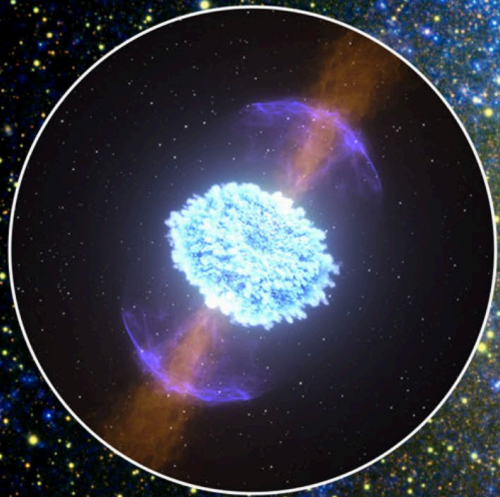
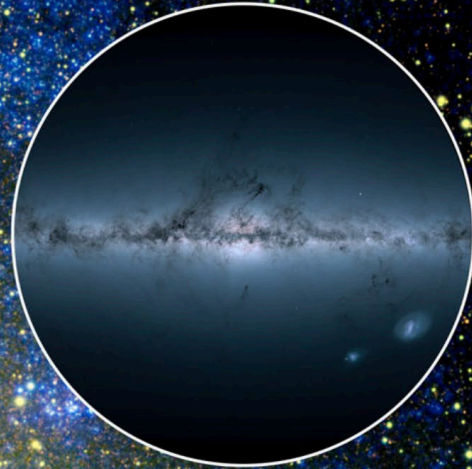


Exploring the Low
Mass Galaxy Frontier



New Views of the
Dynamic Universe



Legacy of Deep
Synoptic Surveys

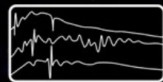
All-Sky Imaging



Time Domain



Spectroscopy



UVEX

The Ultraviolet Explorer

Brian Grefenstette

Caltech

AAS

2025-01-12

UVEX Science Team



Fiona Harrison, Caltech
PI



Dan Weisz, UC Berkeley
Project Scientist



Brian Grefenstette, Caltech
Payload Manager



Hannah Earnshaw, Caltech
Science Team Coordinator



Shri Kulkarni, Caltech
Science Team Lead



Suvi Gezari, STScI
Dynamic Universe Lead



Keivan Stassun, Vanderbilt
Legacy Survey Lead



Danielle Berg, UT Austin
Nebular spectroscopy
lead



Hugues Sana, Leuven
LMC/SMC lead



Mansi Kasliwal, Caltech
EMGW lead



Raffaella Margutti, UC
Berkeley
CCSNe Lead



Matthew Graham,
Caltech
Synoptic Survey lead



Harry Teplitz,
IPAC, Imaging
survey lead

See <https://www.uvex.caltech.edu/page/team>

UVEX Science Pillars



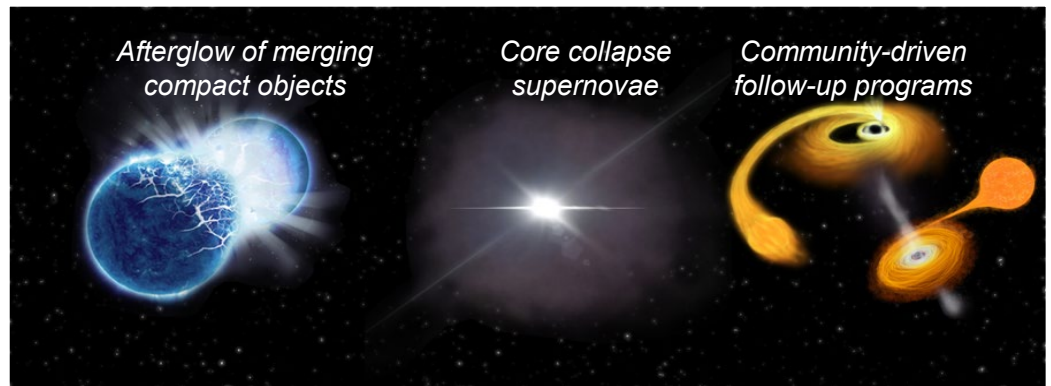
THE LOW-MASS GALAXY FRONTIER

UVEX opens a window onto the lowest mass, lowest metallicity galaxies, and their unique cosmic ecosystems



