The Gravitational-wave Ultraviolet Counterpart Imager (GUCI) Mission

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Scientific Objectives

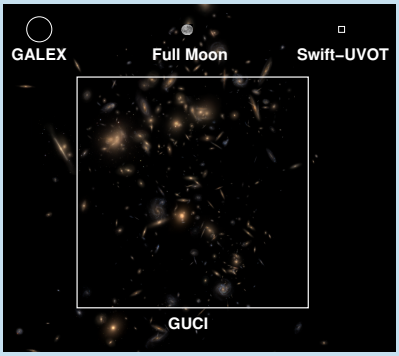
1. **Characterize** the early UV emission from gravitational wave detections

2. **Discriminate** between radioactivity and jet interaction for early power source

3. **Notify** the community promptly to enable multi-wavelength follow-up

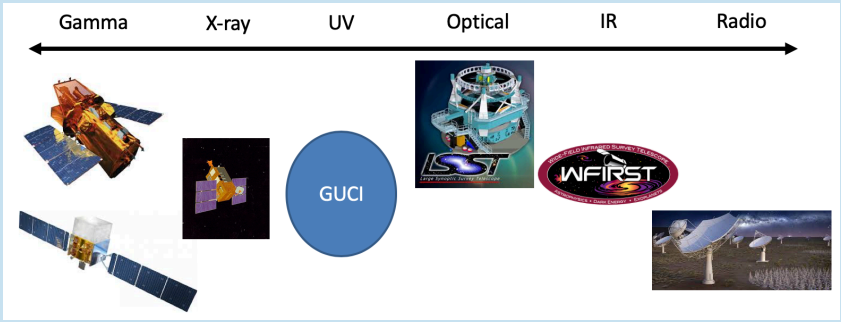
4. Conduct a UV transient sky survey **10x more powerful** than any past mission

Large Field-of-View



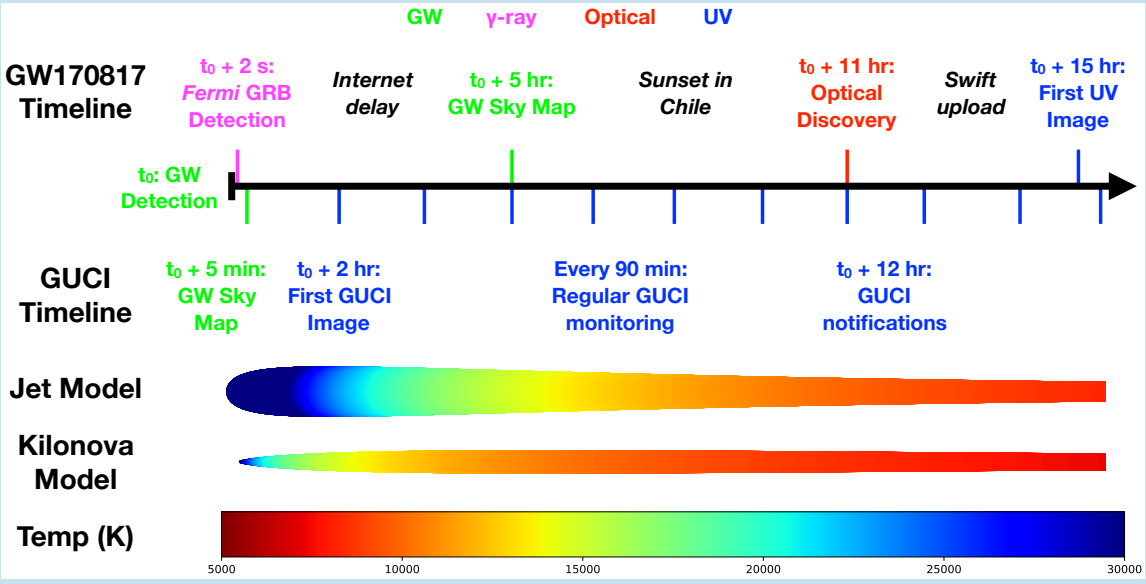
With a 50 deg^2 field-of-view, GUCI will rapidly (< 2 hours) image gravitational wave localizations to characterize the prompt UV signal from binary neutron star mergers.

Powerful UV Synoptic Survey



With a volumetric survey speed > 10x any past/present/planned UV mission, GUCI will conduct the first truly synoptic time-domain survey at UV wavelengths, providing complementary coverage to LSST, WFIRST, eROSITA, and SKA Phase 1.

