Transients, Supernovae and Astrostatistics

Suhail Dhawan (on behalf of all SN people)

KICC Welcome Event, 7 December 2022

Ben | Suhail ** | Matt | Erin | Kaisey | Collin | Sam





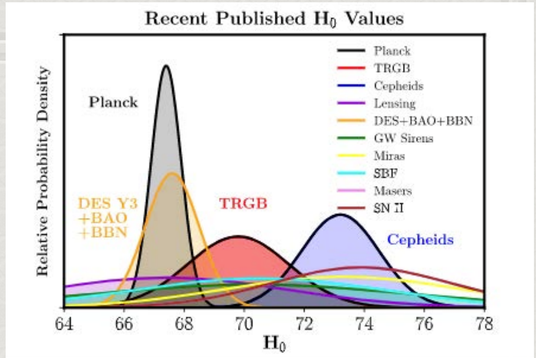


** + R. Ayoade

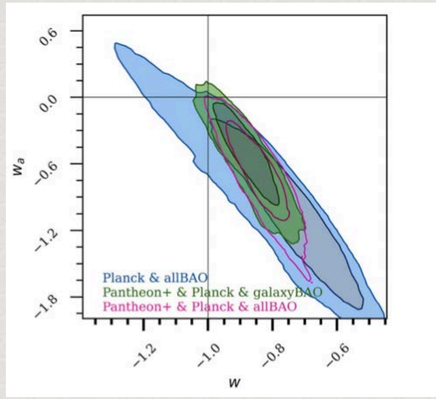
Open Questions in SN Cosmology

- *What causes the Hubble tension?*
- *What is the nature of dark energy?*
- *What is the matter fluctuation amplitude?*