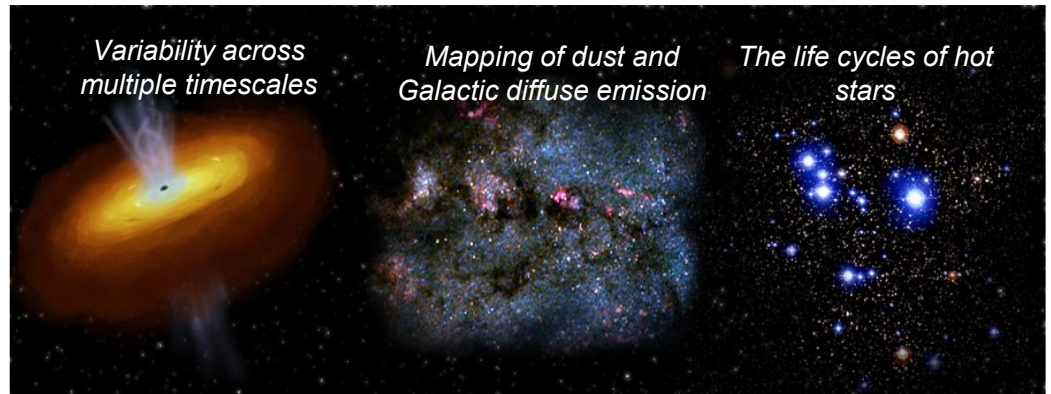
NEW VIEWS OF THE DYNAMIC UNIVERSE

UVEX captures the early UV emission of transient events, testing models and probing mass loss in the years before stellar collapse

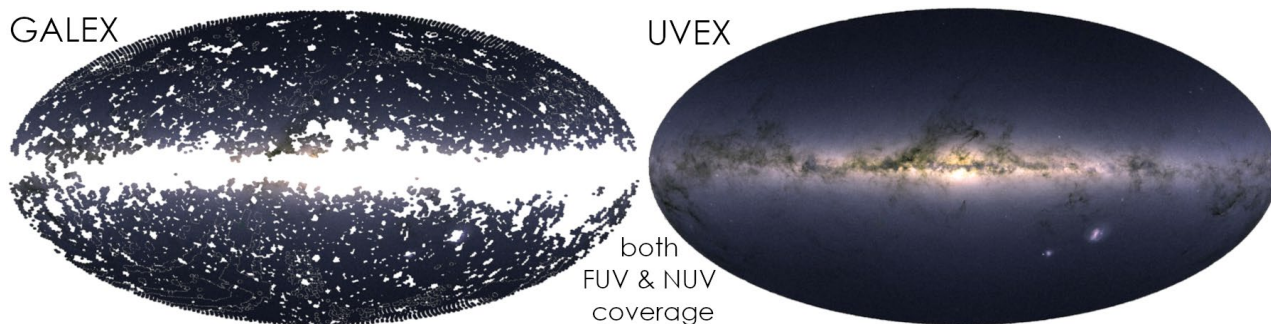


LEGACY OF DEEP, SYNOPTIC IMAGING AND SPECTROSCOPIC DATA

UVEX leaves a large all-sky legacy dataset, enabling a wide range of scientific studies



UVEX Capabilities



Synoptic Two-Band All-Sky Survey

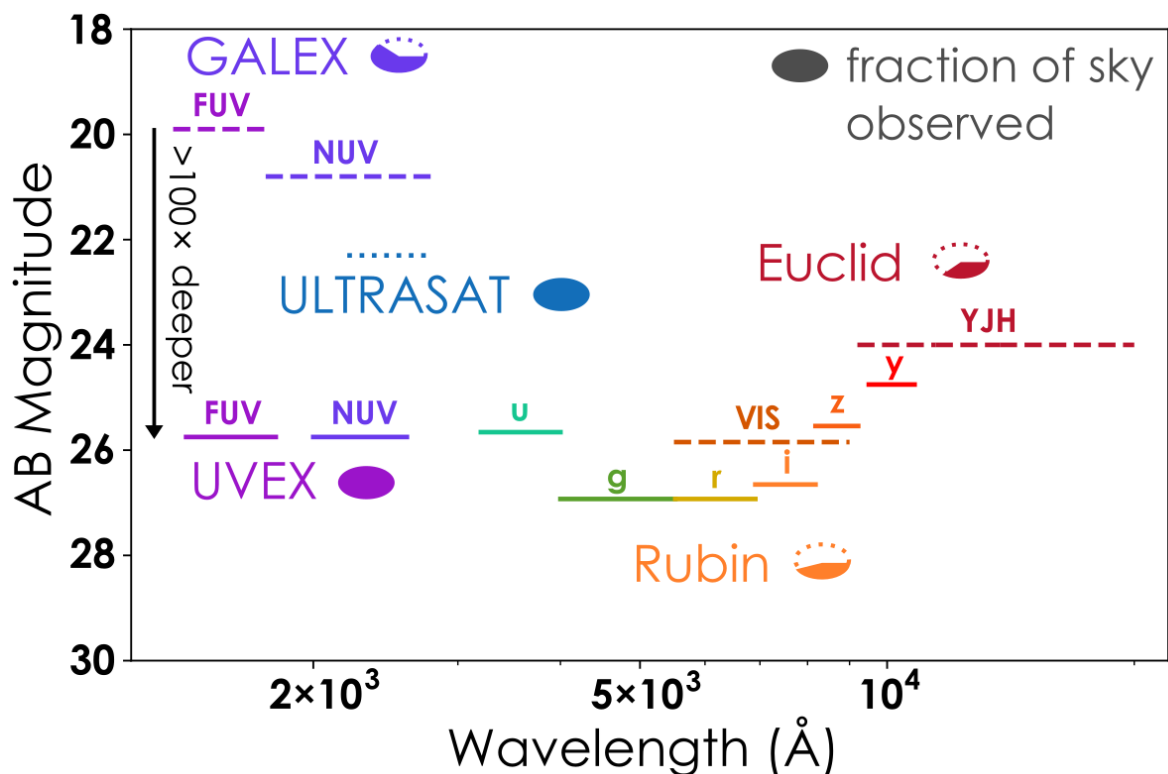
- 50/100x deeper than GALEX in NUV/FUV with 2" imaging
- Depth complementary to Rubin, Euclid, Roman
- Multiple cadences from hours to months

