Dark Energy Bedrock All Sky Supernovae (DEBASS)

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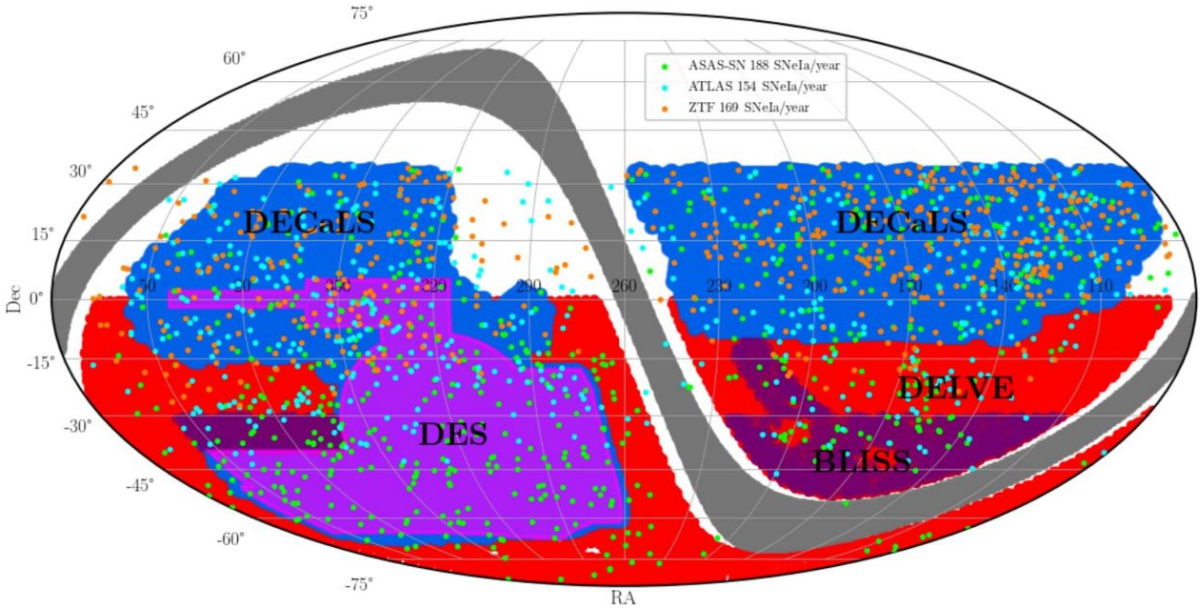
Overview

- What is DEBASS?
- Motivation
- Experimental Design
- Pipeline

What is DEBASS?

- A follow-up program of low-z SNe Ia discovered by external rolling transient surveys like ZTF, ATLAS, and ASAS-SN



Low-z SNe Ia discoveries by ATLAS, ASAS-SN, and ZTF from 2017 − 2019 in colored points. Sky coverage in gr[i]z for DECam past and ongoing programs.

Motivation

1. Recent analyses have adopted significant systematic uncertainties due to the calibration across the compiled 13 heterogeneous low-z samples/telescopes.
    - The large FoV and many years of effort on the all-sky uniformity and absolute calibrations of DECam are essential for measurements of SN Ia brightnesses at low-z and high-z and for spatially-dependant peculiar velocity field cosmology.