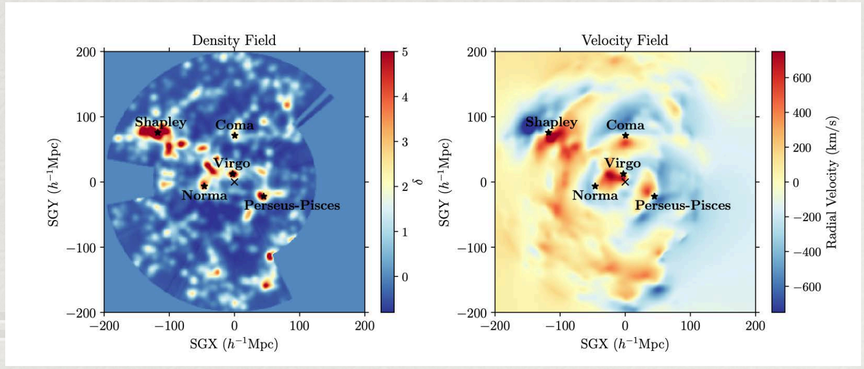
Freedman 2021



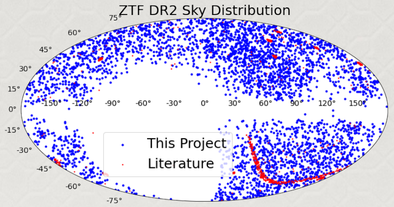
Brout+22



Boruah+2020



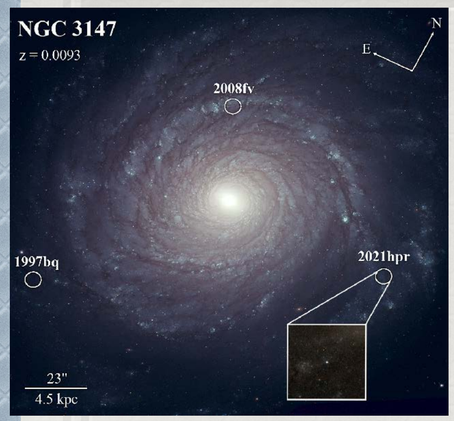
ZTF DR2 sky distribution



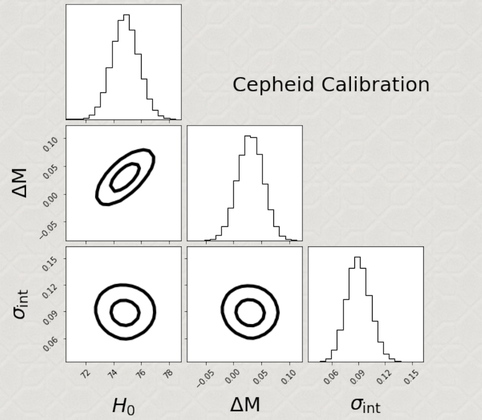
Systematics, not statistics limited

Controlling Systematics for Cosmology

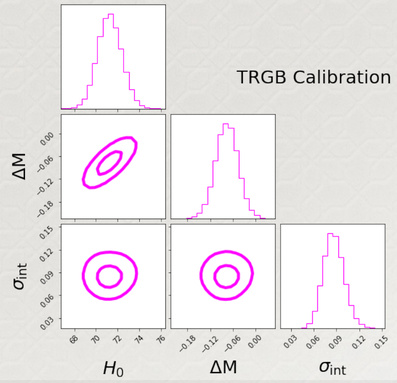
Ward+22, Submitted



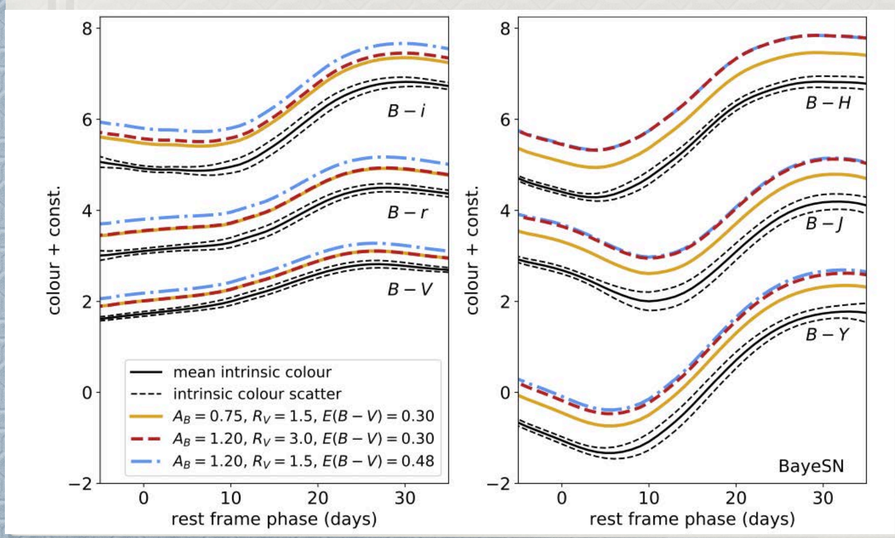
- *Modelling optical to NIR consistently (Mandel+22, Thorp+Mandel'22)*
- *Applied to SN siblings: distance consistencies (Ward+22,submitted)*
- *Integrating BayeSN into cosmo framework (S. Thorp, M.Grayling)*
- *Distance scale: improving Ho uncertainties (SD+22, submitted)*