Time Domain Capabilities

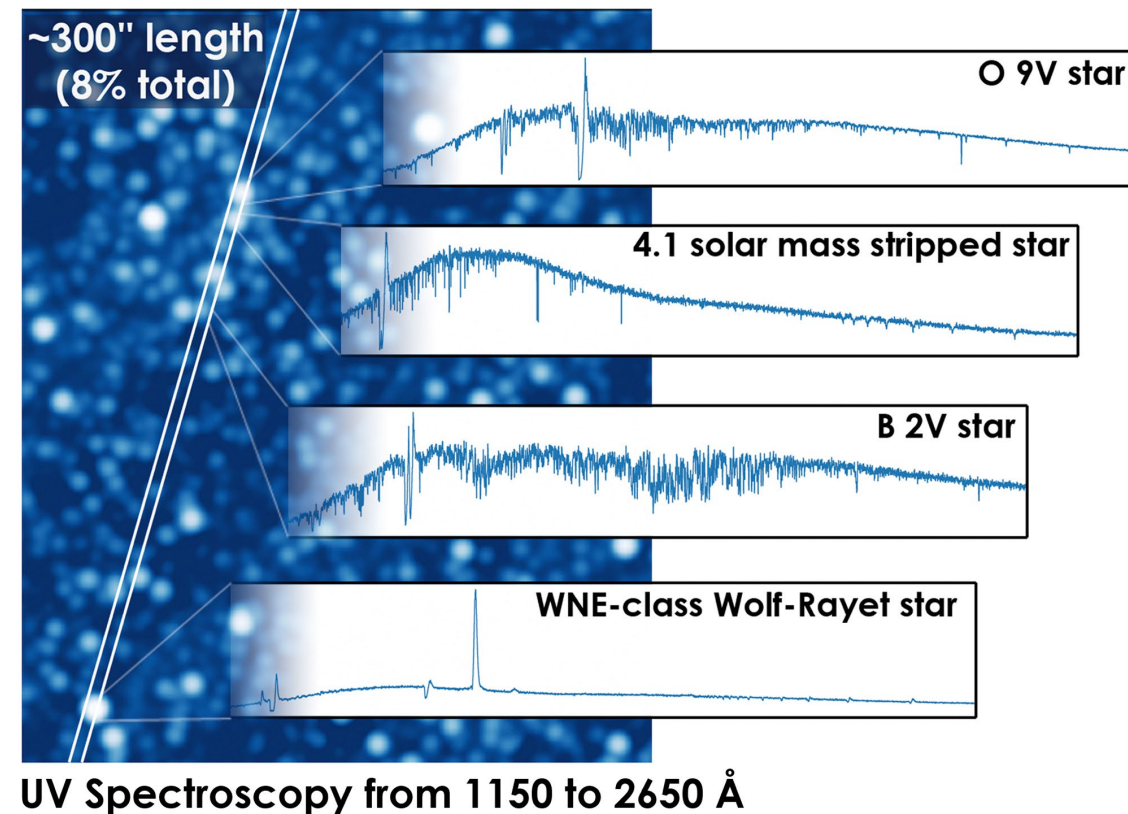
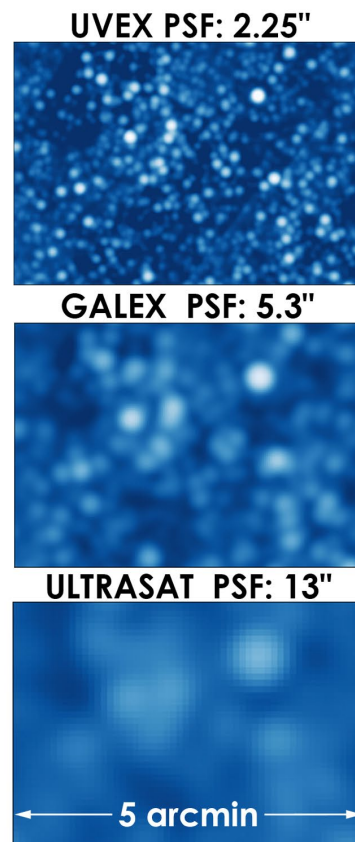
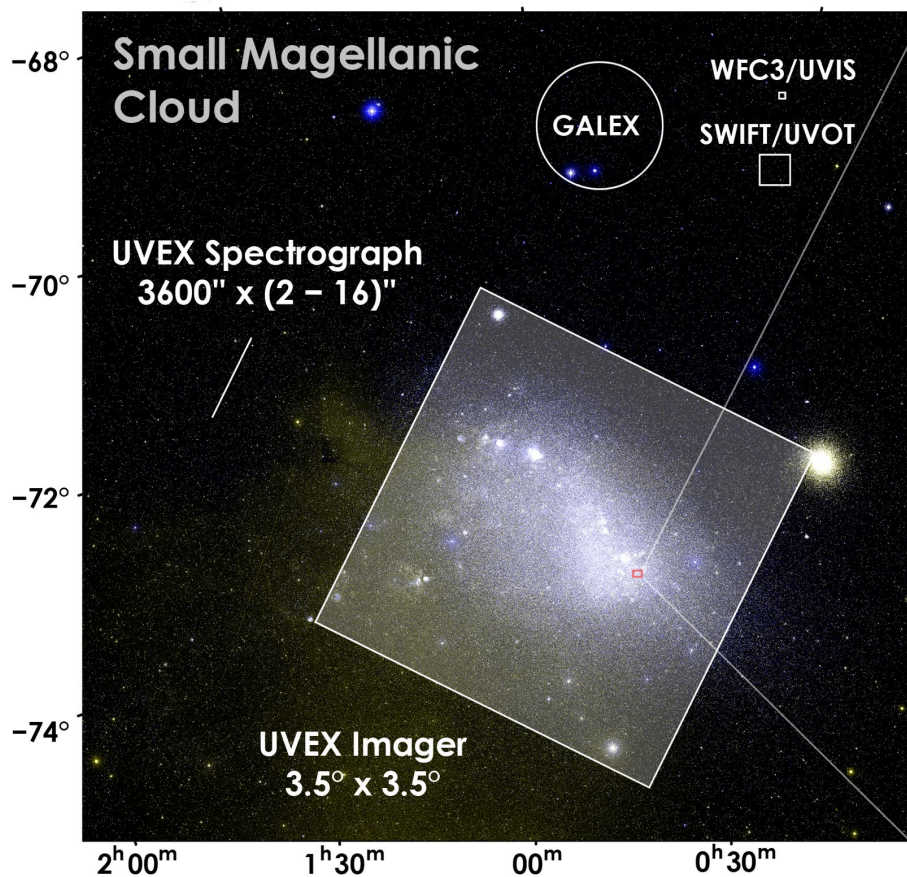
- < 3 hr target-of-opportunity response time
- Low (<6 hr) data latency for transient ID
- Spectroscopic and wide-field (10 deg²) photometric follow up

