Reverberation Mapping:
Trading Time for Spatial Resolution

By Varoujan Gorjian

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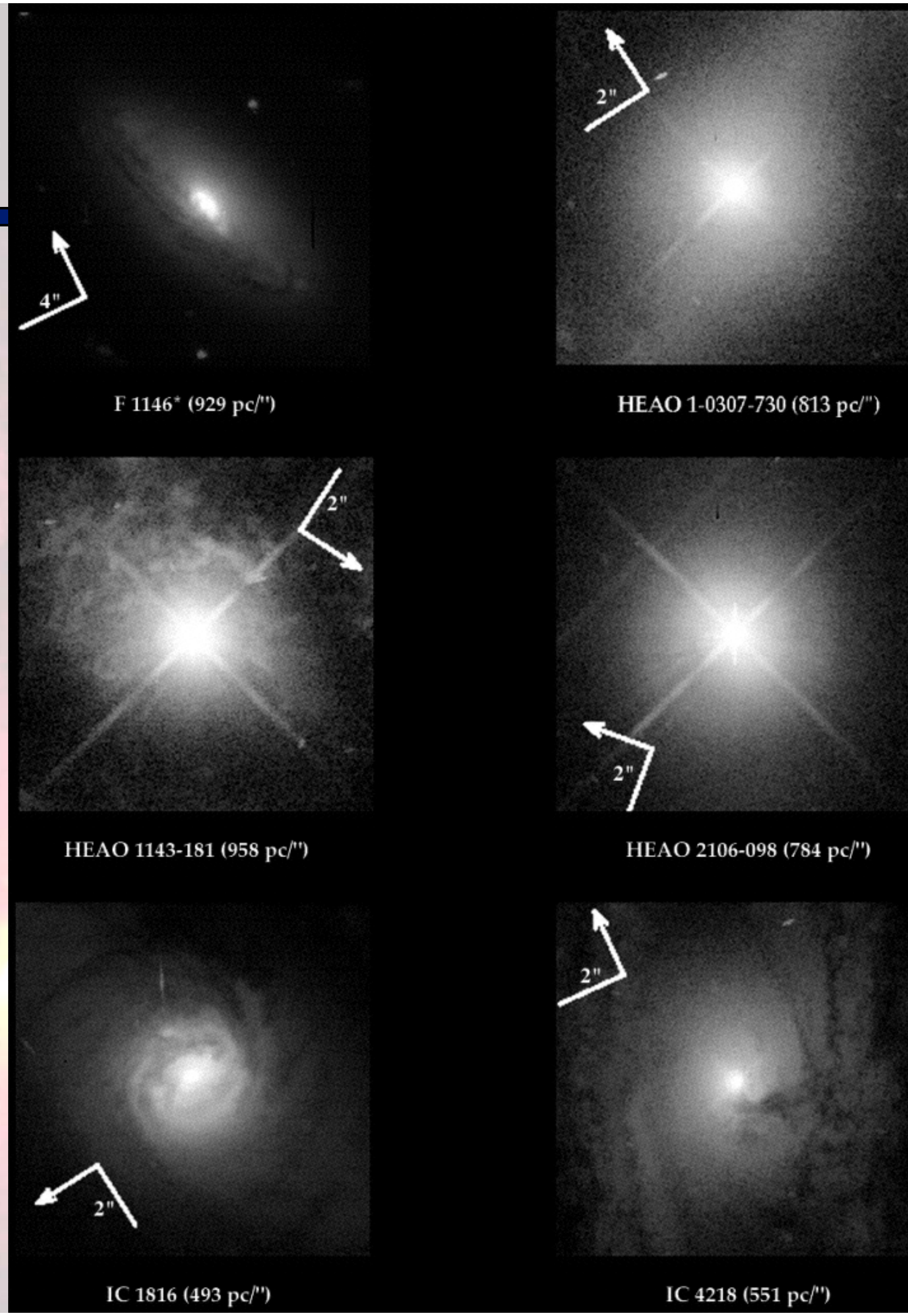
F 1146* (929 pc/")
HEAO 1-0307-730 (813 pc/")
HEAO 1143-181 (958 pc/")
HEAO 2106-098 (784 pc/")
IC 1816 (493 pc/")
IC 4218 (551 pc/")

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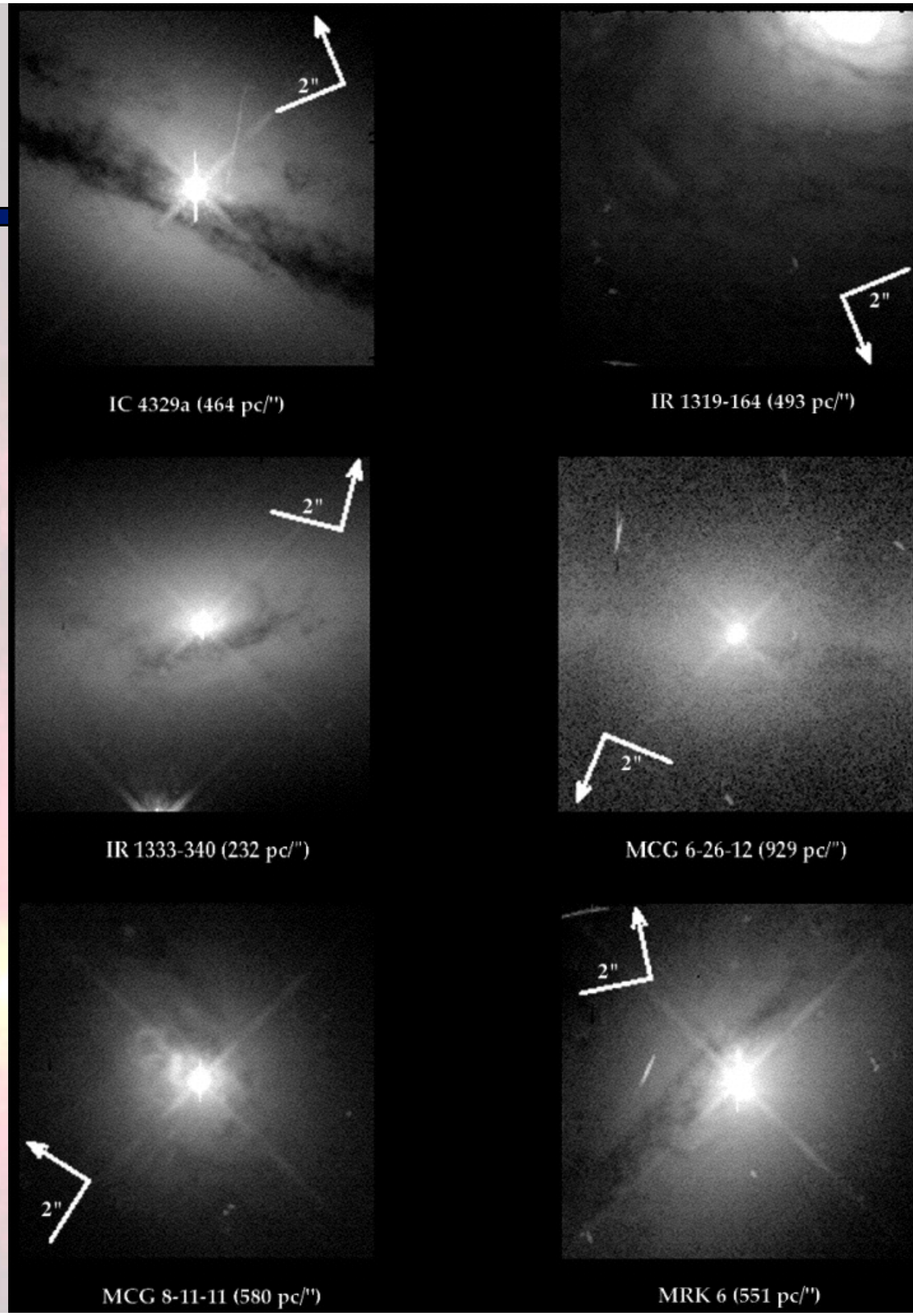