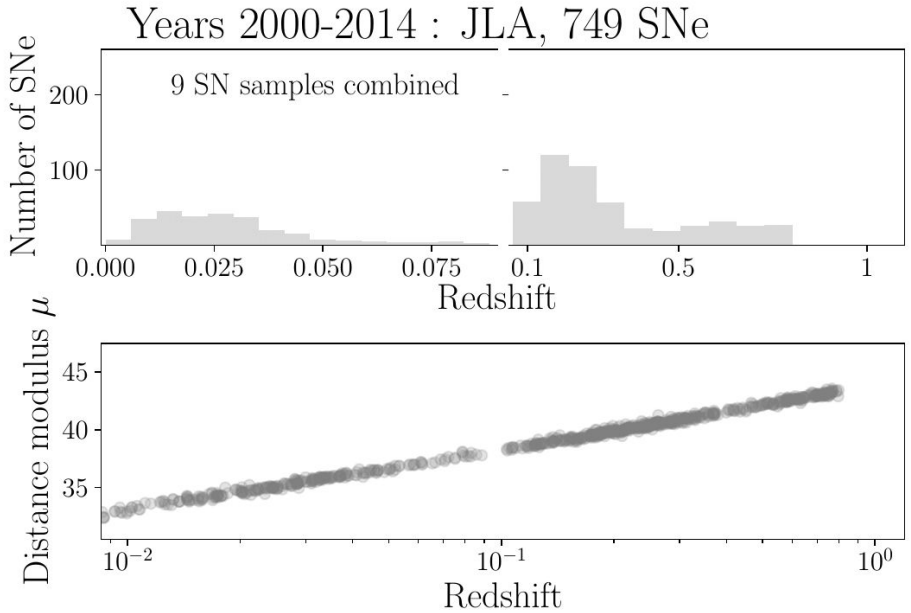


Figure from Maria Vincenzi.

Motivation

1. Recent analyses have adopted significant systematic uncertainties due to the calibration across the compiled 13 heterogeneous low-z samples/telescopes .
2. The low-z SNe of recent analyses were made up of SNe discovered by targeted low-z search programs that discovered preferentially highly extinguished SNe.
    - This is especially costly because targeted searches are difficult to model in simulations (Kessler et al. 2019) and red/extinguished SNe are of poor quality.

Motivation

3. Brout & Scolnic 2020 showed that bluer/un-extinguished SNe Ia exhibit no mass step, are less sensitive to selection effects, and are inherently more standardizable; nearly twice as strong as current low-z samples and as good as space-telescope NIR!

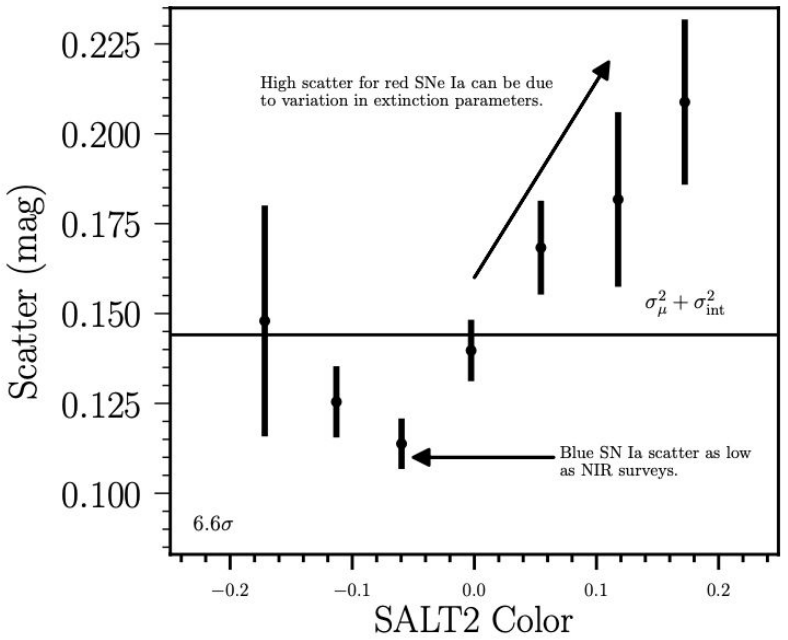


Figure from Brout & Scolnic (2020).

Experimental Design

- Using DECam we will observe ~750 low-z SNe Ia over 8 semesters using 1 hour of observing with a cadence of ~4-5 nights which started in 2020B
- Targets from rolling all-sky surveys such as ATLAS, ASAS-SN, and ZTF will be required to
    - Be in the Hubble flow (z > 0.015) or in a potential Cepheid or TRGB host
    - Have Milky Way reddening (MWEBV) < 0.25 mag
    - Fall in the DES, DECaLs (g, r, z), DELVE, or BLISS footprints
    - Be observable by DECam for at least 45 days
  - With time to follow 20 SNe on any given 1hr epoch, we follow candidates until ~50 days past their peak luminosity (~8 epochs per SN with temporal and filter choice optimization)
    - Estimating ~100 SNe over the entire semester.

Pipeline

- Leveraging DESGW pipeline for templates
- This is unlike the DESYR1 SN pipeline and instead uses all sky SN that was previously ignored
- There are known objects in the pipeline but there is opportunity for discovery
    - Also acts as a test for the GW pipeline as there are objects we expect to find in the images

Summary

- We want to improve our low-z SNe Ia sample, easing the tension between previous surveys
- LIGO O4 starts in March and the DESGW pipeline will be fully functional
- We are over half of the way through our project and will soon begin processing data