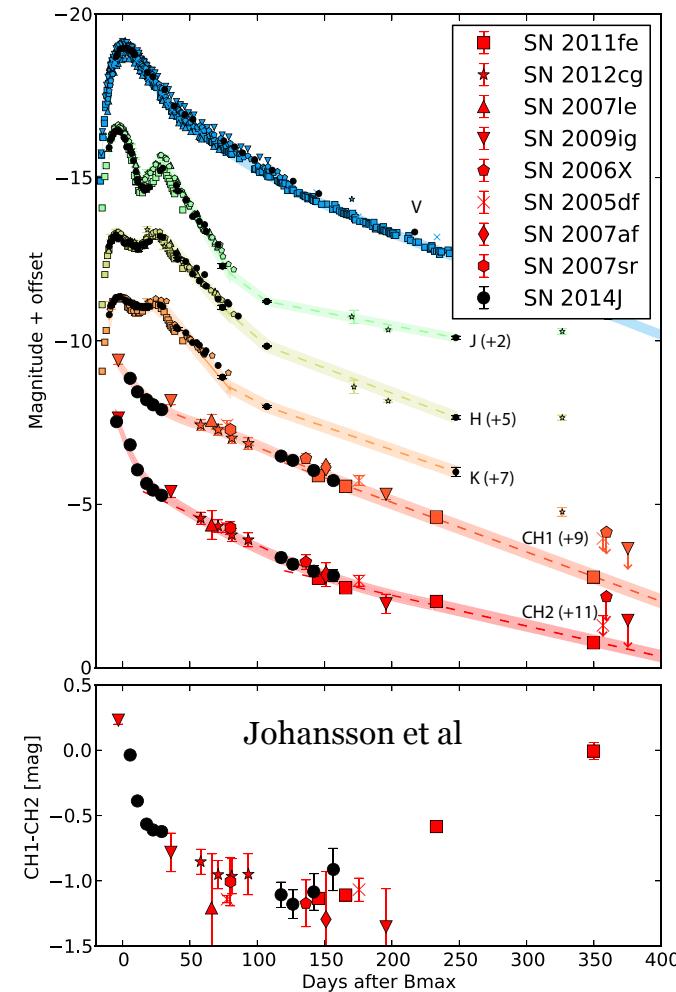
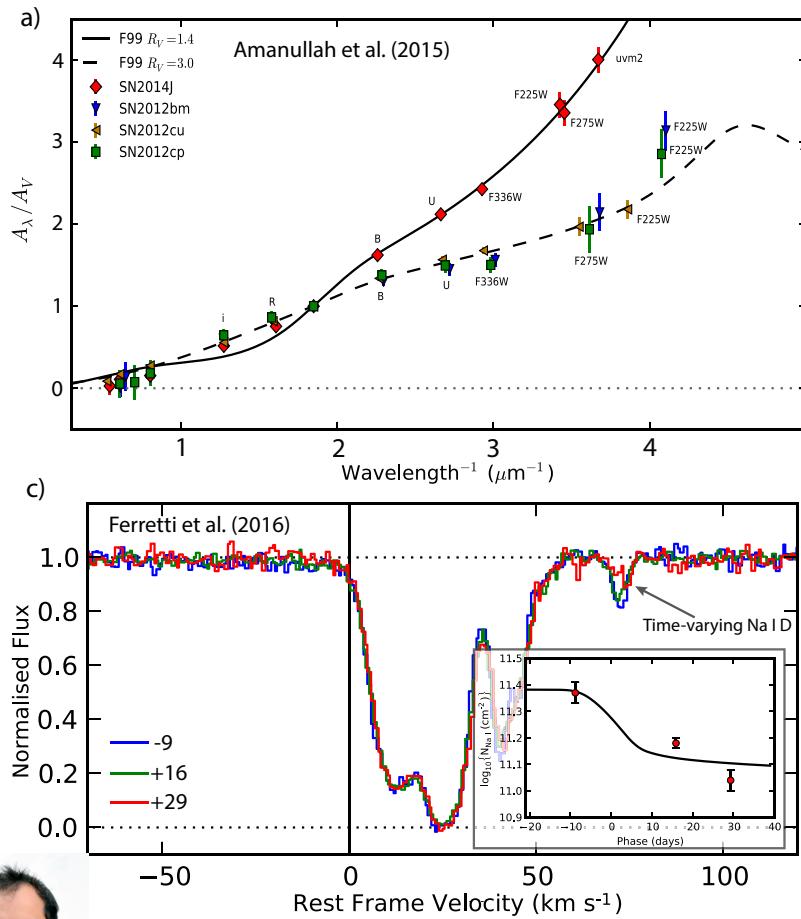
PTF + iPTF SN sample