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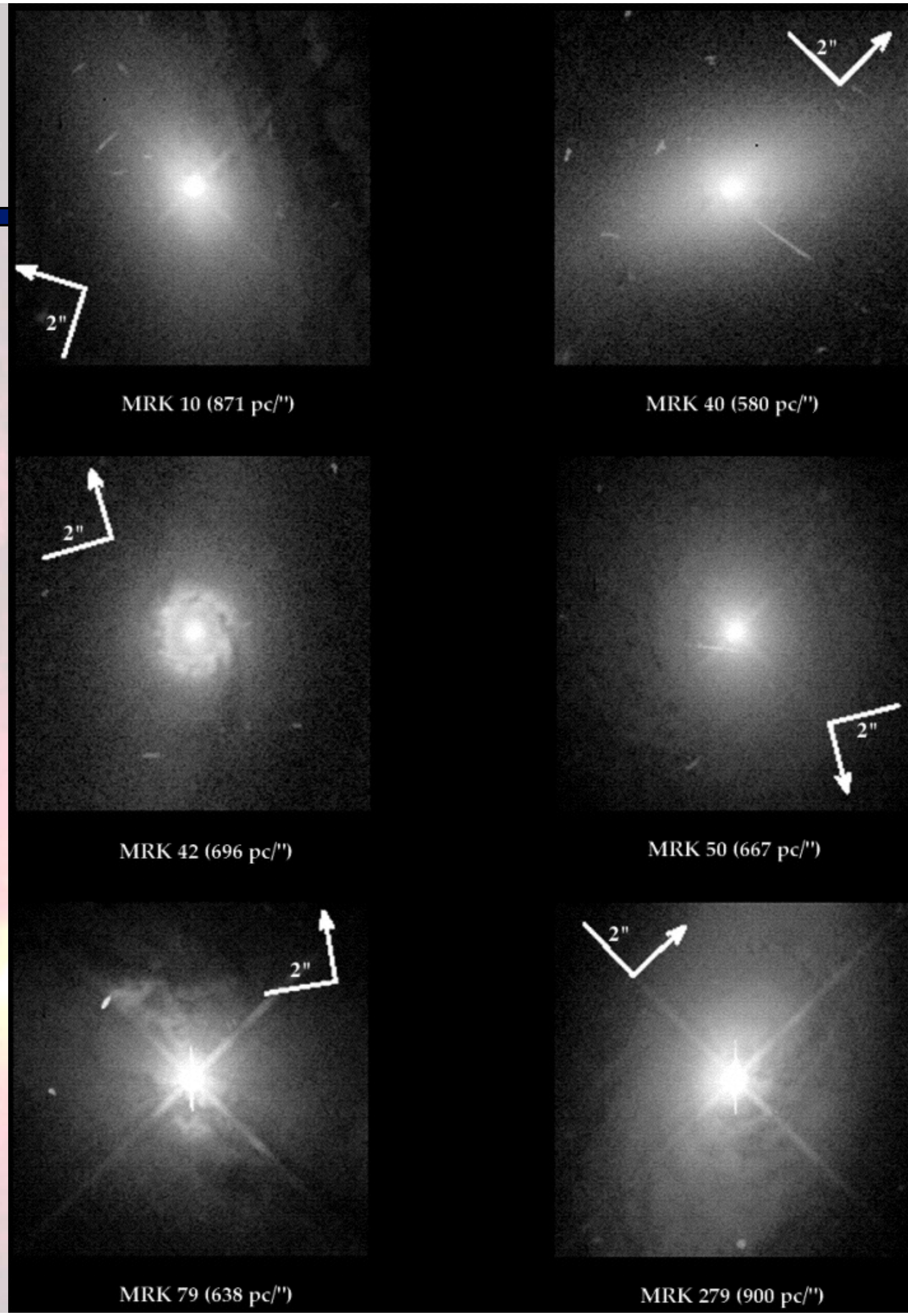

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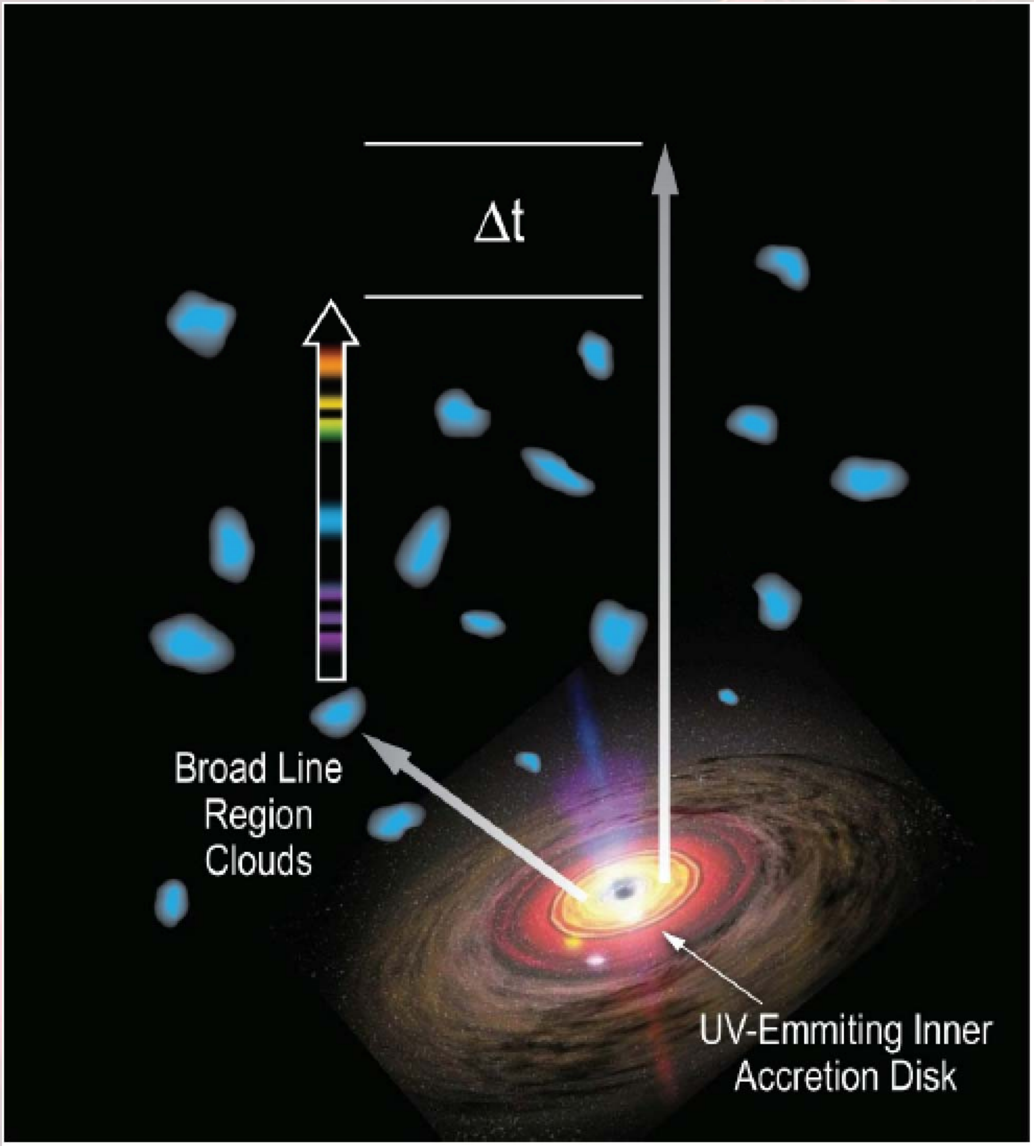
Reverberation Mapping: Trading Time for Spatial R