SD, Thorp, Mandel+'22, submitted



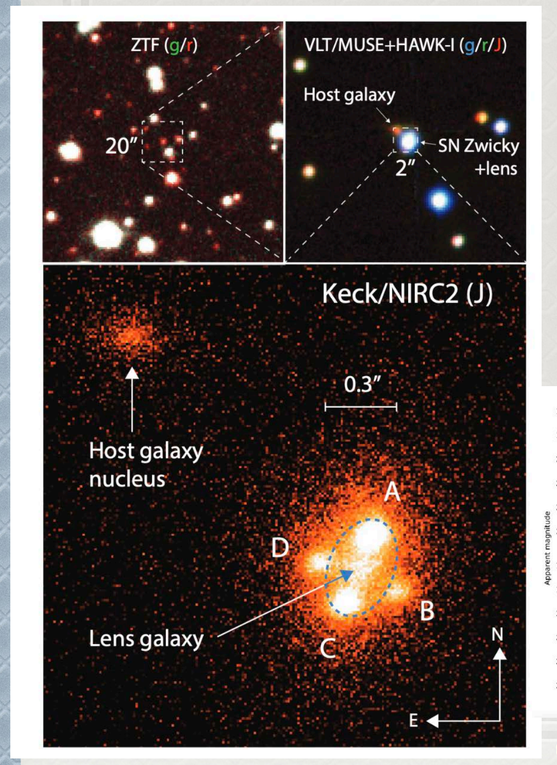
Thorp + Mandel 2022

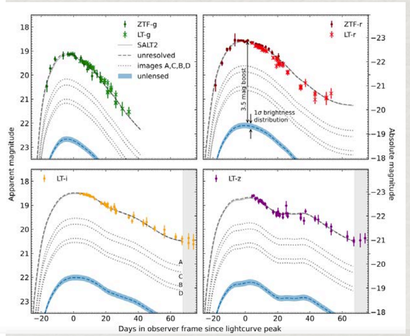


Strong Lensing: Gravitational Telescope

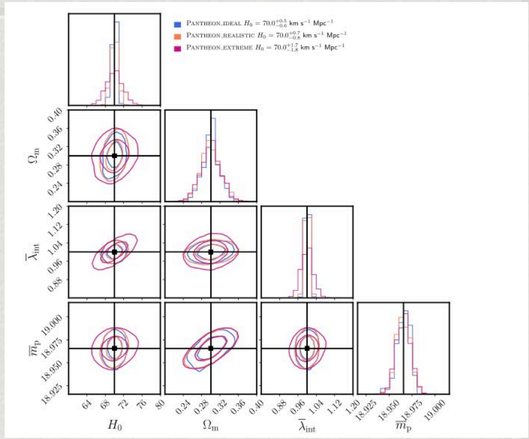
Expected H0 @ 1.5%
(Birrer, SD, Shajib 2022)

- *SN Zwicky: compact lens, first ZTF gLSN*
- *Lens magnification: SN physics tests*
- *Bayesian tools for time-delay inference*
- *Gearing up for LSST discoveries*