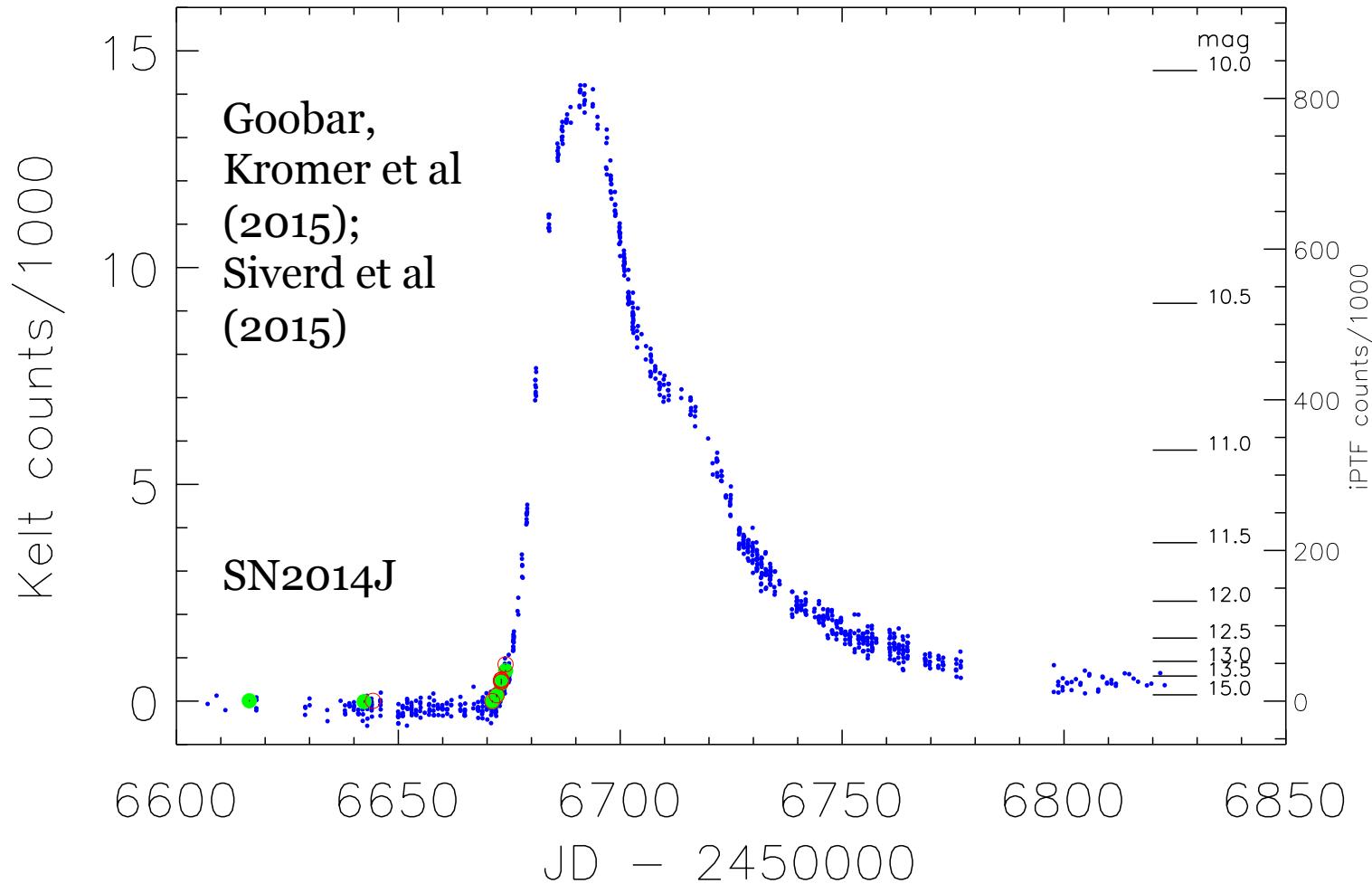
Papadogiannakis et al., in prep
Hangard et al., in prep