Slit Spectroscopy

- Sensitive, $R > 1000$ over broad bandpass (1150 – 2650 Å)
- 2-degree long slit with 2' – 12" widths



UVEX – Instrumentation



12 deg² field of view

Covers LMC/SMC in 7 pointings

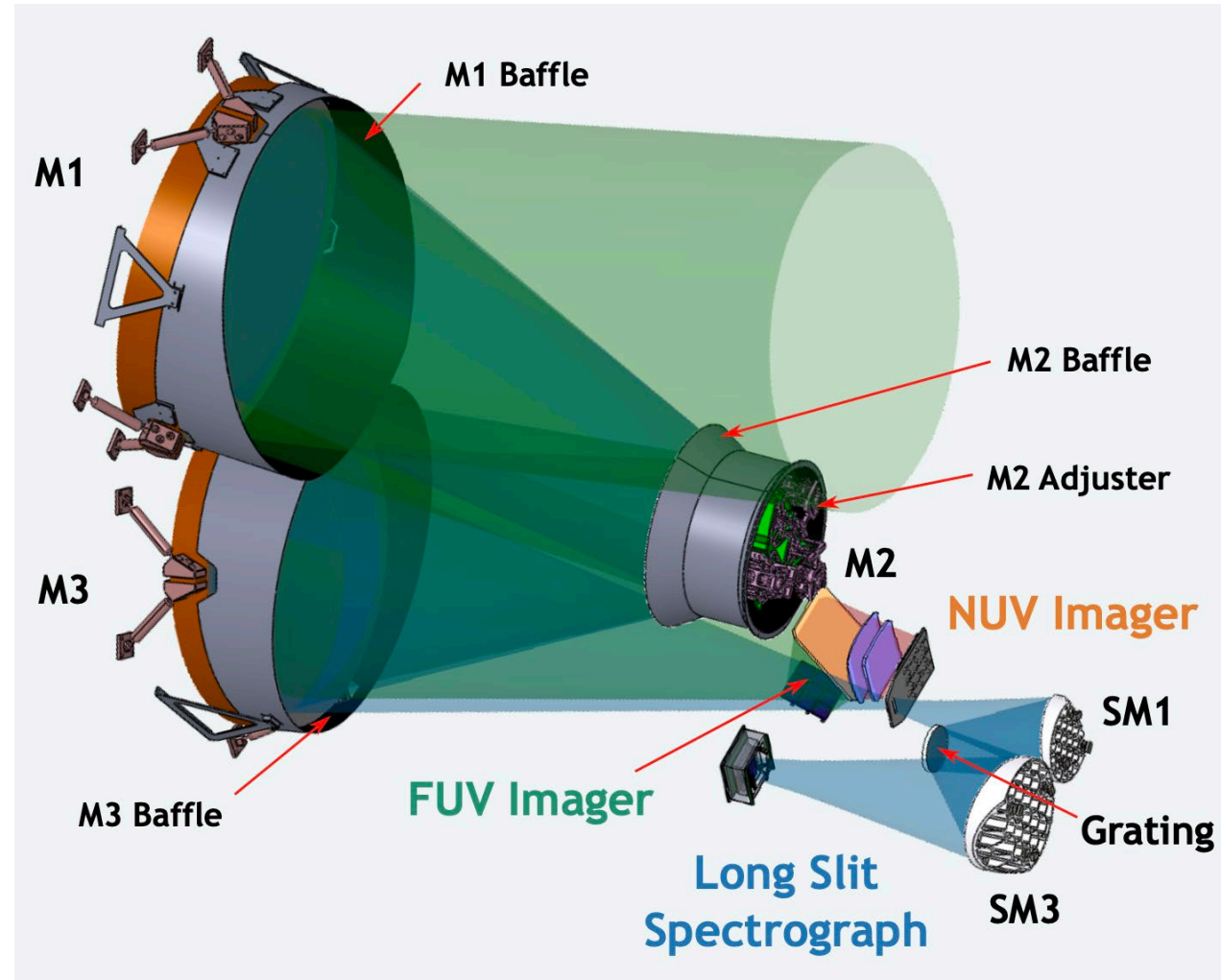
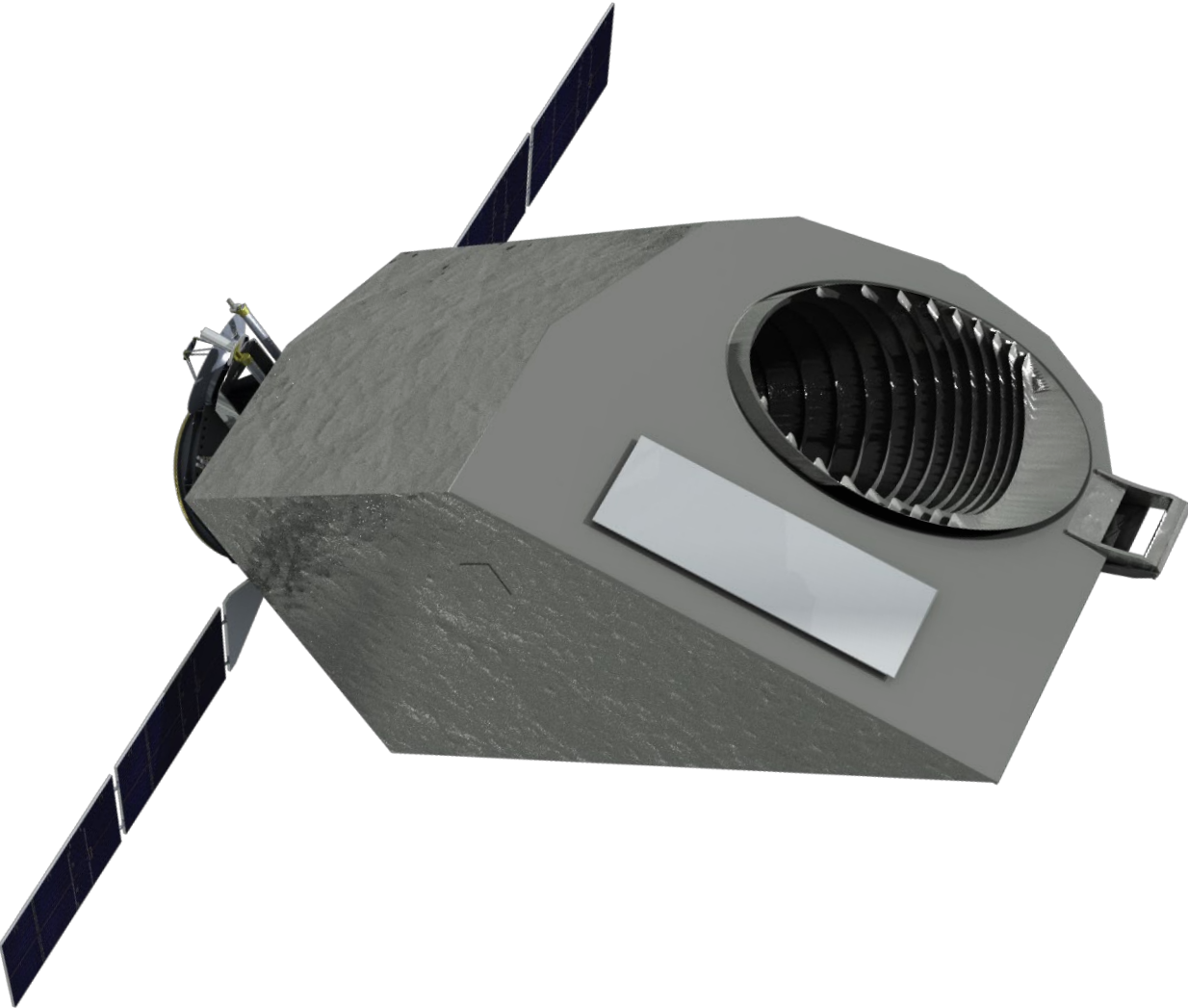
<2.25" FWHM PSF