Not to scale

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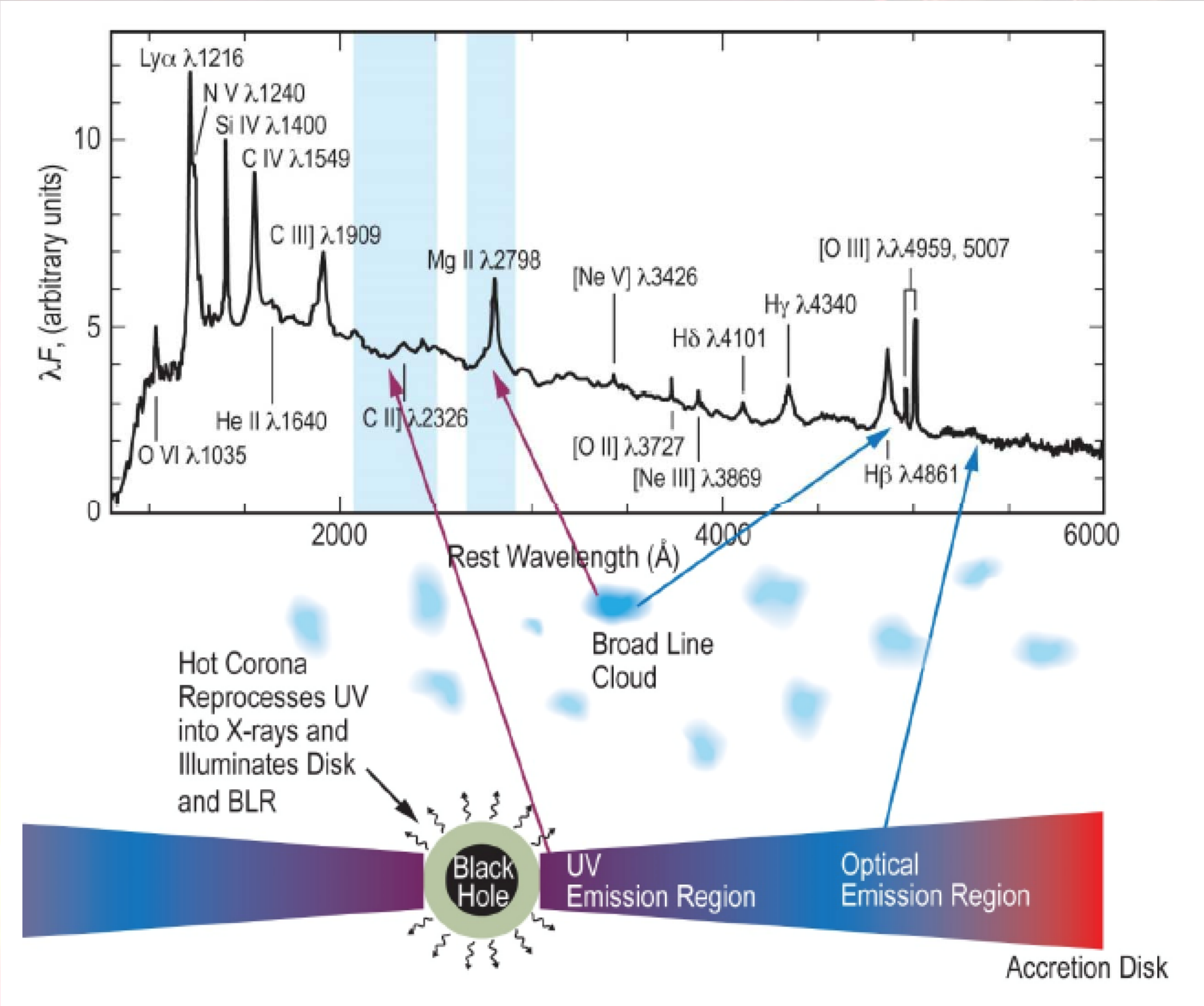

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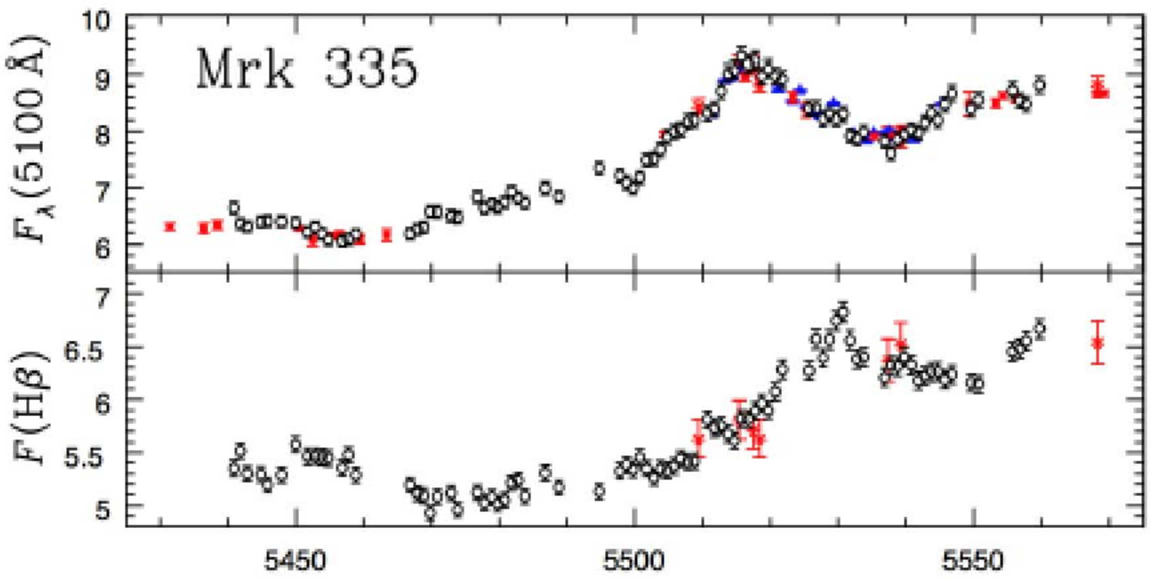