Prompt UV Observations of Gravitational Wave Sources

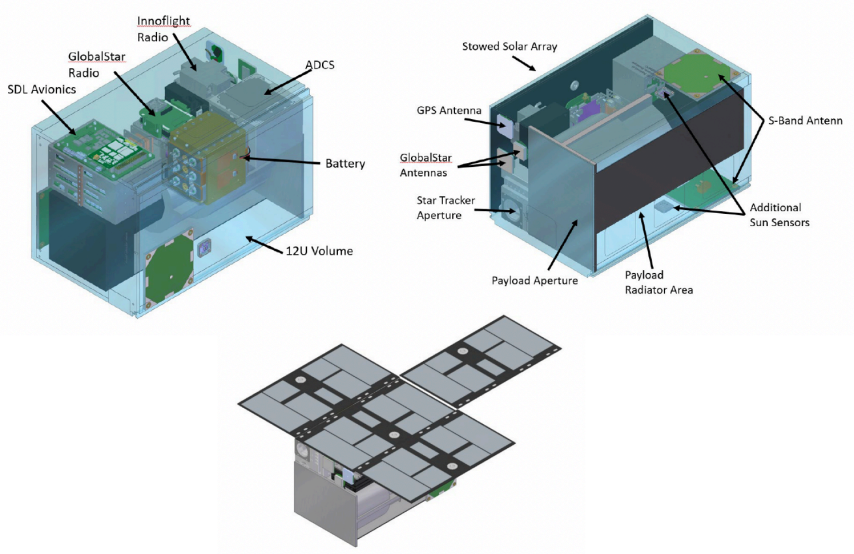


Unlike ground-based telescopes, which suffer from weather and can only observe at night, GUCI can respond promptly to *all* gravitational wave localizations. The resulting high-cadence UV light curves are the most robust means to distinguish between a radioactively powered and jet-interaction powered origin for the early thermal component (for emission models, the line width is proportional to luminosity, while the color represents effective temperature).

Mission Overview

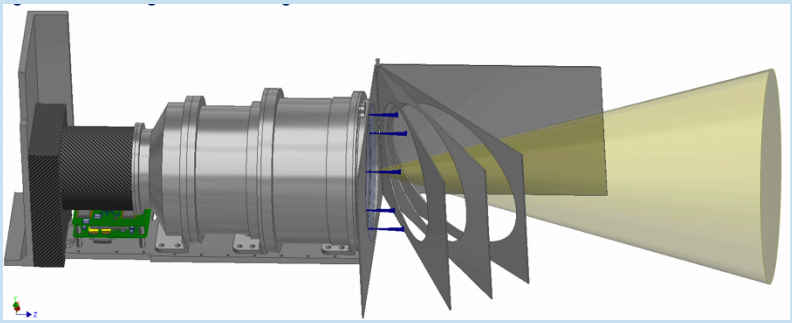
Spacecraft	2 x 12U CubeSat
Bandpass	G1: 190-220 nm G2: 260-290 nm
Field-of-View	G1: 50 deg^2 G2: 50 deg^2
Angular Resolution (FWHM)	G1: 45” G2: 40”
Sensitivity (5σ AB in 300 s)	G1: 20.8 mag G2: 20.3 mag
GW Response	< 2 hours
Transient Notification	< 12 hours
Launch Package	Single ESPA port
Mission Lifetime	1 year

Spacecraft Overview



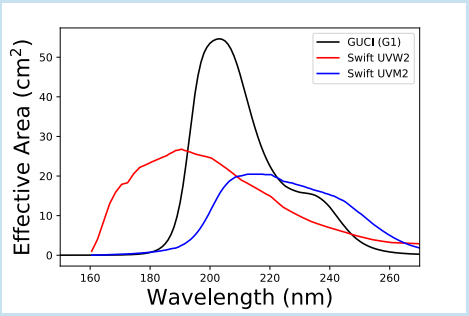
12U high-heritage spacecraft bus from Space Dynamics Laboratory
• Mass: 24.4 kg • Power: 23.8 W • Telemetry: 8.3 Gb day^{-1}

Instrument Overview



13 cm, 6 element refractive telescopes • **High-efficiency delta-doped CCD detectors (JPL)** • High-transmission GdF_3 anti-reflection coatings (GSFC) • Deployable straylight baffles

Large Effective Area



The high-efficiency delta-doped CCDs and high-transmission anti-reflection coatings enable GUCI to achieve a larger effective area than *Swift*-UVOT, despite a much smaller aperture (13 vs 30 cm)

Highly Experienced Team

- PI: Cenko (GSFC; *Neil Gehrels Swift Observatory)*
- Project Scientist: Singer (GSFC; LIGO GW alerts)
- Project Manager: Johnson (GSFC/WFF; *HaloSat*)
- Instrument Management: GSFC
- Delta-Doped CCD Detectors: JPL (Jewell, Nikzad)
- Spacecraft Bus: Space Dynamics Laboratory
- Science Team Members: Kasliwal (Caltech; GW observations); Piro (Carnegie; GW theory); Gezari (Maryland; Extragalactic transients); Gorjian (JPL; AGN); Grefenstette (Caltech; Galactic transients); Richardson (Toledo; Stellar variability); Bellm (UW; LSST Alert scientist); Kruk (GSFC; WFIRST, UV instrumentation); Marshall (GSFC; Science Data Center)

Programmatic Overview

- Proposal Opportunity: 2019 Mission of Opportunity (MO) – SmallSat Class ($35M cost cap)
- Launch Readiness Date: May 2025 (coinciding with upgrade to “A+” gravitational wave network
- Orbit Constraints
  - LEO
  - Elevation: 450 – 600 km
  - Inclination: 20° – 60°