GALEX

Galaxy Evolution Explorer
The mission

+ **UV satellite** in a 1h 40min orbit (launched in 2003).

+ It takes images in 2 bands:
  + the **NUV (175nm-275nm)**
  + the **FUV (135nm-175nm)**

+ Its main purpose is to study **Star Formation in Galaxies**.

+ (GALEX has spectroscopic capabilities too!)
Technical specs

+ **50cm** reflector, ~50cm$^2$ effective area (small η).

+ Optics wheel, beam splitter/corrector and 2 detectors (NUV & FUV).

+ **Field of view: 1.2°** (circular)

+ **Angular resolution: 4.5” (FUV) and 6.5” (NUV)**

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**GALEX On-Orbit Performance**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Effective area</td>
<td>20–50 cm$^2$</td>
</tr>
<tr>
<td>Angular resolution</td>
<td>4.5–6” FWHM</td>
</tr>
<tr>
<td>Spectral resolution</td>
<td>100–250</td>
</tr>
<tr>
<td>Field of view</td>
<td>1°²</td>
</tr>
<tr>
<td>Bands (simultaneous)</td>
<td>FUV 1350–1750 Å, NUV 1750–2750 Å</td>
</tr>
<tr>
<td>Sensitivity (AB mag)</td>
<td>100 s 20.5 (AIS) 1 ks 23.5 (MIS/NGS) 30 ks 25.5 (DIS)</td>
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<tr>
<td>Astrometry</td>
<td>1” (rms)</td>
</tr>
<tr>
<td>Observations</td>
<td>Nighttime—1 eclipse = 1000–2000 s</td>
</tr>
<tr>
<td>Mission length</td>
<td>Baseline 38 months, 13 months to date</td>
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</tbody>
</table>
Observing strategy

- Observes during the night, rests during the day.
- **Pointed observations** (up to 1 full orbit a time).
- Space background is low: 20/60 counts s\(^{-1}\) (FUV/NUV)
- **GALEX limits:**
  - **faint:** \( m \sim 23.5 \) mag
  - **bright:** 50 kilocounts s\(^{-1}\)
Science goals: I

- **Converting UV luminosity into Star Formation Rate**
  - UV is an **excellent tracer of Star Formation** over timescales of ~100 million yr.
  - The UV scales with the SFR for a very **wide range** of SFR.
  - **Problems** to be overcome: **extinction**, **starburst history**, initial mass function, metallicity.
  - **Calibrate** UV Star Formation indicators over a wide range of environments and modalities, and use it to **extrapolate to high-z galaxies**.
Science goals: II

+ Reconstructing the Star Formation History for $z = 0 \sim 2$
+ Use UV indicators calibrated from the nearby universe to infer the SFR density as a function of redshift for $z=0 \sim 2$.
+ Provide an anchor for optical/NIR surveys probing rest-frame UV at $z > 1.5$.

“Madau plot”
Science goals: III

- Probing the physics of Star Formation
  - Use large samples, and detailed maps of nearby galaxies in the UV.
  - Build models of star formation, using additional multiwavelength data.
Main Surveys

- **All-Sky Imaging Survey (AIS)**
  - (almost) All-sky, shallow survey (10-100 sec, \(z_{\text{med}}=0.1\)). Covers \(~95\%\) of sky, down to magnitude \(m=20.5\)
  - 10^7 sources, with a volume of 1 Gpc^3.

- **Medium Imaging Survey (MIS)**
  - Intermediate area, intermediate depth survey (1500 sec, \(z_{\text{med}}=0.6\)). Covers 1000 deg^2, down to magnitude \(m=23\)
  - Matches well Sloan footprint and Sloan photometric limits.

- **Deep Imaging Survey (DIS)**
  - Narrow, deep survey (30 ks, \(z_{\text{med}}=0.85\)). Covers 80 deg^2, down to \(m=25\)
  - Focuses on fields where major multiwavelength efforts are underway.
Main Surveys

- Nearby Galaxy Survey (NGS)
  - Survey of 200 nearby galaxies (500 sec). Will go down to surface brightness of $\mu=27.5$ mag arcsec$^{-2}$ (or SFR of $10^{-3}$ M$_{\odot}$ yr$^{-1}$).
  - Includes most of the Spitzer SINGS galaxies.

- Ultra Deep Imaging Survey (UDIS)
  - Very narrow, ultra-deep survey (200 ks, $z_{\text{med}} = 0.9$). Covers 1 deg$^2$, down to $m=26$

- Matching Spectroscopic Surveys (WSS,MSS,DSS)
  - WSS covers the DIS footprint down to $m=20$ mag
  - MSS covers central 8 deg$^2$ of DIS, down to $m=21.5$ mag
  - DSS covers 2 deg$^2$, down to $m=23$ mag
GALEX data

+ **GALEX archive:** galex.stsci.edu/GR4/
GALEX data

+ **galexview**: browse GALEX images (and download fits files)
GALEX data

Schema & SQL query: submit queries to the GALEX database
GALEX data

Search Surveys (AIS, MIS, NGS etc.)