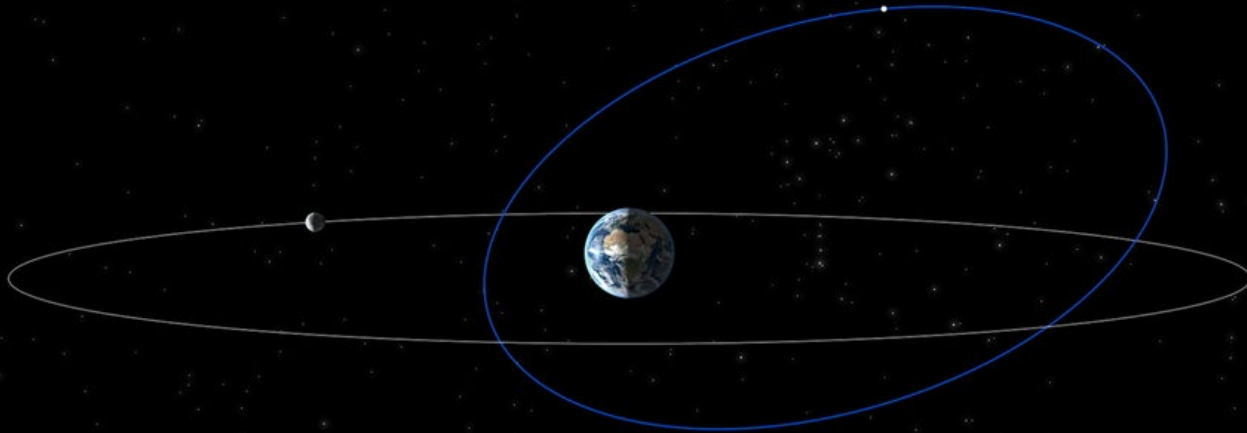
Can resolve all but the densest regions of the LMC/SMC

2° long, multi-width slit

R>1000 across broad UV band, multitude of serendipitous spectra

UVEX – Architecture





TESS Orbit, credit NASA's Goddard Space Flight Center

High-Earth, TESS-Like Orbit

- 14-day period
- Away from Earth (airglow)
- Re-orient to downlink once every 6-hrs
- ~20 imaging or spectroscopy dwells between downlinks

Large Field of Regard

- >70% of the sky accessible at any time

Two-year Baseline Mission

- Data released as soon as validated
- High-level science products (sky maps, etc) released at regular cadences

UVEX – A TDAMM Machine

A TDAMM **Discovery** Machine

- Over half the mission is a synoptic, all-sky survey
- Data downlinks every 6-hrs, then alerts out to broker as soon as possible
- Partnering with IPAC on the ground segment for image subtraction, transient identification
- Sky surveys to be designed to cover a wide range of cadences (hrs to years)

UVEX – A TDAMM Machine

A TDAMM **Follow-Up** Machine

- Incorporates a moderate resolution ($R \sim 1000$) spectrograph
- Designed to follow-up transients within hrs
- Core automated alerts for both imaging and spectroscopy (SNe, EMGW)
- Substantial (8%) of observing time allocated to community-triggered ToOs for hrs-to-days follow-up (the NuSTAR model)

UVEX – TDAMM Report Findings

- UVEX early spectroscopy will require additional theoretical modeling of studying shock interactions in supernovae (breakout and beyond)
- Early kick-off meetings underway (first one pre-Christmas) between Caltech, UC-Berkeley, NNSA labs to identify students / postdocs. NNSA providing code support and theoretical interpretation.
- Goal is to keep theory rolling so that data are fully utilized in 2030

