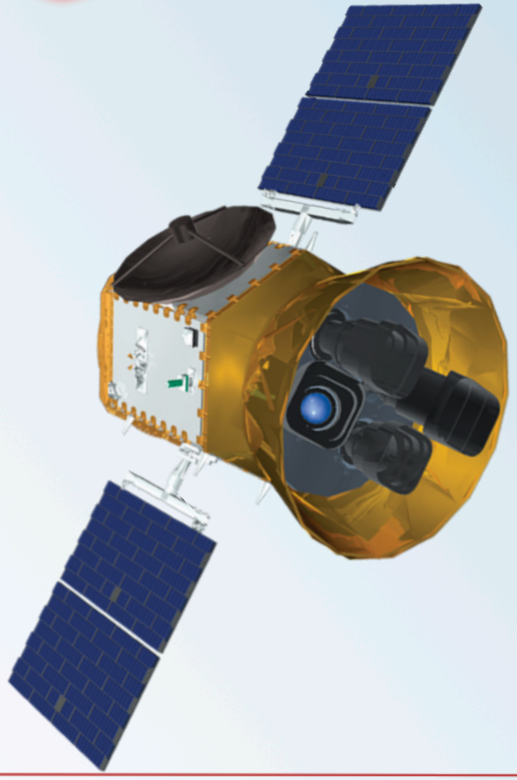
Transiting Exoplanet Survey Satellite



Transiting Exoplanet Survey Satellite and AGN

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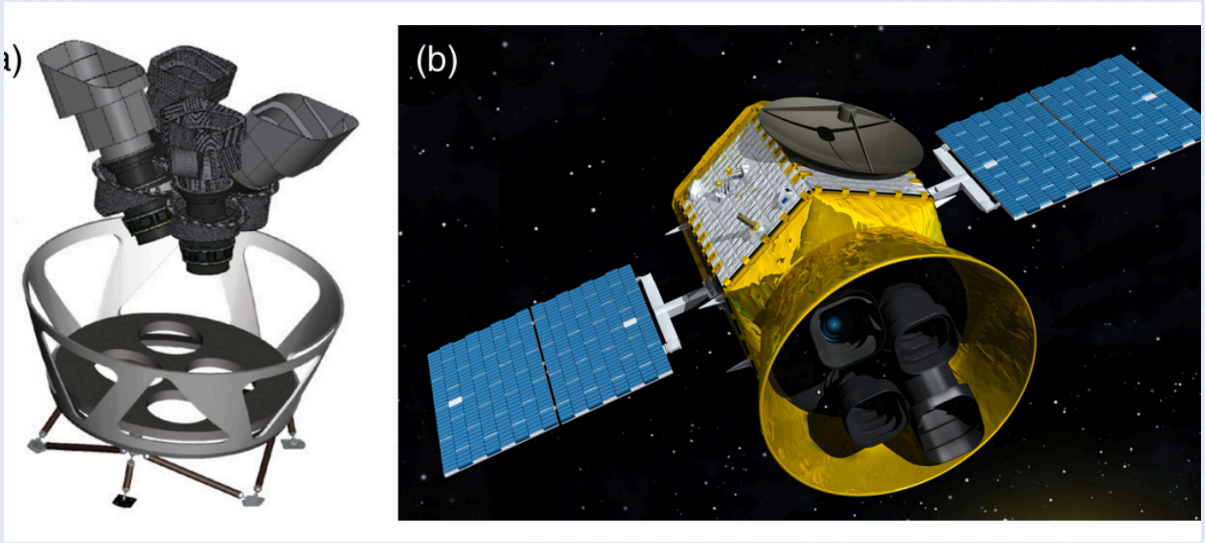
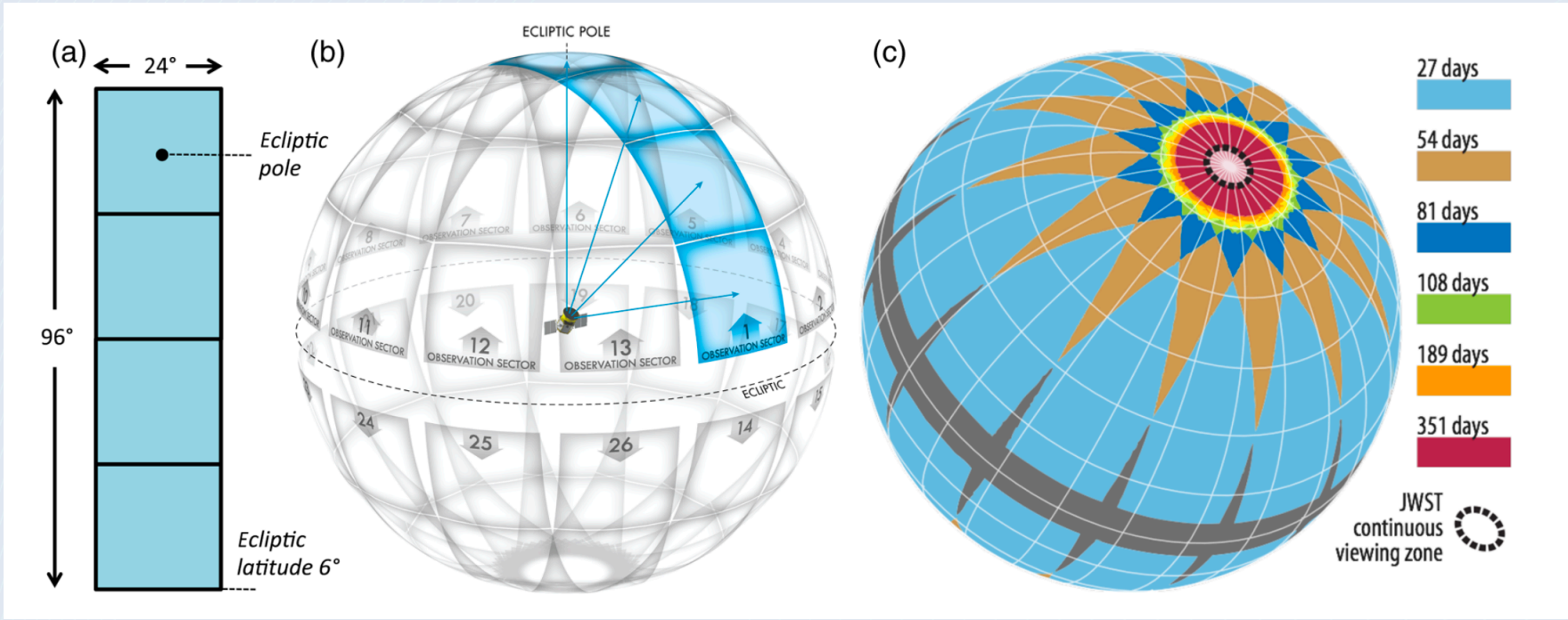
