



Updates to and Features of the Dark Energy Survey Gravitational Wave Collaboration Data Pipeline

Nora Field Sherman

SIST/GEM Final Presentations

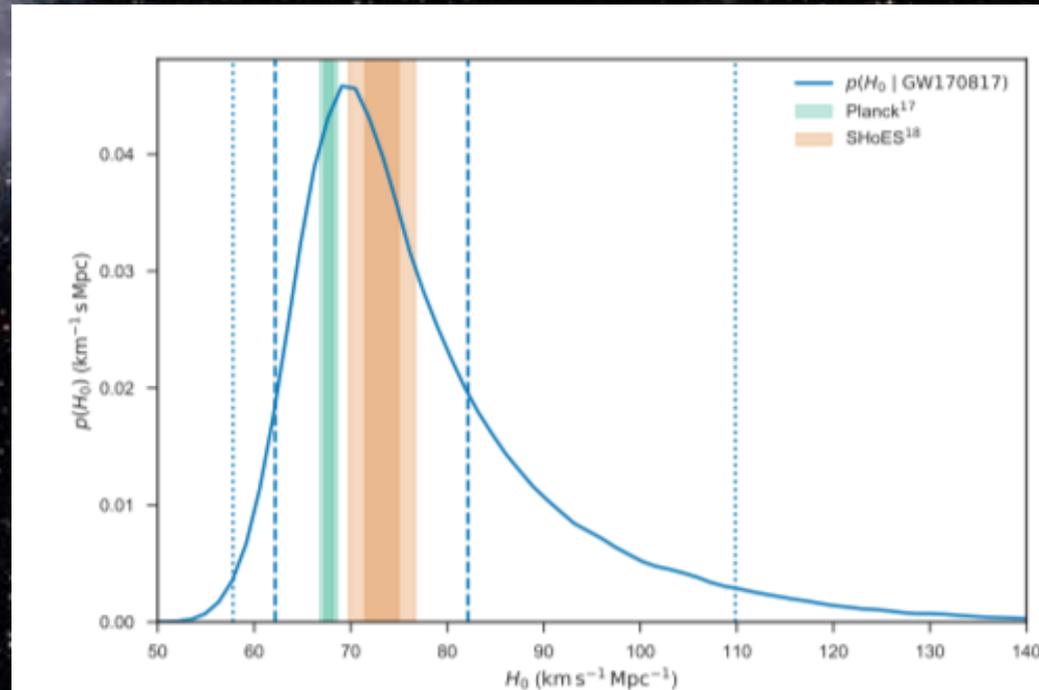
5 August 2019

Outline

- Science Motivation
- The Dark Energy Camera
- DESGW Data Pipeline
- Updates and Improvements to the Pipeline