UVEX – Timeline



GALEX 2003 – 2013

ULTRASAT 2026 →

HST 1990 →

Swift 2004 →

UVEX 2030 →

Euclid 2023 →

Rubin 2025 →

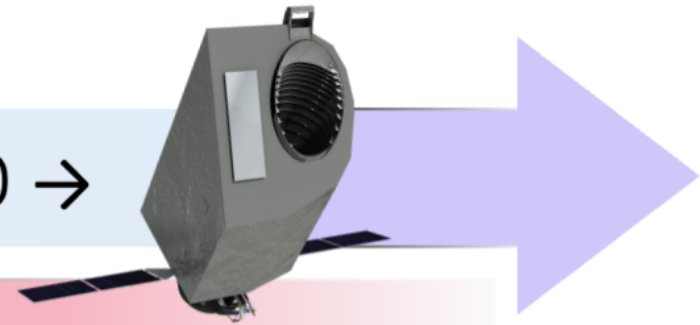
Roman 2027 →

LIGO/Virgo/KAGRA

O5

O6

UVEX: an all-sky ultraviolet mission for the coming generation



Backup

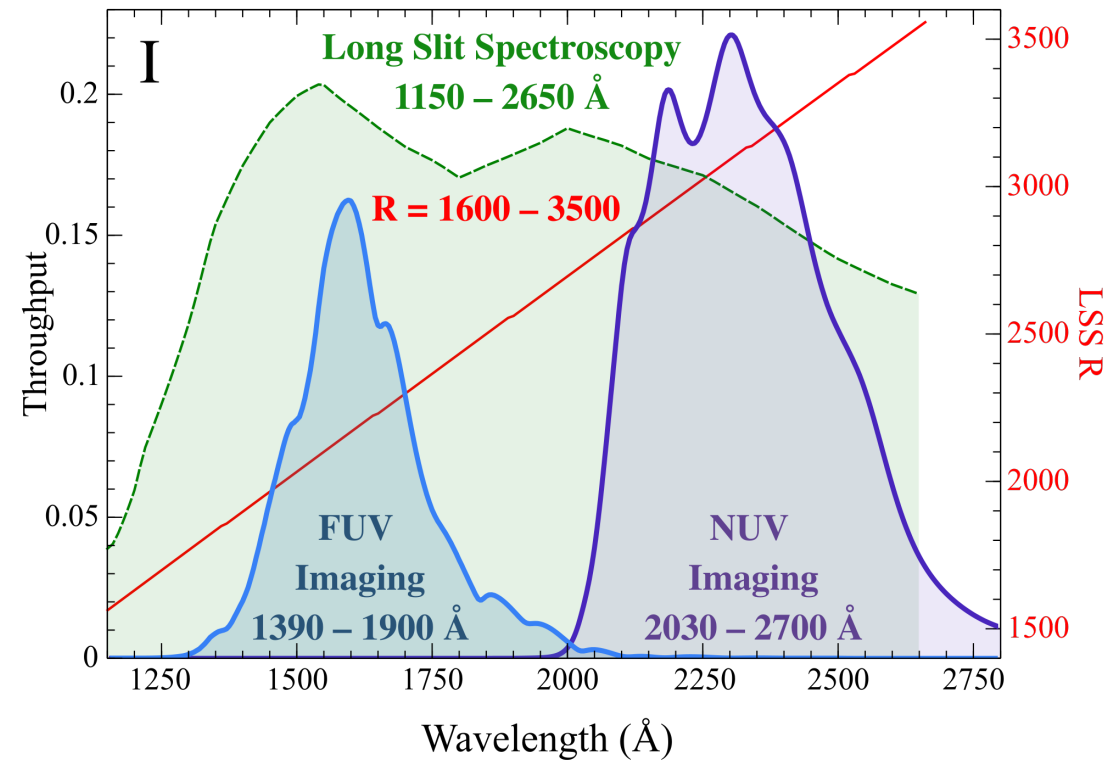
FUV and NUV Imagers:

- Imaging FoV $3.5^\circ \times 3.5^\circ$
- Imaging PSF $< 2.25''$ HPD
- Pixel Size $1''$
- FUV Band $1390 - 1900 \text{ \AA}$
- NUV Band $2030 - 2700 \text{ \AA}$
- Detectors $4k \times 4k$ CMOS

Spectrometer

- Bandpass $1150 - 2650 \text{ \AA}$
- Slit size $2'' / 4''$
- Slit length 1°
- R ($\lambda/d\lambda$) $1450 - 3150$

