

# Stellar Death in the Nearby Universe

Thomas W.-S. Holoien  
The Ohio State University

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ASAS SN



# ASAS SN

- The **All-Sky Automated Survey for SuperNovae**
- Goal: survey the entire sky to  $\sim 17^{\text{th}}$  magnitude with a rapid cadence
- 14-cm lenses, 4.5 x 4.5 degrees FOV, V-band
- Current: 2 units (8 telescopes), 2500 images per night, 16,000 sq. degrees per night
- Fully automated data reduction pipeline
- Discoveries announced publicly

# ASAS-SN: Current Telescopes

- ASAS-SN North: “Brutus”
  - Haleakala, Hawaii
  - 2 telescopes: Dec. 2011,  
4 telescopes: Dec. 2013

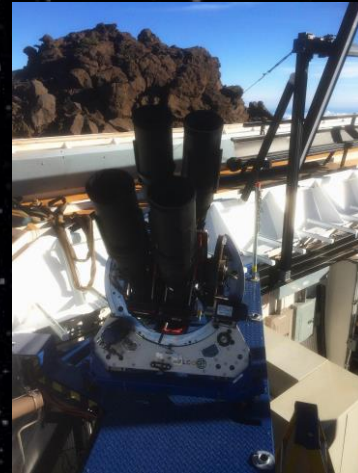


Image: Mark Elphick



Image: Jon De Vera

- ASAS-SN South: “Cassius”
  - Cerro Tololo, Chile
  - 2 telescopes: May 2014,  
4 telescopes: July 2015