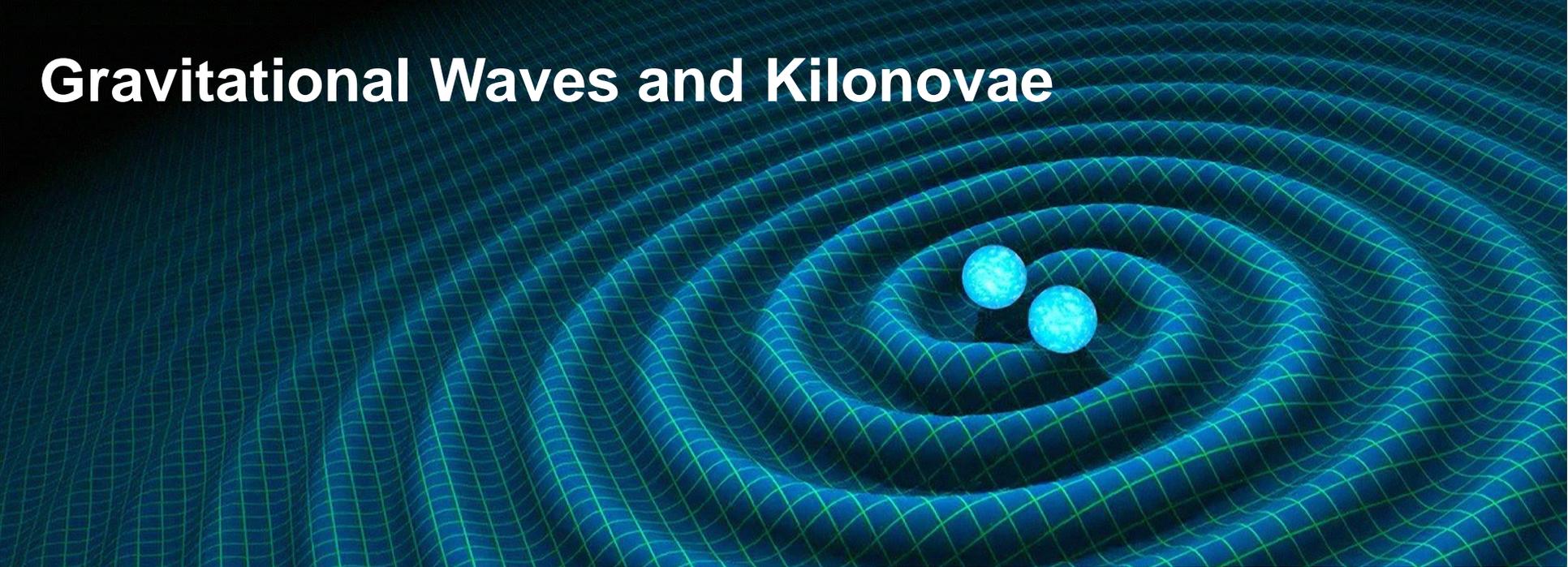
Dark Energy and H_0

- The Universe undergoes accelerated expansion
 - Dark Energy
- Hubble Constant, H_0
 - Current rate of expansion
 - SH0ES
 - Supernova data
 - $H_0 > 70 \frac{\text{km}}{\text{Mpc} \cdot \text{s}}$
 - Planck
 - CMB data
 - $H_0 < 70 \frac{\text{km}}{\text{Mpc} \cdot \text{s}}$
 - DESGW
 - Gravitational Waves
 - Electromagnetic Waves



<https://arxiv.org/pdf/1710.05835.pdf>

Gravitational Waves and Kilonovae

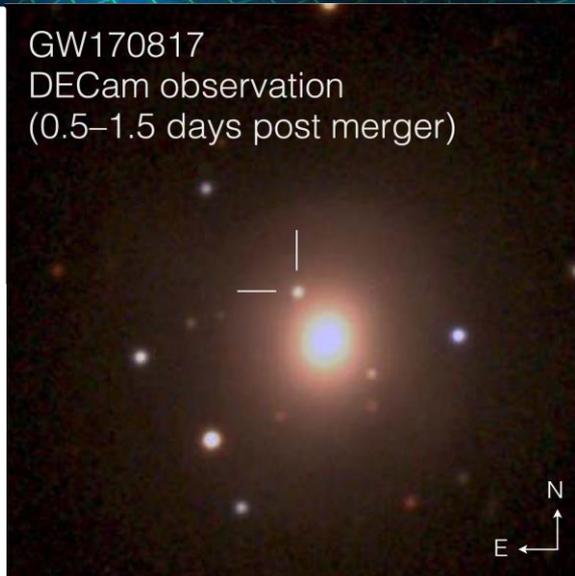


The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/Virgo GW170817. I. Discovery of the Optical Counterpart Using the Dark Energy Camera

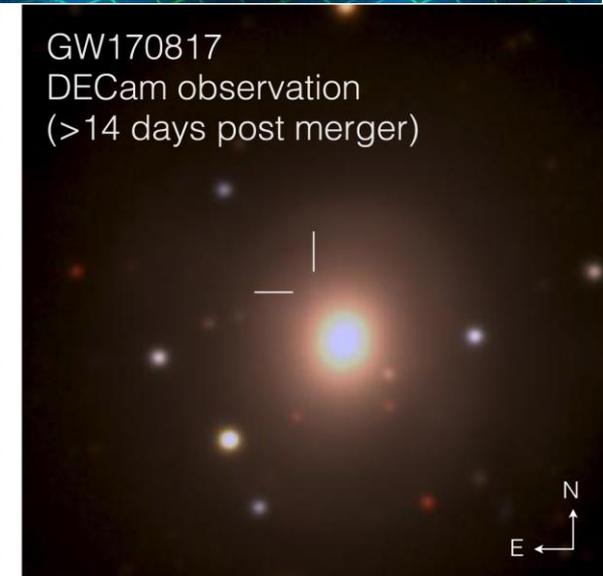
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(THE DARK ENERGY SURVEY AND THE DARK ENERGY CAMERA GW-EM COLLABORATION)