Figure 1.1-3. Optical continuum (top) and broad Hβ line emission (bottom) light curve for Mrk 335. The line emission lags the continuum by 13.9 ± 0.9 days. (Grier et al 2012).

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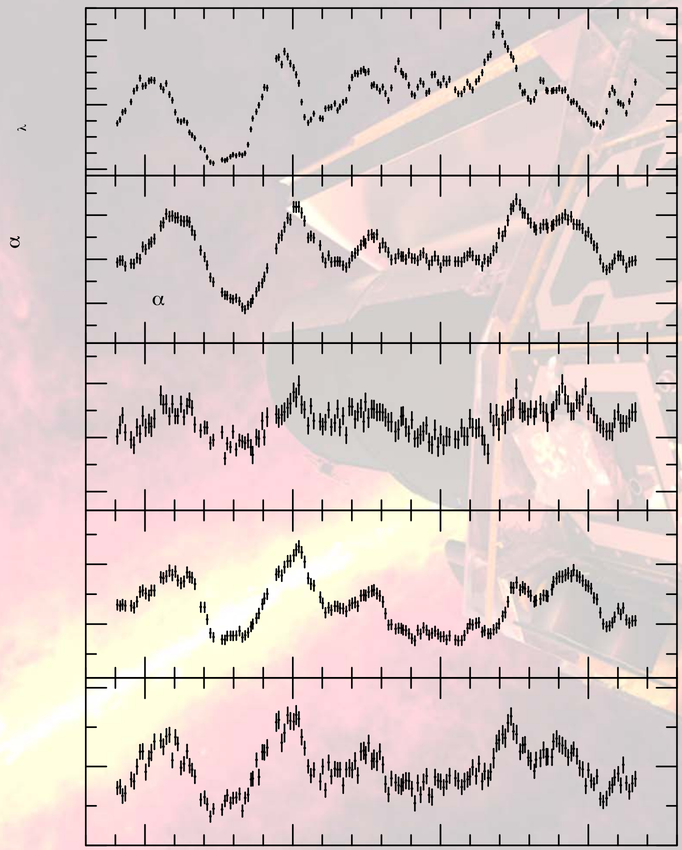

Figure 3. Integrated light curves. The continuum flux at 1367 Å is in units of 10^{-15} erg s^{-1} cm^{-2} Å^{-1} and the line fluxes are in units of 10^{-13} erg s^{-1} cm^{-2} and are in the observed frame. Flux uncertainties include both statistical and systematic errors.

De Rosa et al. 2015

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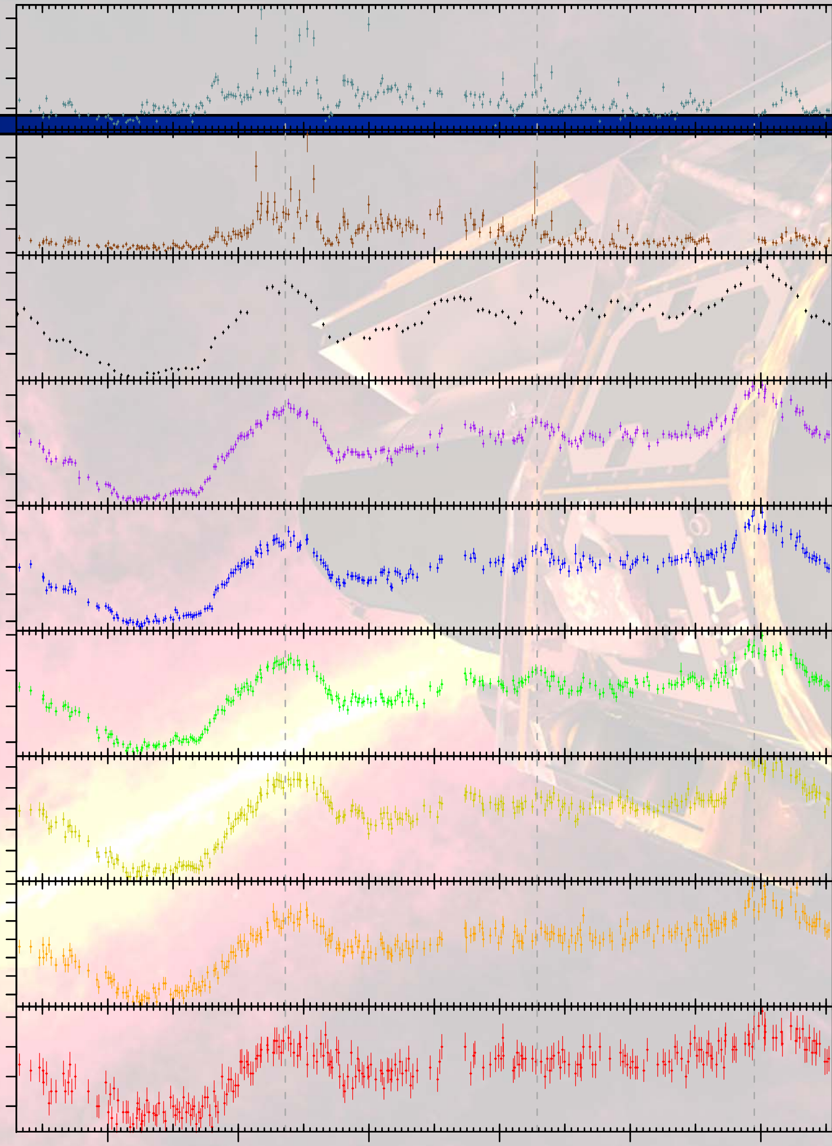

FIG. 2.— Light curves for the intensive monitoring period (HJD 2,456,706-2,456,831), going from shortest wavelength (top) to longest (bottom). The band name and central wavelength are given on the left of each panel. Top two panels show the *Swift* hard and soft X-ray (HX and SX respectively) light curves, in units of c/s. Third panel shows the *HST* light curve, in units of 10^{-14}ergs^{-1}cm^{-2}Å^{-1}. Error bars for this light curve are typically ∼1.5%, just barely visible in the plot. The bottom six panels show the *Swift* light curves, again in units of 10^{-14} erg cm^{-2}s^{-1}Å^{-1} . Dashed gray lines show times THJD 747.179, 785.752 and 818.993, three local maxima of the *HST* light curve.