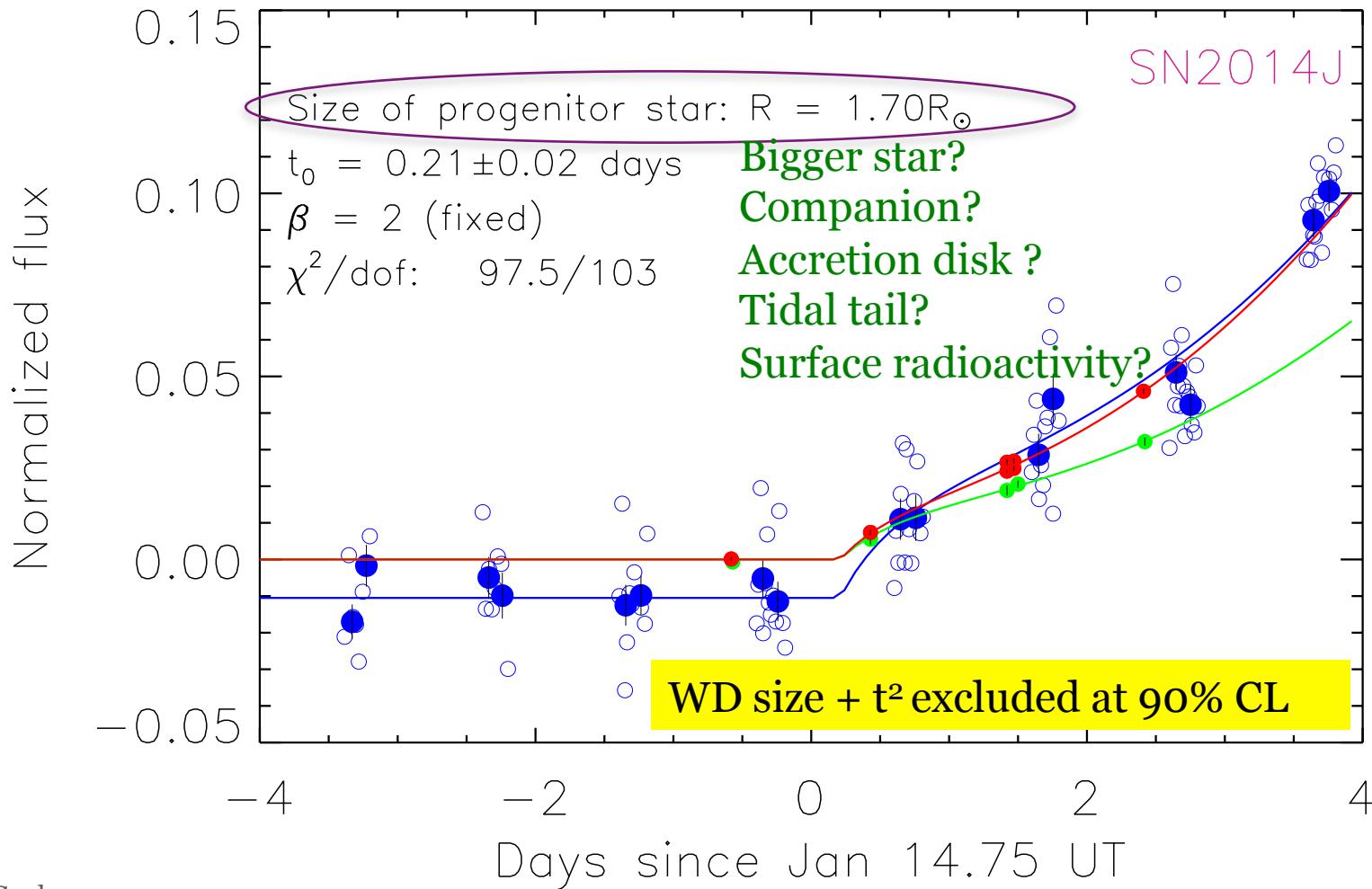
Expanding the set of observables (I)