# ASAS SN Data



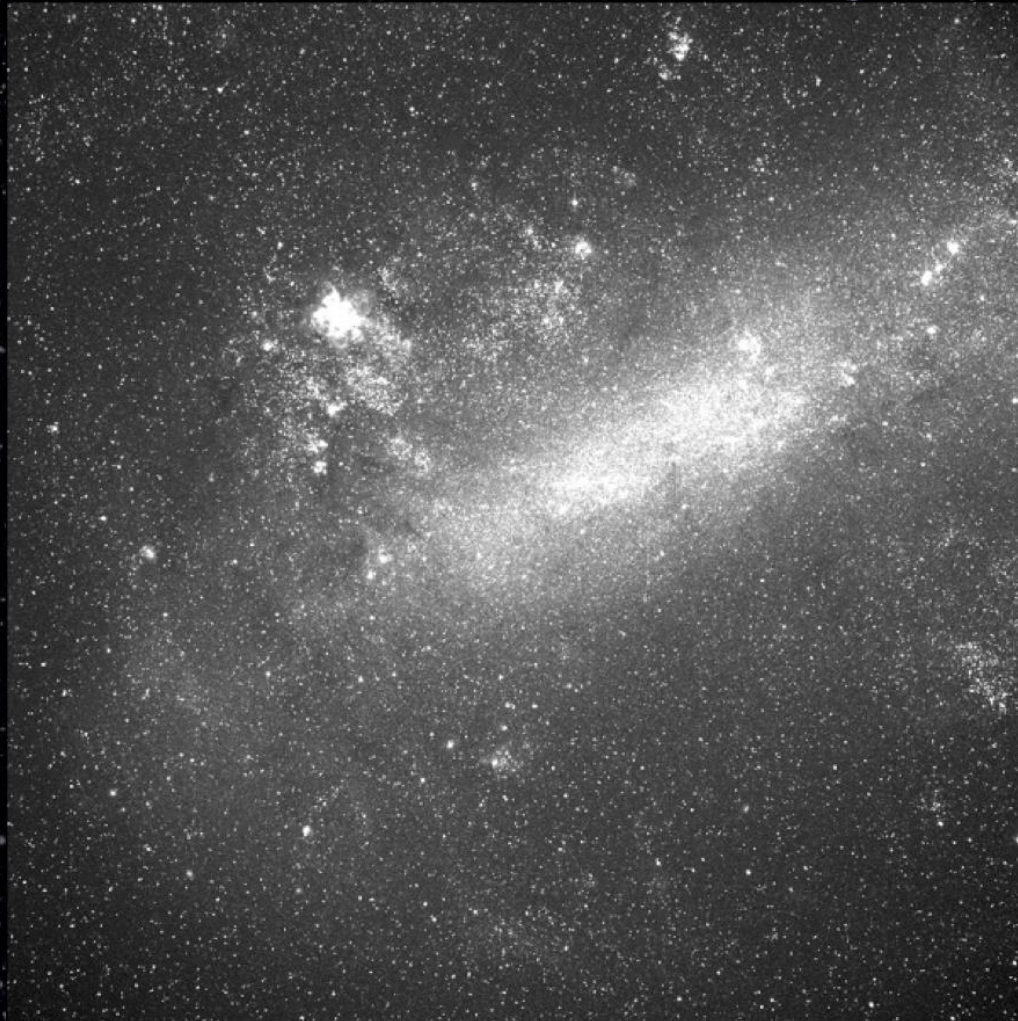
$\approx 4.5^\circ$

# ASAS SN Data



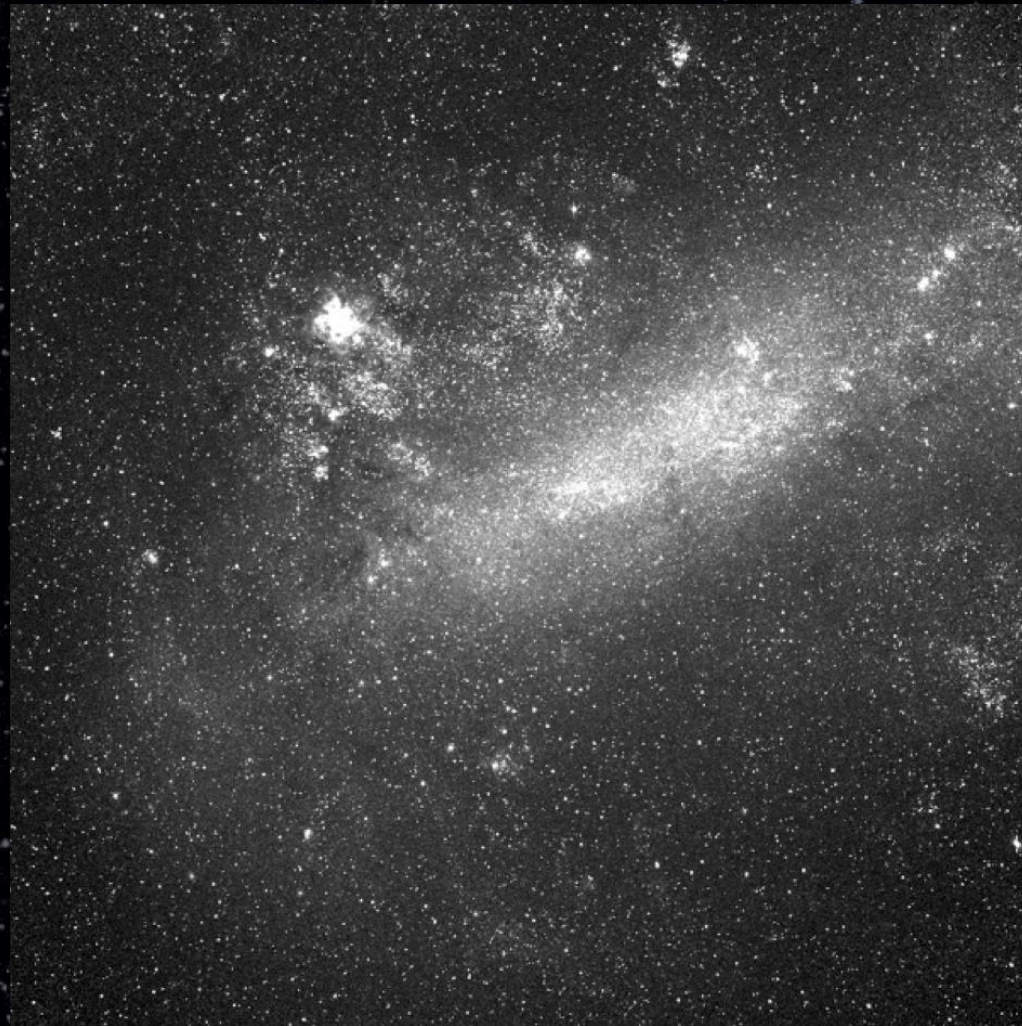
≈4.5°

# ASAS SN Pipeline



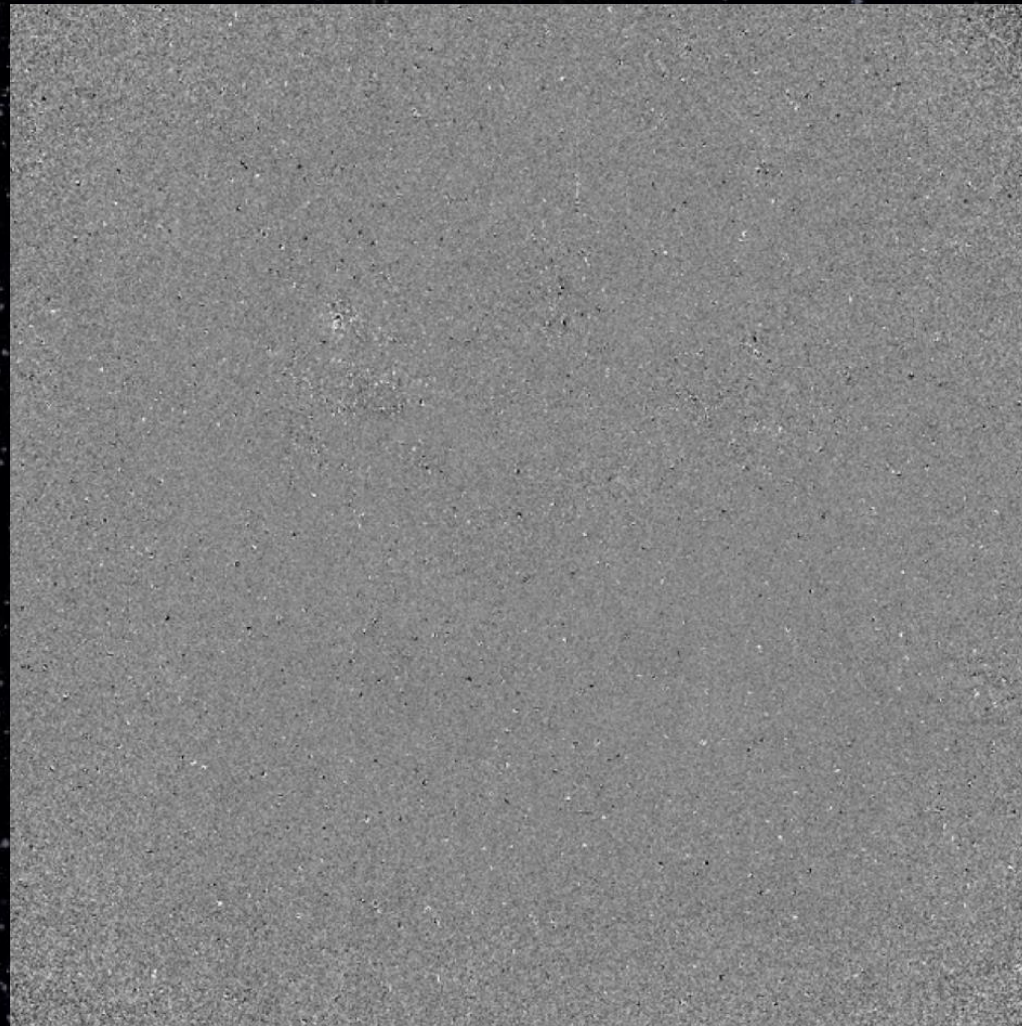
Reference Image

# ASAS SN Pipeline



New Image

# ASAS-SN Pipeline



Subtracted Image



# ASAS-SN Pipeline

- Multiple cuts, including machine learning classifier, reduce false positive numbers
- Few hundred candidates looked at per night



# ASAS SN Discoveries

- ~1000 new cataclysmic variables
  - Herczeg+ 2015
- ~50 4+ mag M- and L-dwarf flares (6  $\Delta V \geq 8$  flares)
  - Schmidt+ 2014, 2016
- “Changing look” AGN flare
  - Shappee+ 2014
- ~20 blazar flares
- Rare “Exor” accretion event on young stellar object
  - Holoien+ 2014a
- 1 comet
- 3 Tidal Disruption Events
  - Holoien+ 2014b, Holoien+ 2016a, Holoien+ 2016b