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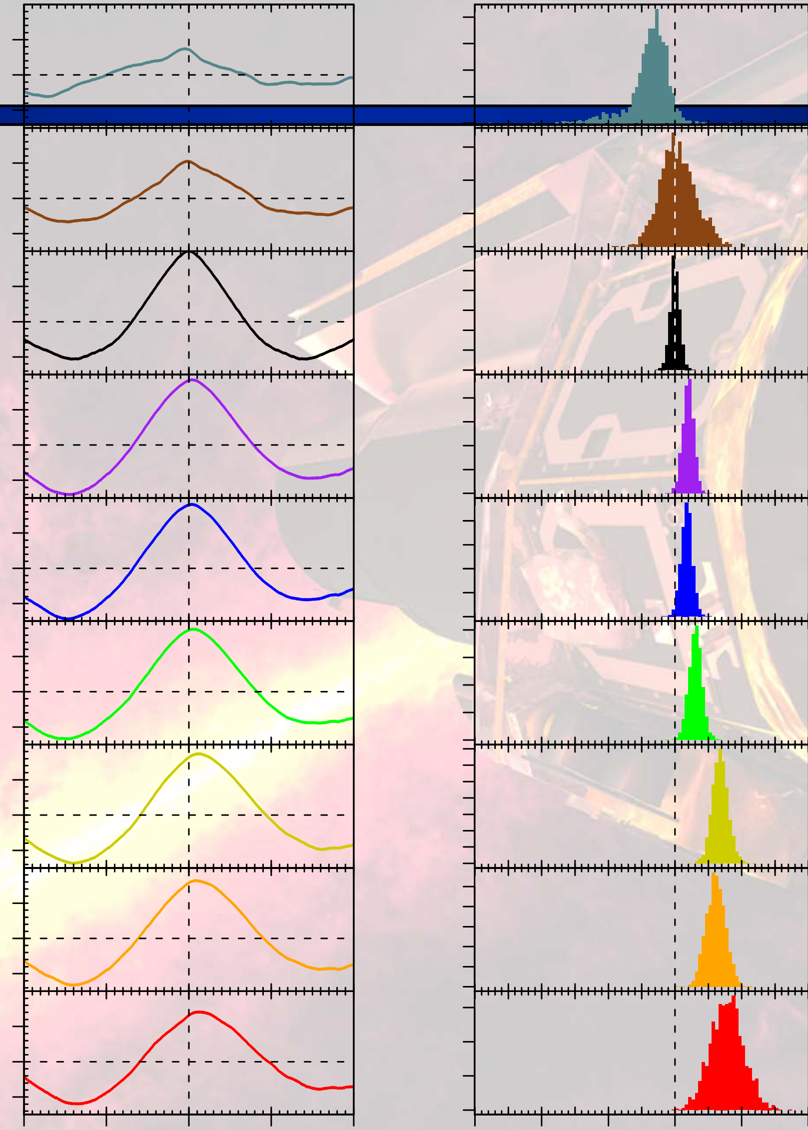

FIG. 3.— (3a) Interpolated cross-correlation functions for the intensive monitoring period light curves (Figure 2), with all correlations measured relative to the *HST* light curve, after removing long term trending (see Section 3). The band name and central wavelength are given on the left of each panel. Note that the interband lag goes from negative to increasingly positive as the band's wavelength increases. Note also that the UV/optical correlations are all strong ($r_{max} = 0.57 - 0.90$) but the X-ray/UV correlations are much weaker, ($r_{max} < 0.45$). (3b) Cross-correlation centroid histograms derived from the CCFs as discussed in the text. The band name and central wavelength are given on the left of each panel. All distributions except HX appear consistent with a Gaussian.

Edelson et al. 2015

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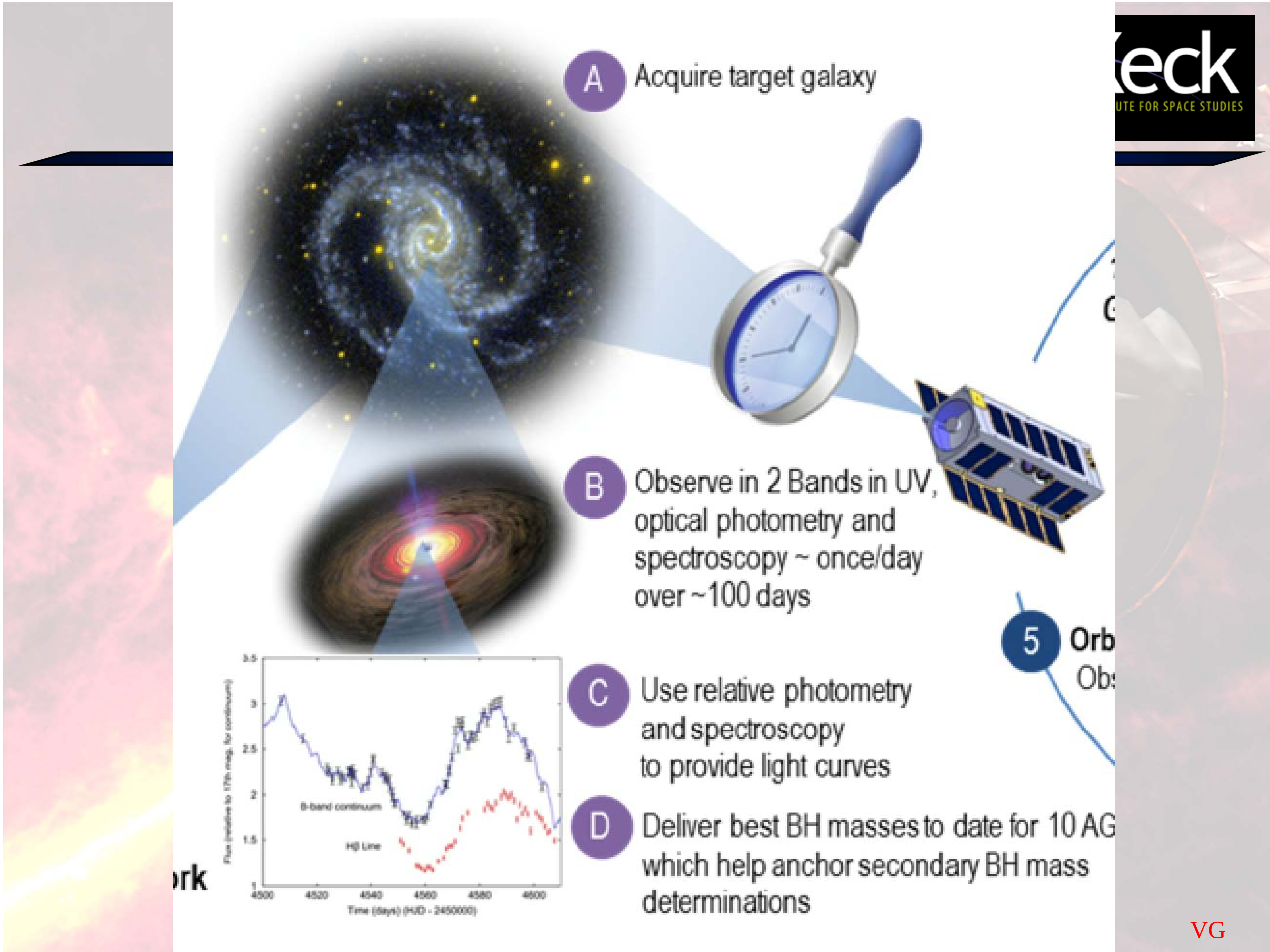