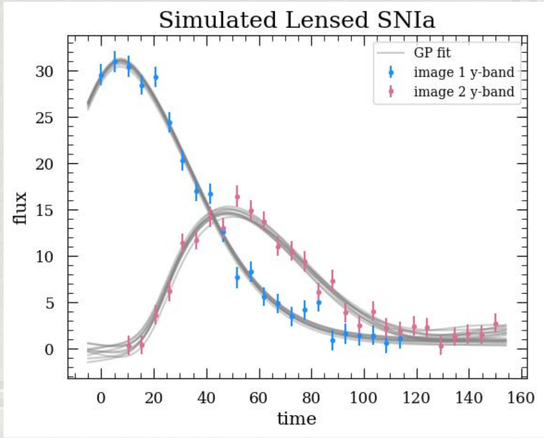




Goobar,.., SD+ Nat. As., Submitted

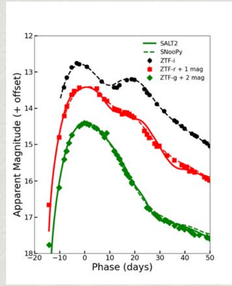


https://github.com/erinhay/GausSN
FC: E. Hayes

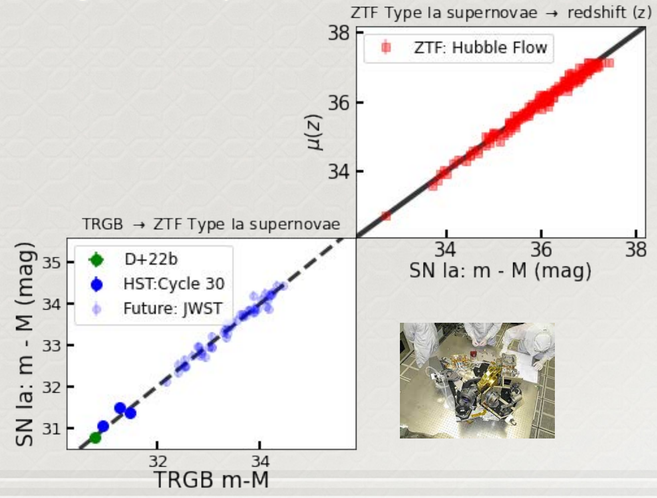


Cosmological Inference

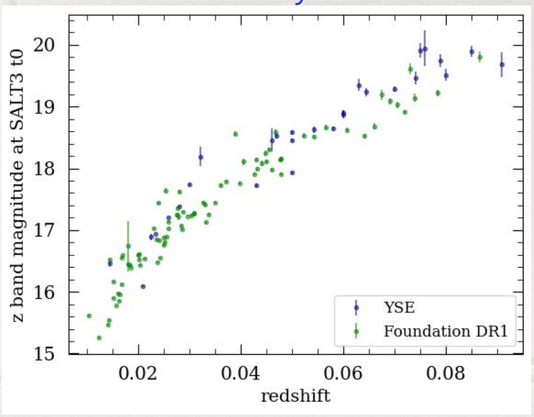
- *SNIa as z-band standard candles (E. Hayes: PhD)*
- *SimpleBayeSN: Hierarchical inference of Ho + DE (B. Boyd: PhD)*
- *Dust constraints with non-parametric inference (S. Ward: PhD)*
- *Dark energy: Bayesian model comparison (T. Lovick: Part III)*



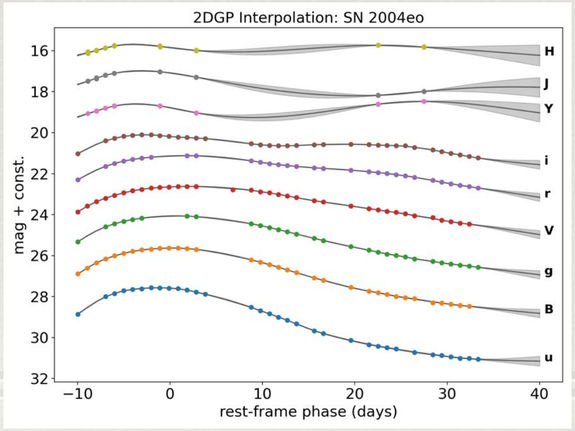
Single survey distance ladder (SD+22b)



Prelim. z-band Hubble diagram
FC: E.Hayes

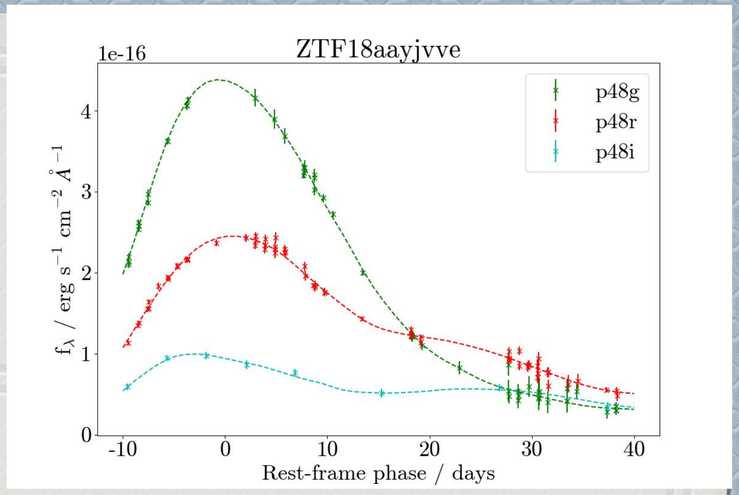


Non-parametric optical + NIR inference
Ward+ ’23, in prep.



Going Forward!

- *Scalable BayeSN with INLA (see Collin's talk)*
- *New ZTF calibrators: HST C30 + JWST C1*
- *YSE DR1: Cosmology analysis*
- *ZTF DR2: Anisotropy analysis (SD+22c, submitted)*
- *Augmenting the SED model (B. Boyd: Phd Project)*



FC: M. Grayling

FC: B. Boyd