Expanding the set of observables (II)

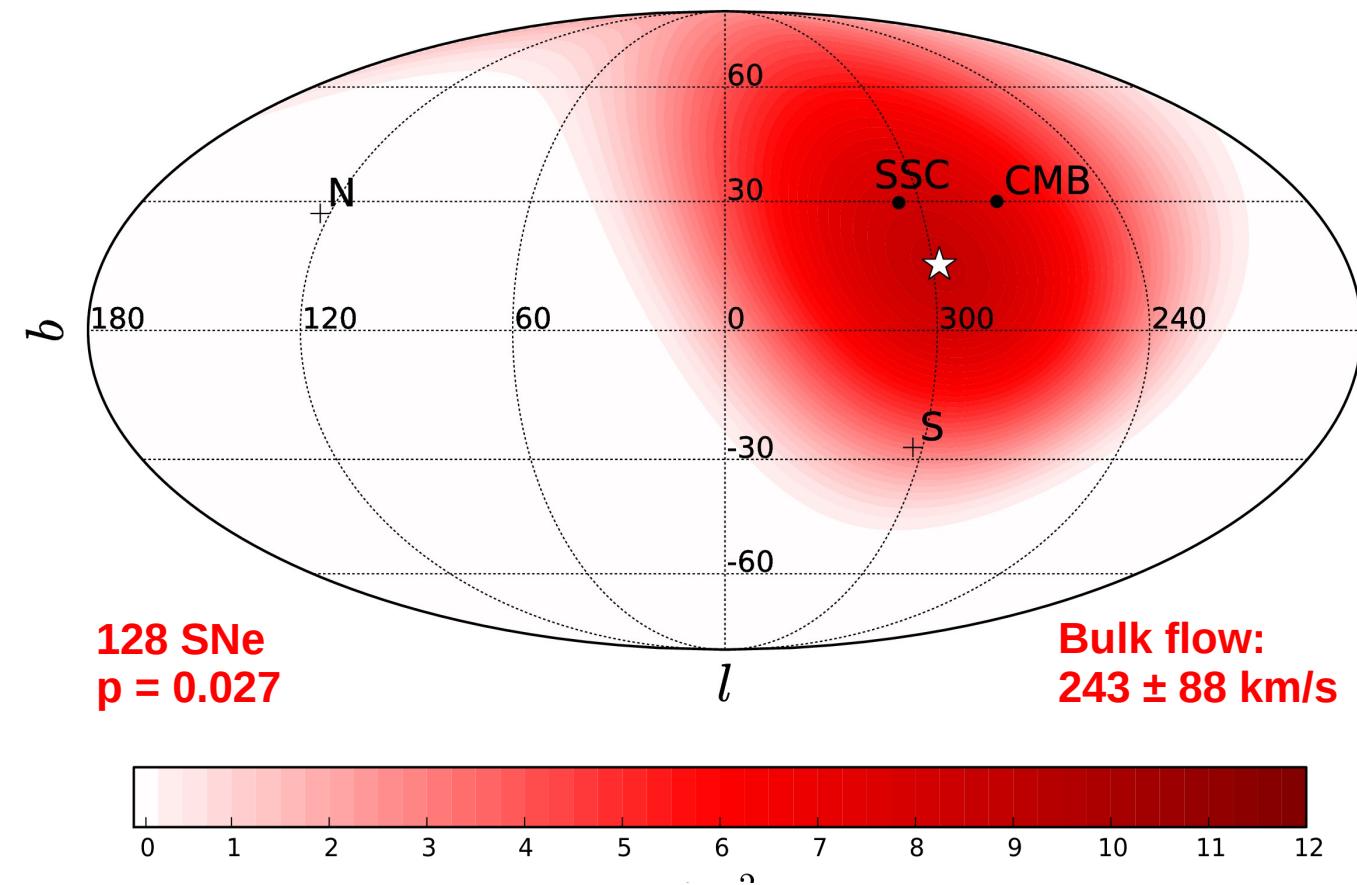
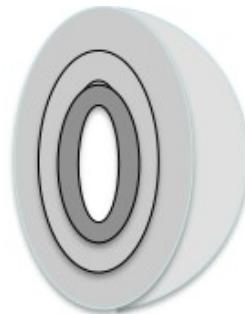


Signs of shock-heated material in 14J?