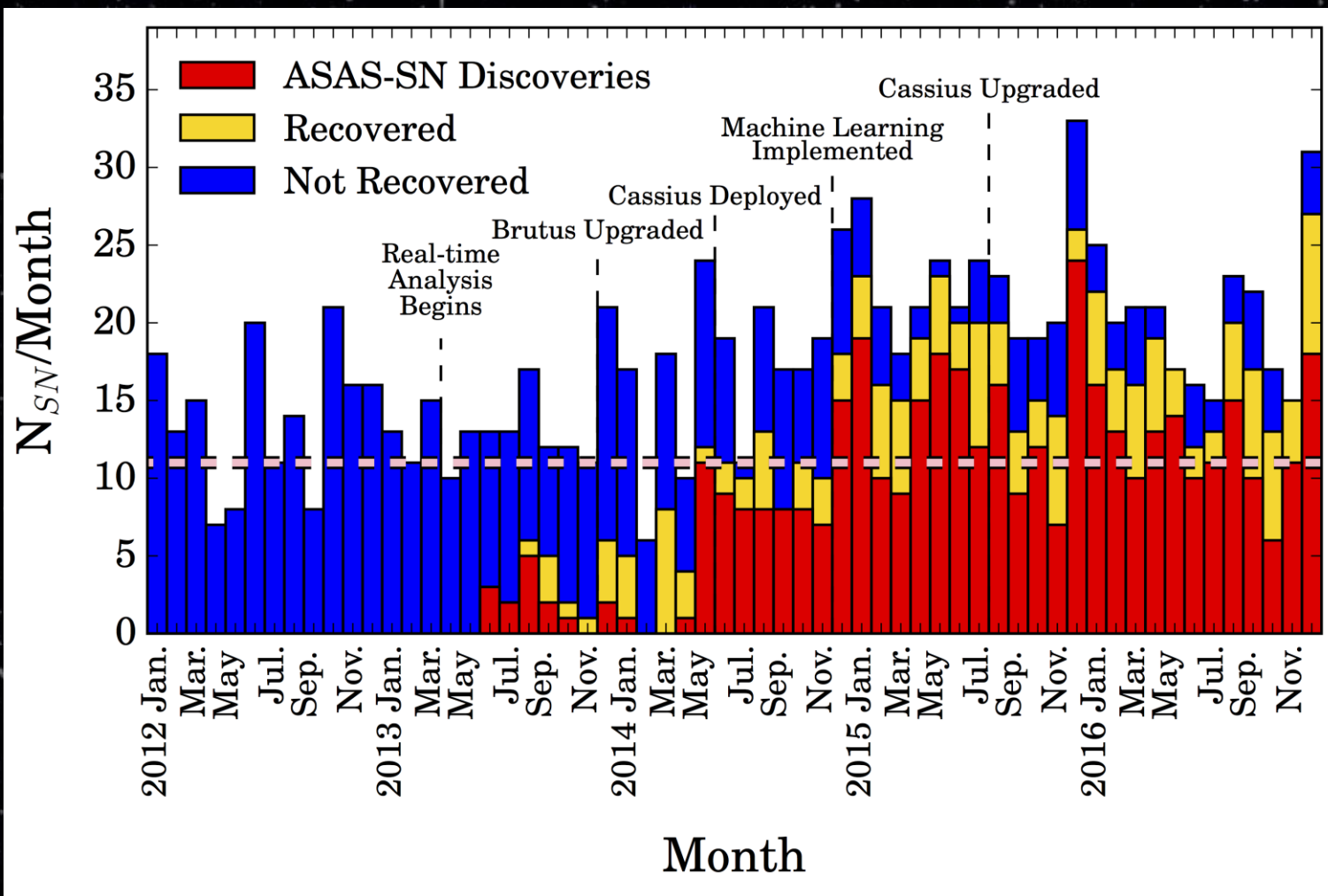
# Supernovae

- Explosive deaths of stars
- Produce heavy elements, regulate star formation, affect galaxy evolution...
- Most SNe are found in distant galaxies

