Contribution ID: **553** Type: **Oral**

Optical follow-up of gravitational wave triggers with DECam

Wednesday 12 October 2016 12:30 (15 minutes)

Gravitational wave (GW) events can have several possible progenitors, including binary black hole mergers, cosmic string cusps, core-collapse supernovae, black hole-neutron star mergers, and neutron star-neutron star mergers. The latter three are expected to produce an electromagnetic signature that would be detectable by optical and infrared
telescopes. To that end, the LIGO-Virgo Collaboration (LVC) has agreements with a number of partners to send an alert following a possible GW event detection so that the partners can begin to search for an electromagnetic counterpart. One such partner is the Dark Energy Survey (DES), which makes use of the Dark Energy Camera (DECam), situated on the 4m Blanco Telescope at the Cerro Tololo Inter-American Observatory in Chile. DECam is an ideal instrument for performing optical followup of GW triggers in the southern sky. The DES-GW followup program compares new search images to template images of the same region of sky taken in the past, and selects new candidate objects not present in previous images for further analysis.
Due to the short decay timescale of the expected EM counterparts and the need to quickly eliminate survey areas with no counterpart candidates, it is critical to complete the
initial analysis of each night's images within 24 hours. The computational
challenges in achieving this goal include maintaining robust I/O pipelines
in the processing, being able to quickly acquire template images of new sky regions outside of the typical DES observing regions, and being able to rapidly provision additional batch
computing resources with little advance notice. We will discuss the
search area determination, imaging pipeline, general data transfer strategy, and methods to
quickly increase the available amount of batch computing through
opportunistic use of the Open Science Grid, NERSC, and commercial clouds.
We will conclude with results from the first season of observations from
September 2015 to January 2016.

Tertiary Keyword (Optional)

Computing models

Secondary Keyword (Optional)

Distributed workload management

Primary Keyword (Mandatory)

Data processing workflows and frameworks/pipelines

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Session Classification: Track 1: Online Computing

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