Bulk Flow Analysis

Dipole fit: $0.015 < z < 0.035$



Bulk flow modeled as velocity dipole

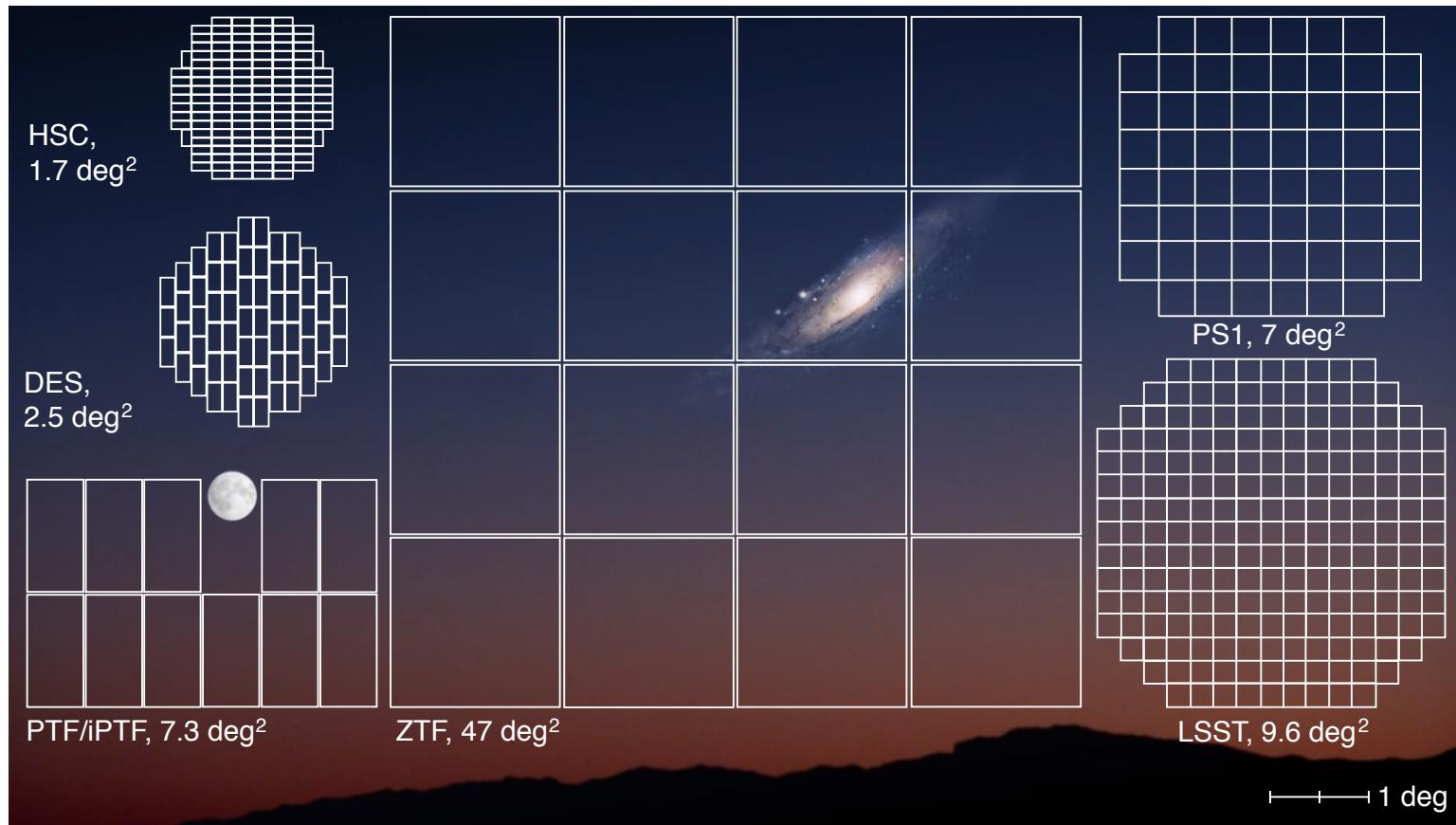
Best fit direction consistent with direction to Shapley