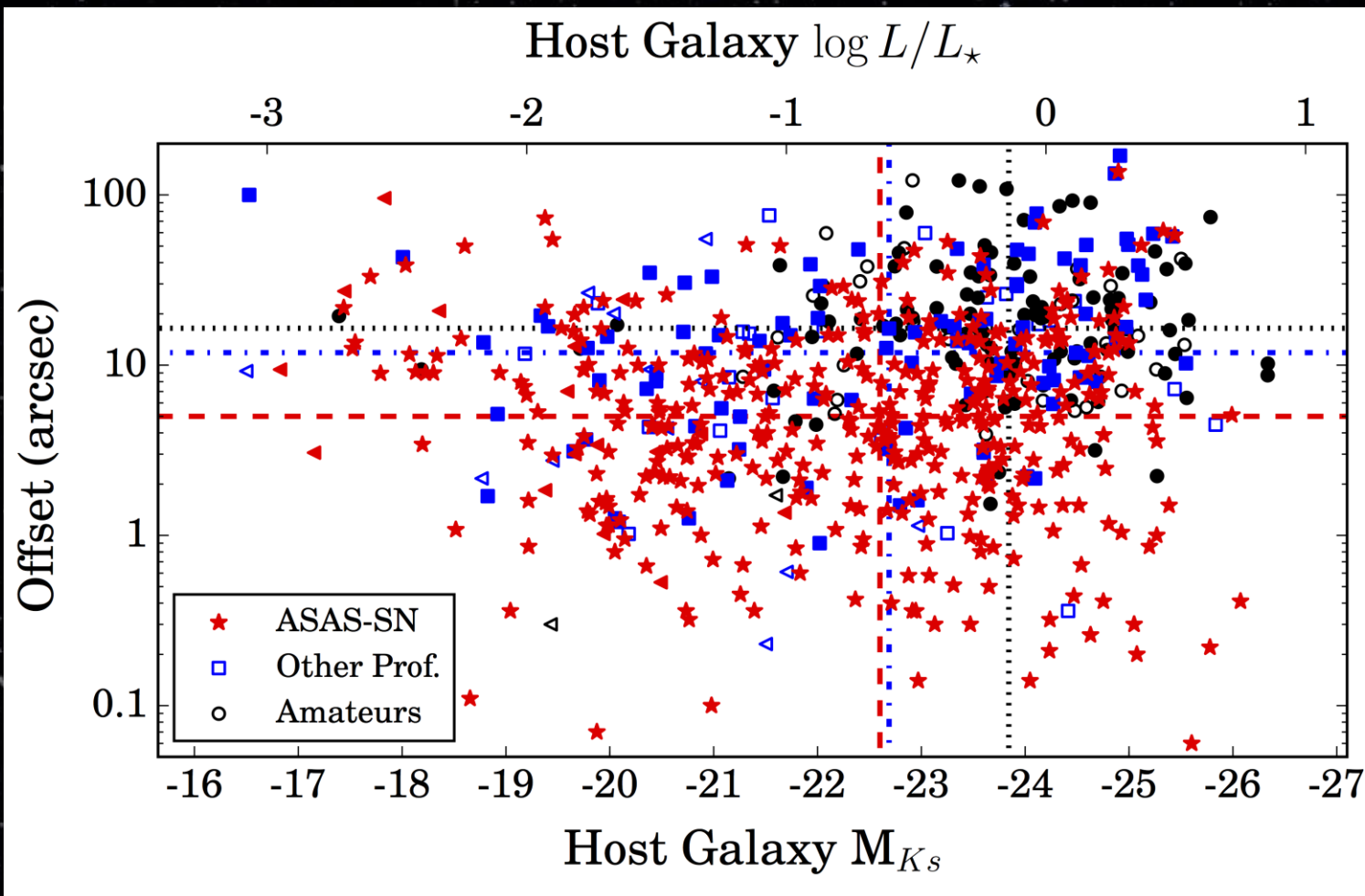
# The ASAS-SN Bright SN Sample

- All bright ( $m \leq 17.0$ ), spectroscopically confirmed SNe discovered between May 1, 2014 and December 31, 2016 (668 total)
- Divide non-ASAS-SN discoveries into other professionals or amateur discoveries
- Note whether ASAS-SN independently recovers these SNe in our data
- Also collect host magnitudes, offsets, redshifts...