A Acquire target galaxy
B Observe in 2 Bands in UV, optical photometry and spectroscopy ~ once/day over ~100 days
C Use relative photometry and spectroscopy to provide light curves
D Deliver best BH masses to date for 10 AG
which help anchor secondary BH mass determinations
B-band continuum
Hβ Line
Time (days) (HJD - 2450000)
5 Orb
Obs
VG

Making the most of a single detector

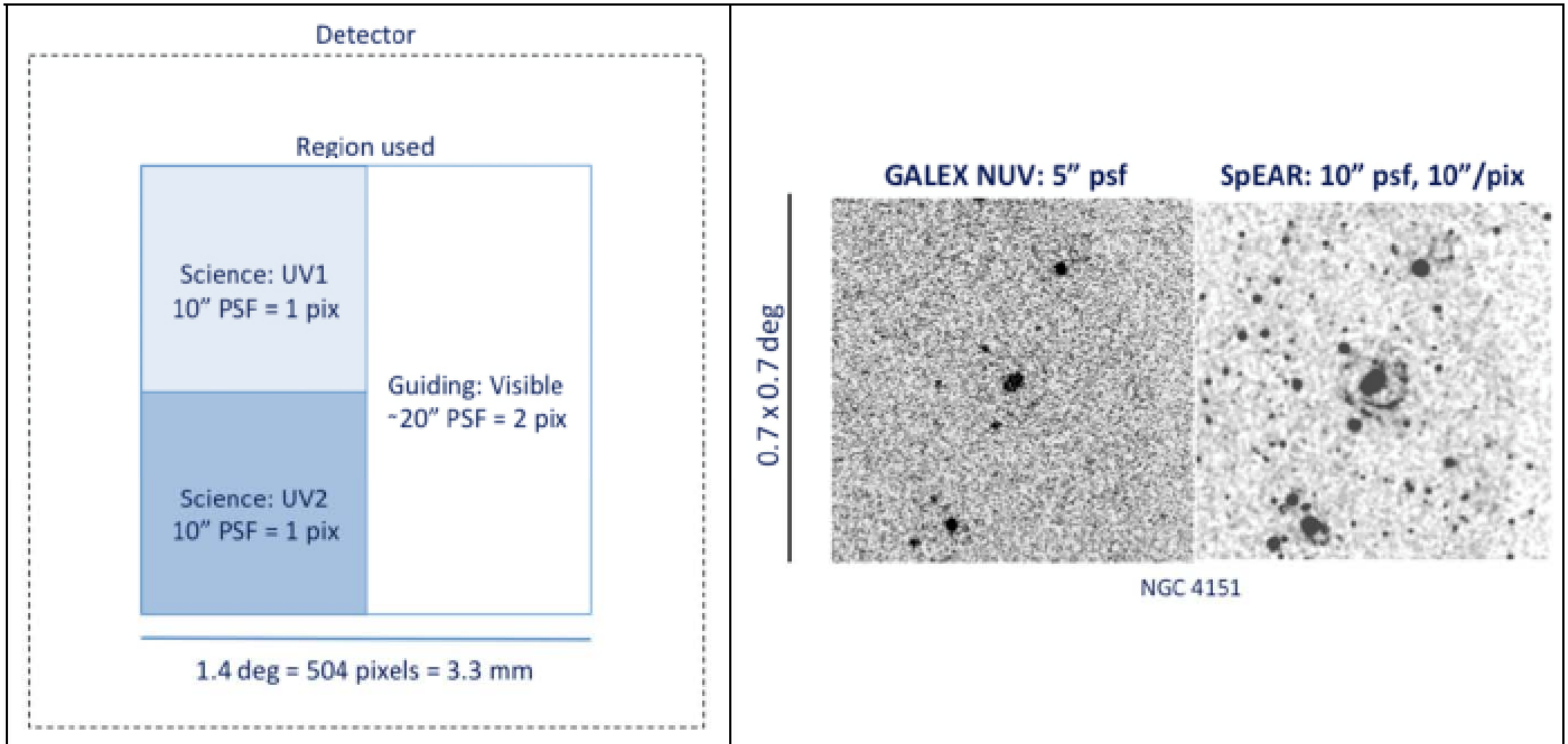
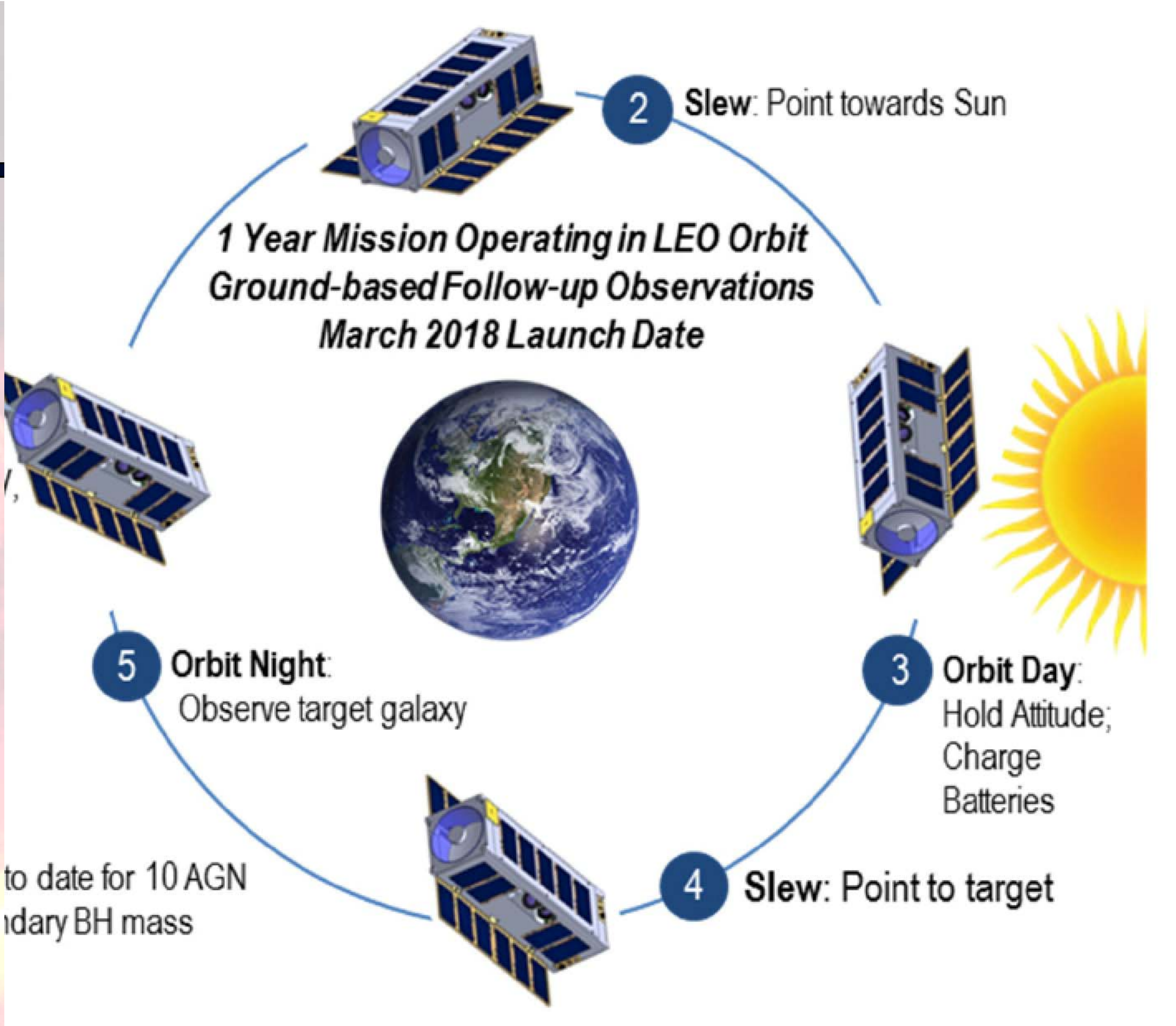