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

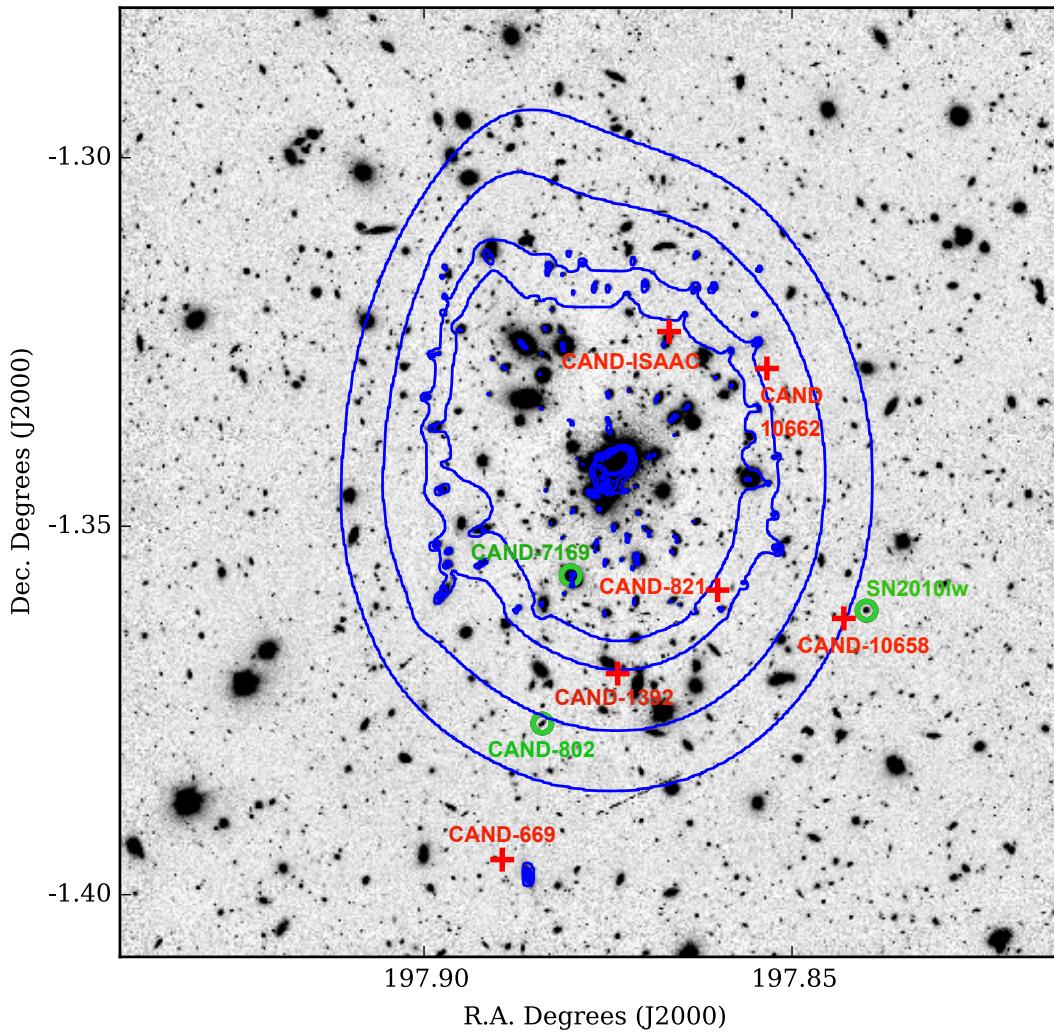
- ZTF excellent discovery machine for low- z SNe
- Spectroscopic screening of “young” transients on P60 SEDM
- But(!), not a good site for precision photometry
- Follow-up instruments in good locations could add significant value to the SNIa program for cosmology: ugriz + NIR + multi-epoch spectroscopy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