GW170817
DECam observation
(0.5–1.5 days post merger)

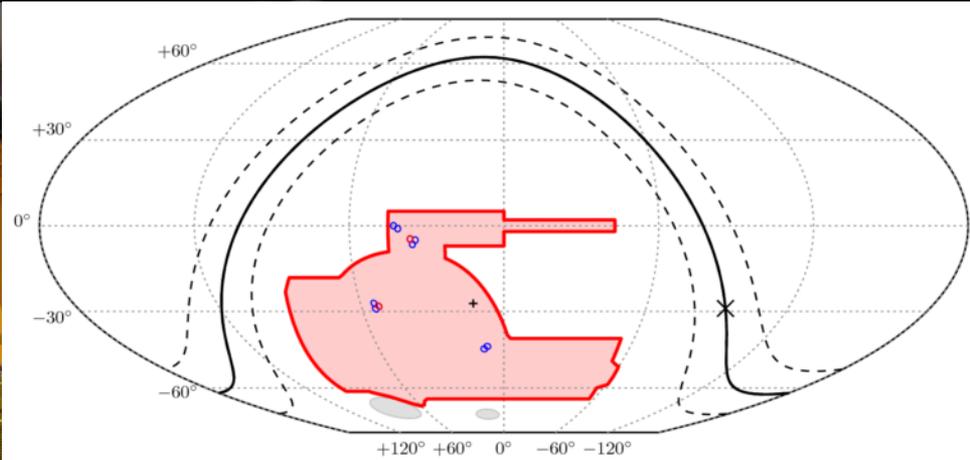
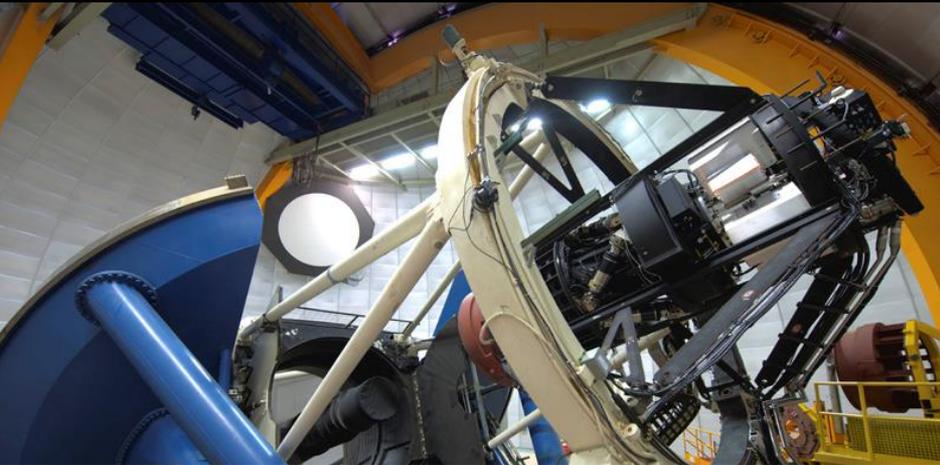


GW170817
DECam observation
(>14 days post merger)