Figure 1.2-2. Left: SpEAR's CMOS detector provides two science fields and guides our precision poining. **Right: SpEAR's large FOV allows for** additional ancillary science on M-dwarf variability.


1 Year Mission Operating in LEO Orbit
Ground-based Follow-up Observations
March 2018 Launch Date
2 Slew: Point towards Sun
3 Orbit Day: Hold Attitude; Charge Batteries
4 Slew: Point to target
5 Orbit Night: Observe target galaxy
to date for 10 AGN
ndary BH mass

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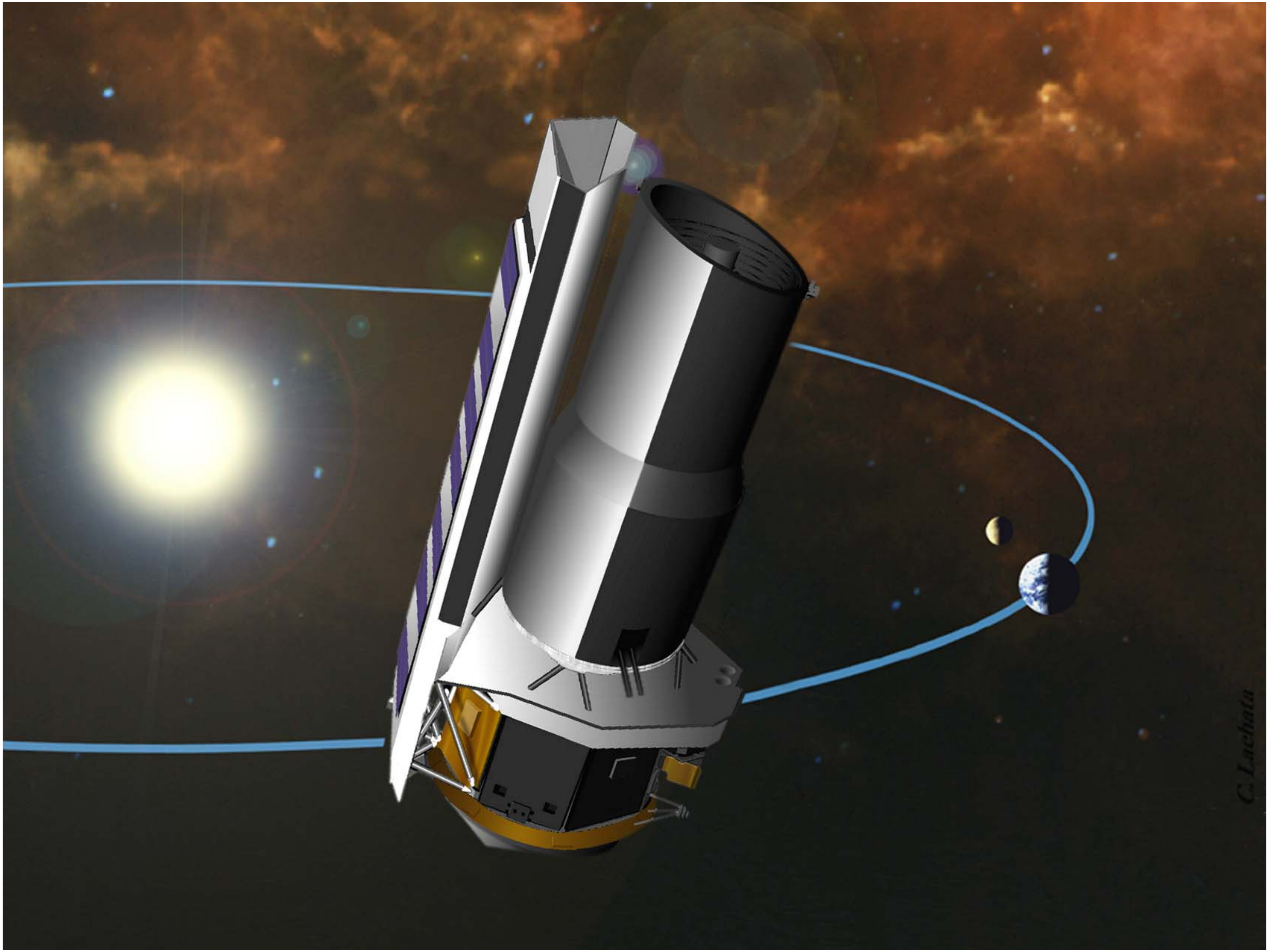
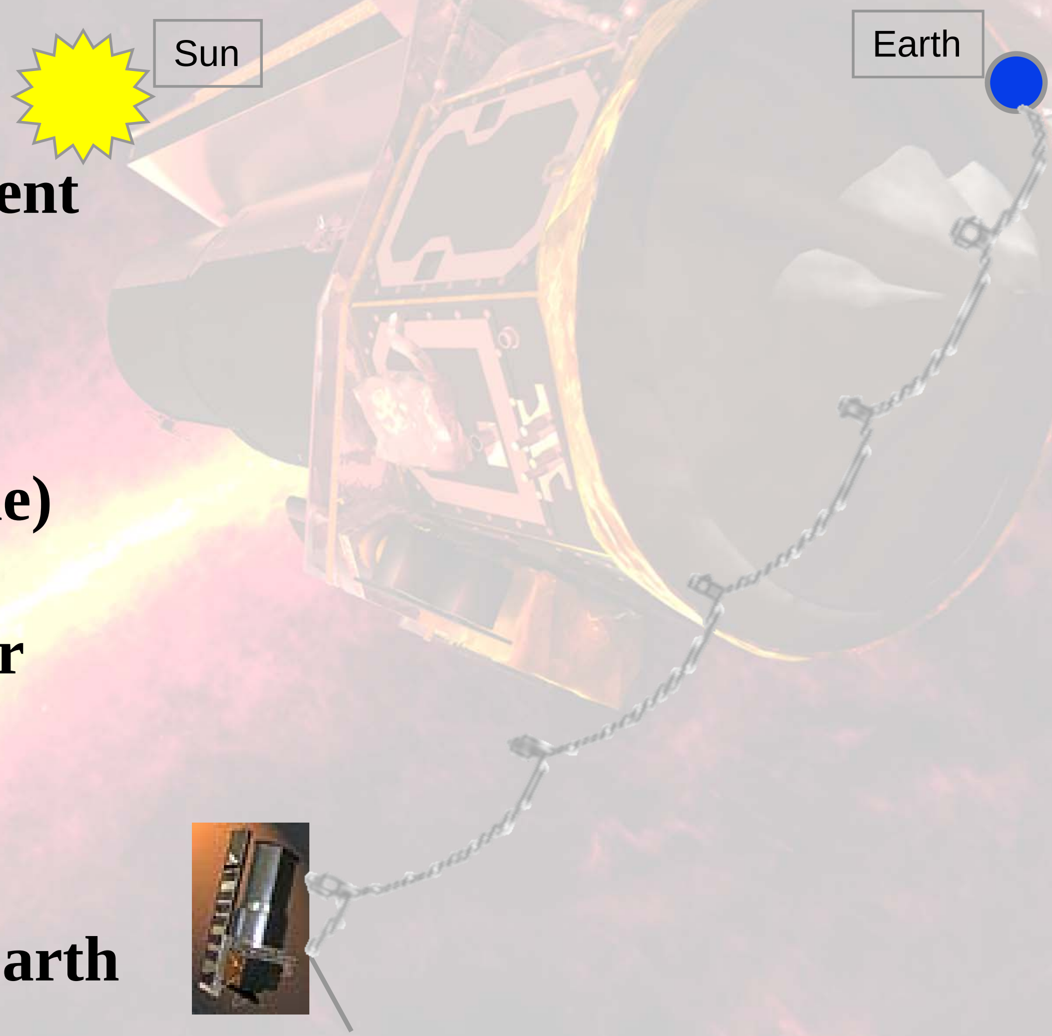