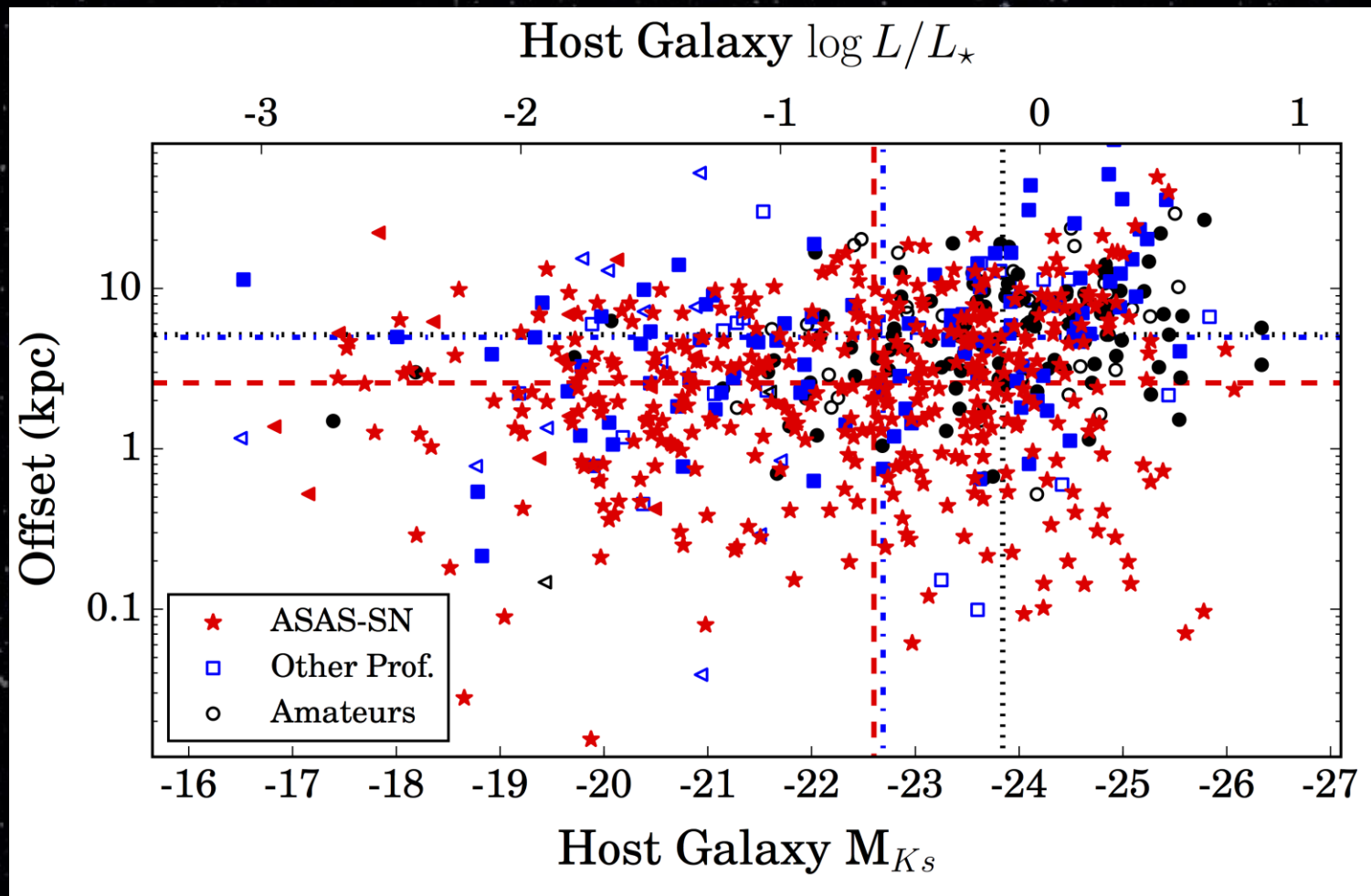
# The ASAS-SN Bright SN Sample



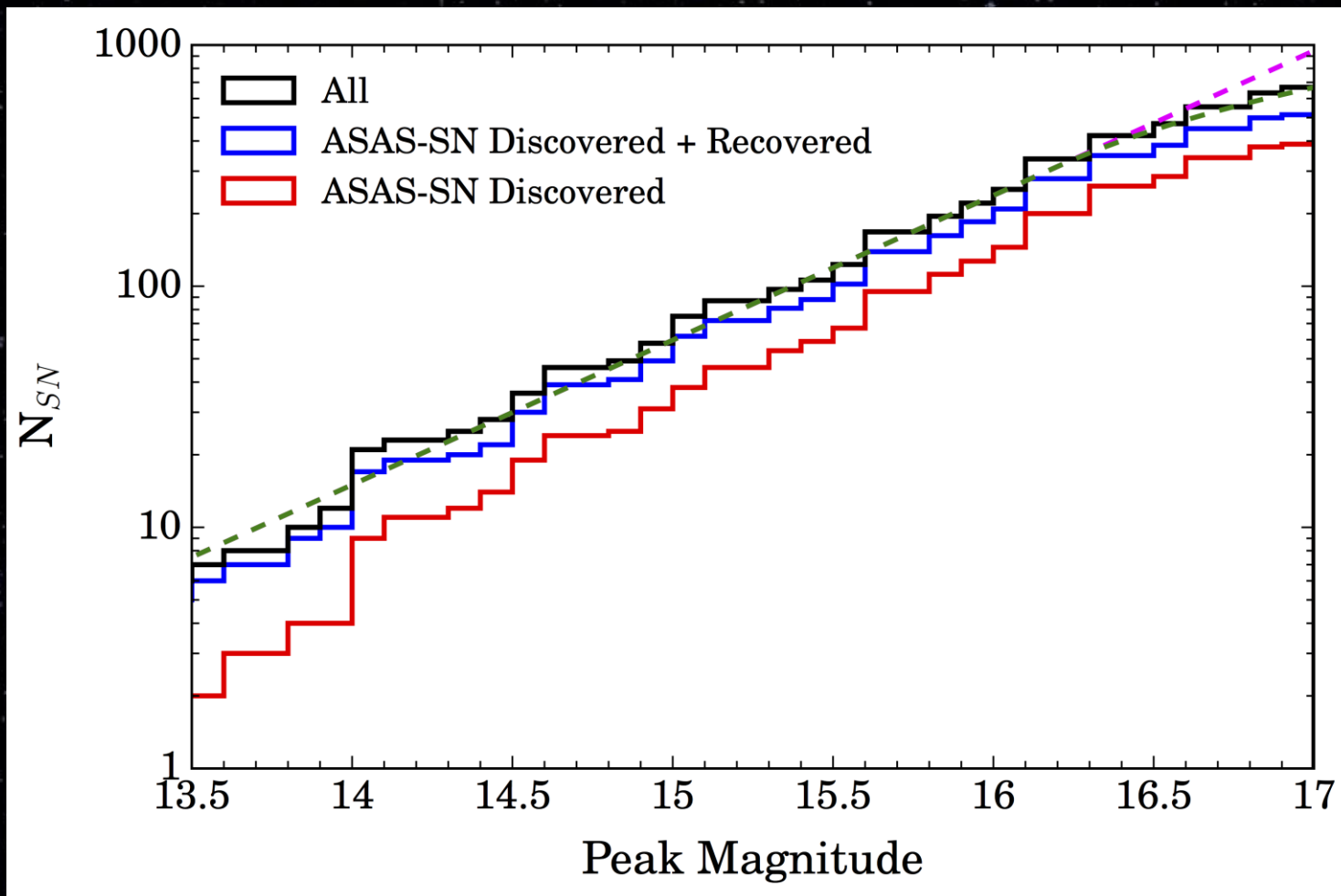
# The ASAS-SN Bright SN Sample



# The ASAS-SN Bright SN Sample



# The ASAS-SN Bright SN Sample





# Takeaways

- ASAS-SN is finding the best and brightest transients in the sky, allowing for detailed study of individual objects and new population studies
- ASAS-SN is the dominant source of bright SNe, and is finding SNe that would not be found otherwise
- The ASAS-SN sample is less biased by host galaxy selection effects and is less biased against nuclear sources
- Sample is complete to  $m \approx 16.3$
- This sample will allow for more accurate rate calculations and population studies

# Thank You

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