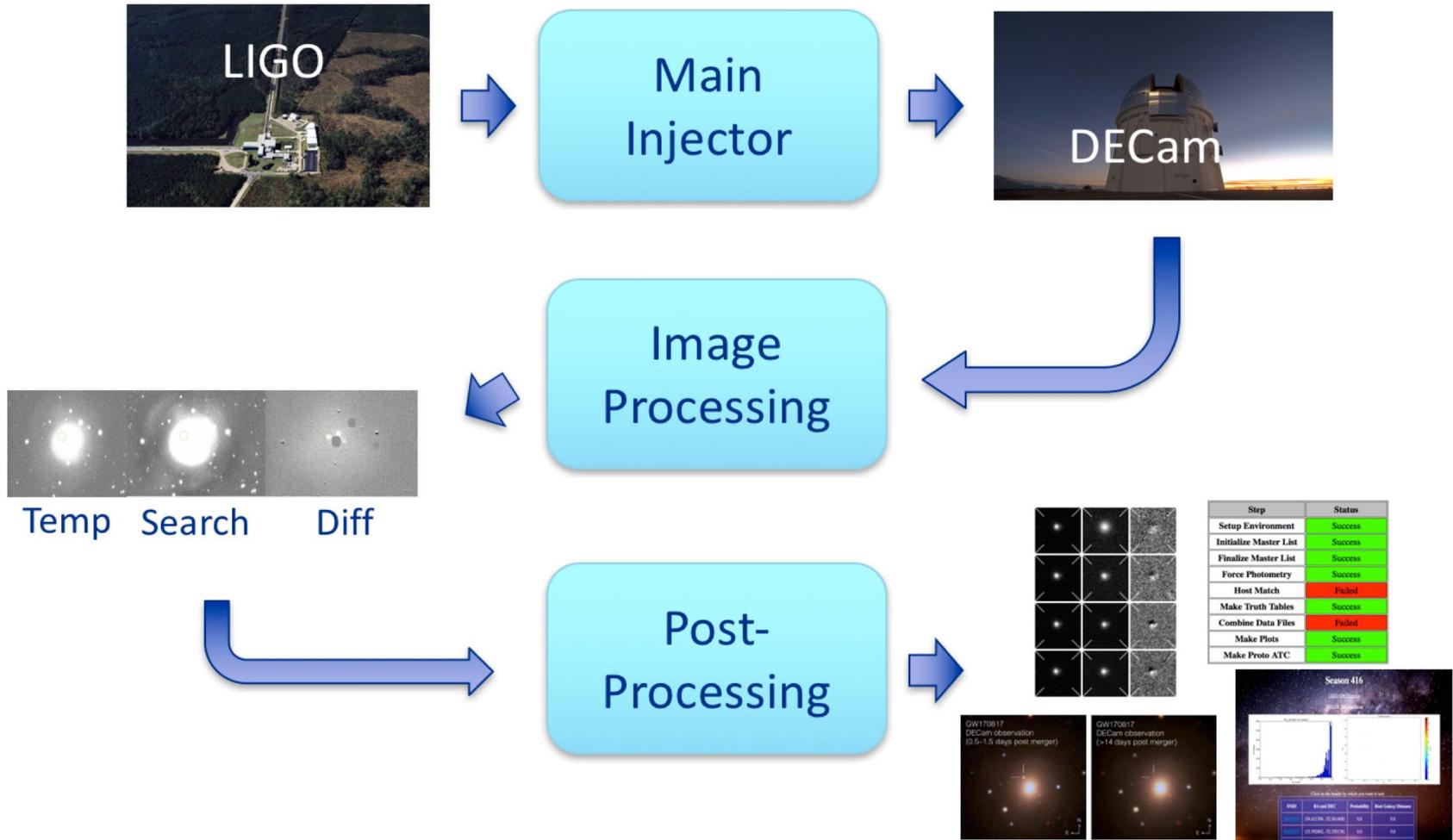
DECam and the DES Footprint

- Dark Energy Camera (DECam)
 - 62 CCDs
 - Views in several bands
 - i, g, z, Y, r
 - Located at Cerro Tololo Inter-American Observatory
 - Mounted on Victor M. Blanco Telescope



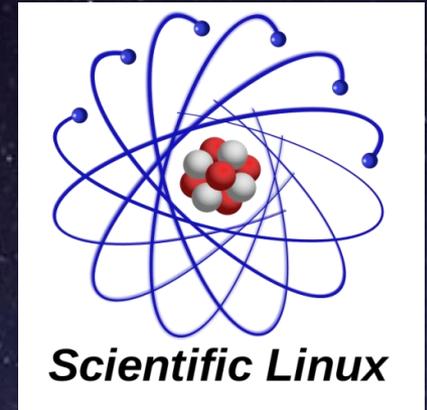
<https://www.darkenergysurvey.org/dr1-data-release-papers/>