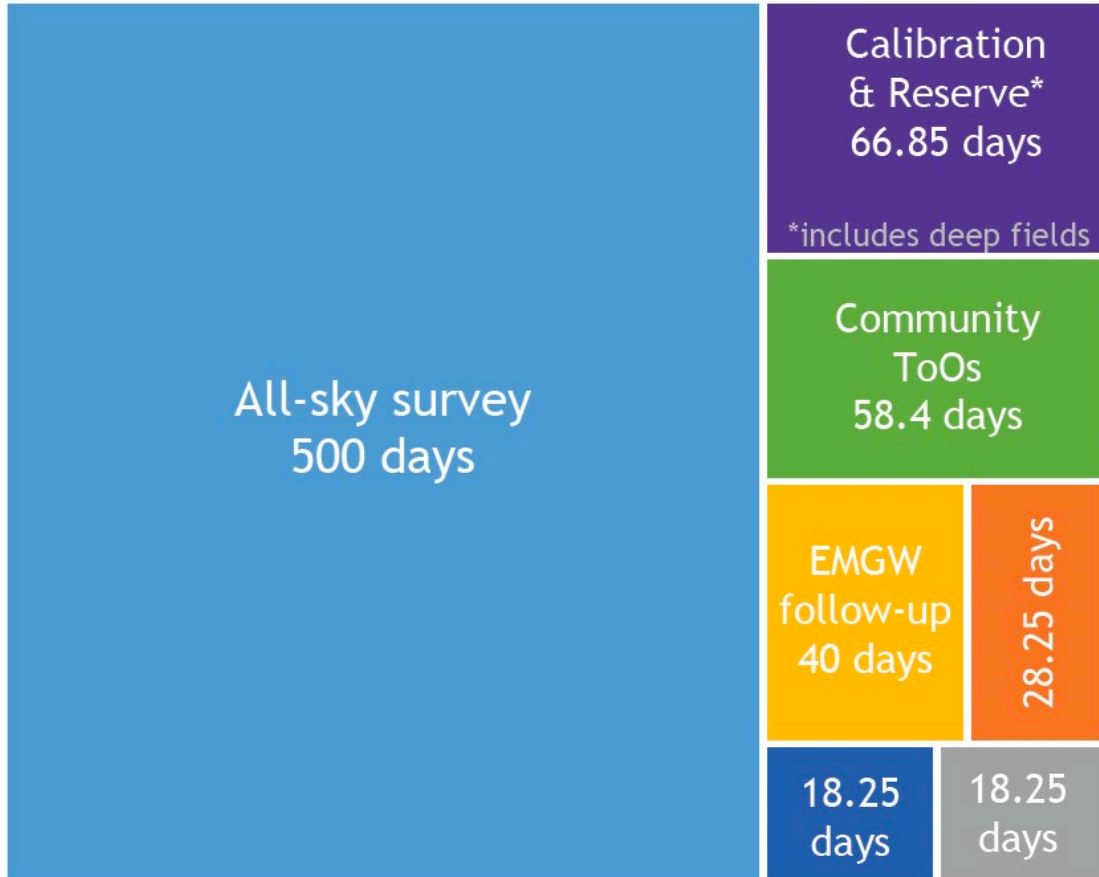
Simultaneous Imaging + Spectroscopy



Science Observing Breakdown

Two-year science mission

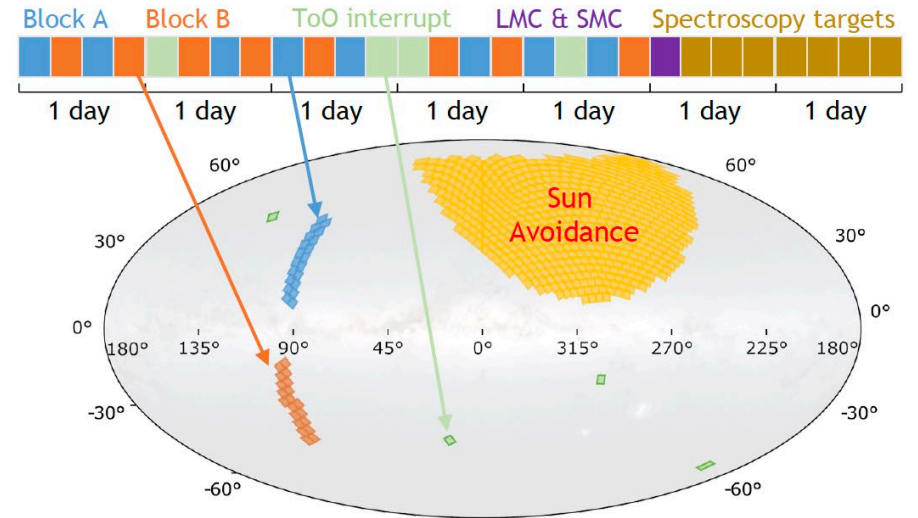
730 days of science operations



Low Metallicity Galaxies spectroscopy
 Rapid CC SNe spectroscopy
 LMC/SMC (imaging & spectroscopy)

High Cadence Survey

2 blocks at ~12-hr cadence, including interrupts, ~5 days total



Low Cadence Survey

16 blocks at ~4-day cadence, including interrupts, ~32 days total