C. Lachata

Solar Orbit:
A chain of observatories

Why a Better Choice?



Better Thermal Environment
(allows passive cooling)
No Need for Earth-Moon Avoidance
(Maximizes observing time)
No Earth Radiation Belt
(no damage to detectors or electronics

… AND easier to get into Earth Trailing than GEO or L2

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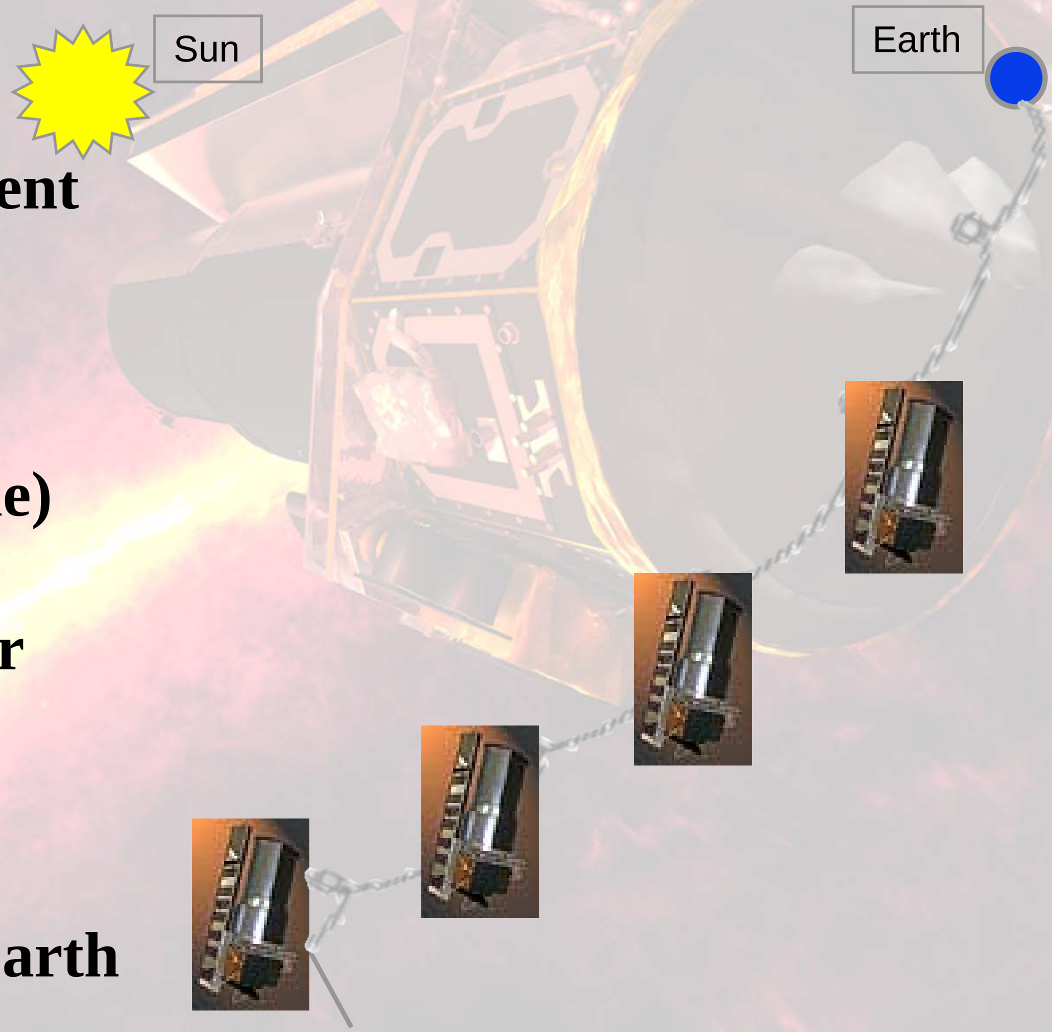

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