DESGW Data Pipeline



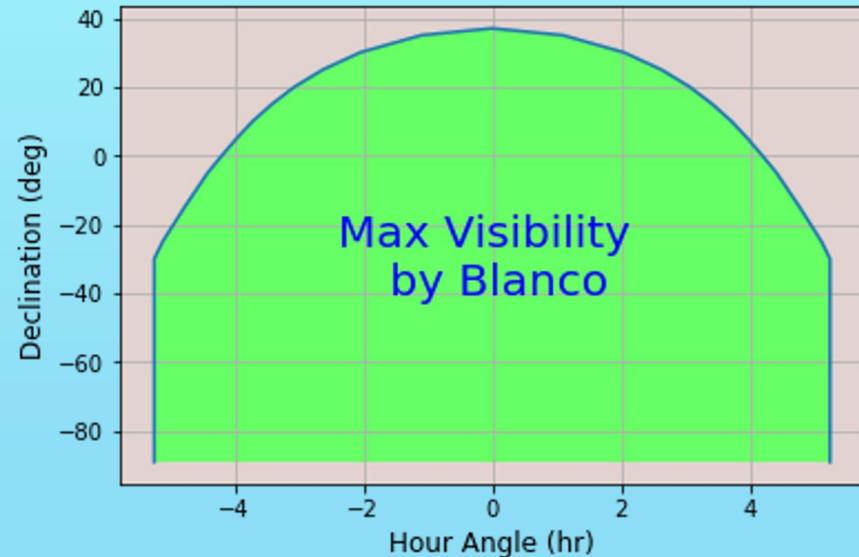
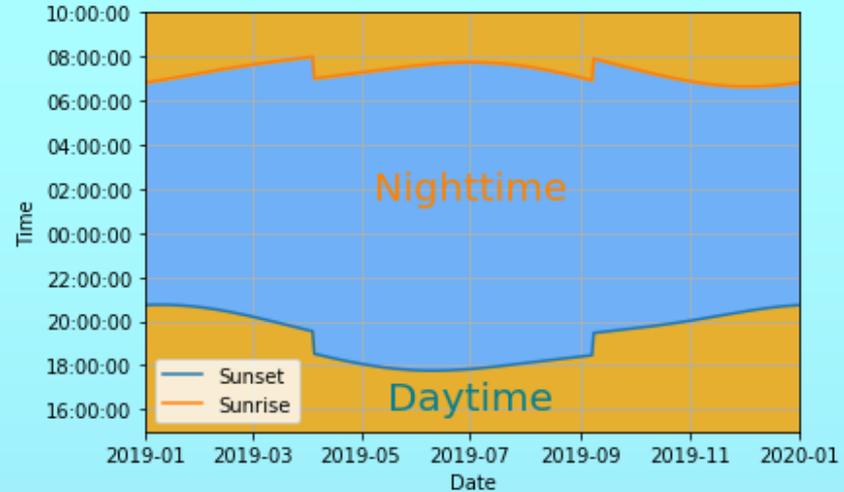
Operating System Transferability

- Fermilab will discontinue support for SL6
 - SL7 to replace SL6
 - Later CentOS 8 will replace SL7
 - Not SL8
- Testing image processing pipeline on SL7
 - Data from most recent binary neutron star merger



Revolving Door

- Load and offload templates based on visibility from DECam
 - Accommodate preexisting visibility restrictions of the telescope
 - Determine visibility throughout observations
 - Entire night, weeks in advance
 - Consideration of sunrise and sunset times at telescope
- Store existing templates in localized area
- Further considerations
 - Add log of templates per band
 - Improve visible range calculations
 - Implement air mass cuts



Conclusion

- Tested DESGW data pipeline for use on SL7
- Developed Revolving Door program

Questions?

Image Credit: DES Fermilab Photo Gallery unless otherwise credited