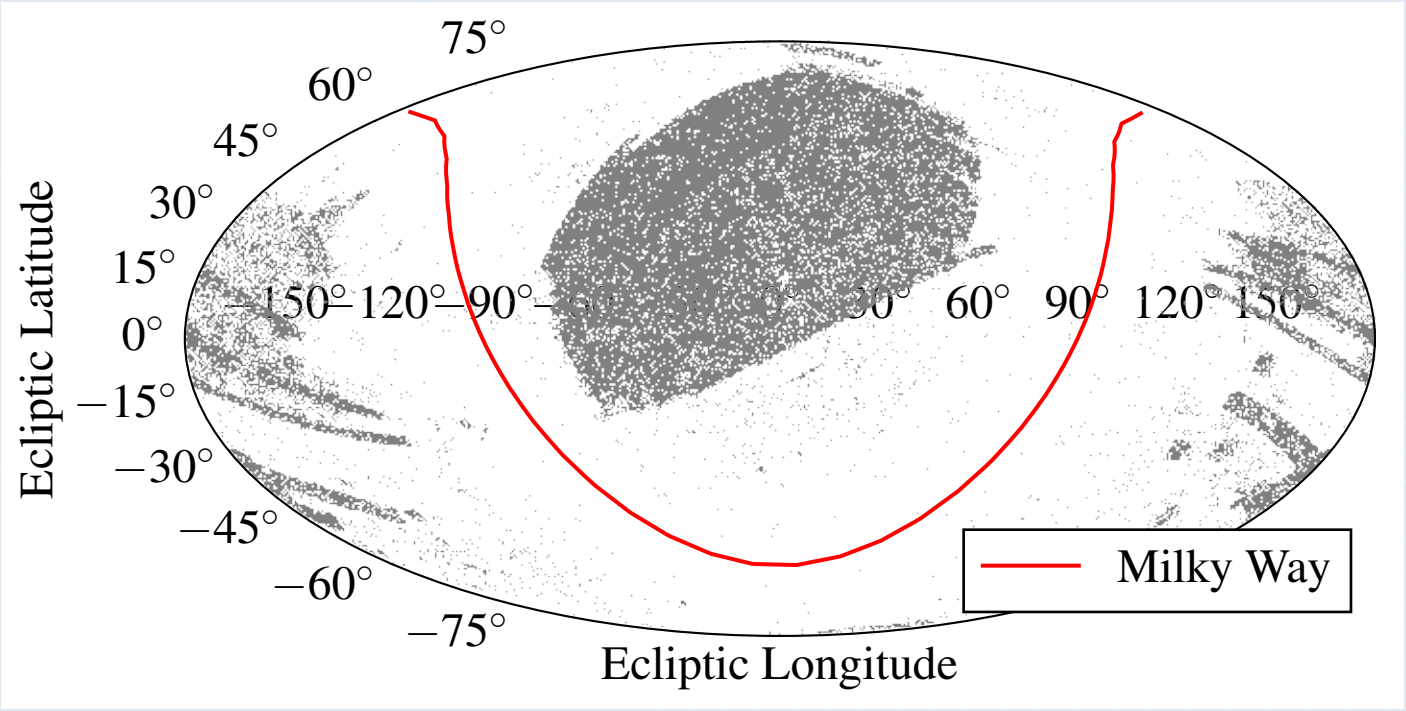
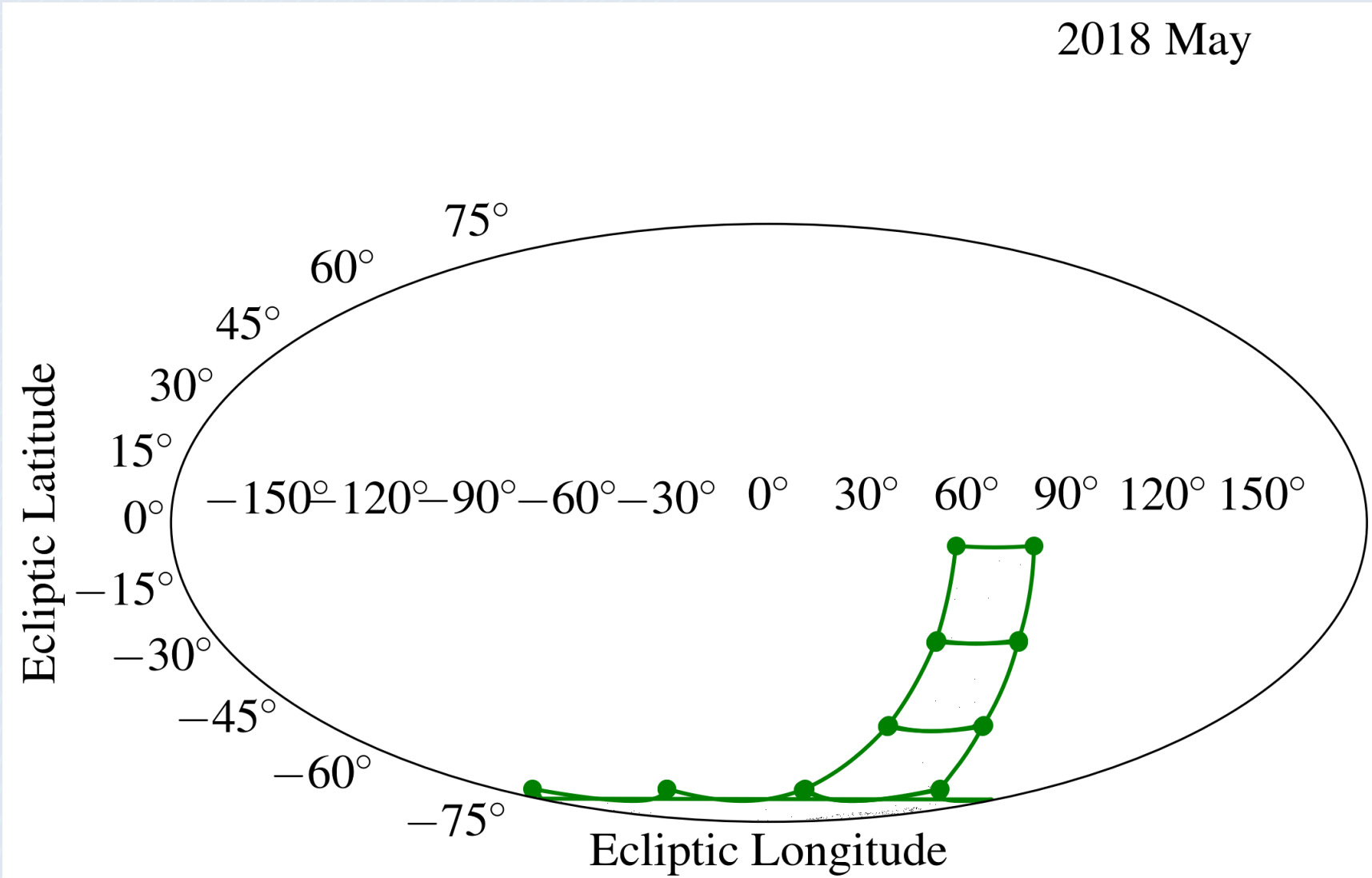
8/18/2017

- Level 1 Science requirement:
  - *Masses for 50 planets with radius < 4R_Earth*
- Search many bright stars
  - *Discovery by transits*
  - *Masses by follow-up (RV)*
- Transits require:
  - *rapid cadence (minutes)*
  - *high precision (earth around sun is ~100 ppm)*
- Challenges for extra-galactic astronomy, but….
  - *Unique cadence/precision for variability studies*
  - *Many objects (nearly whole sky)*


(b)

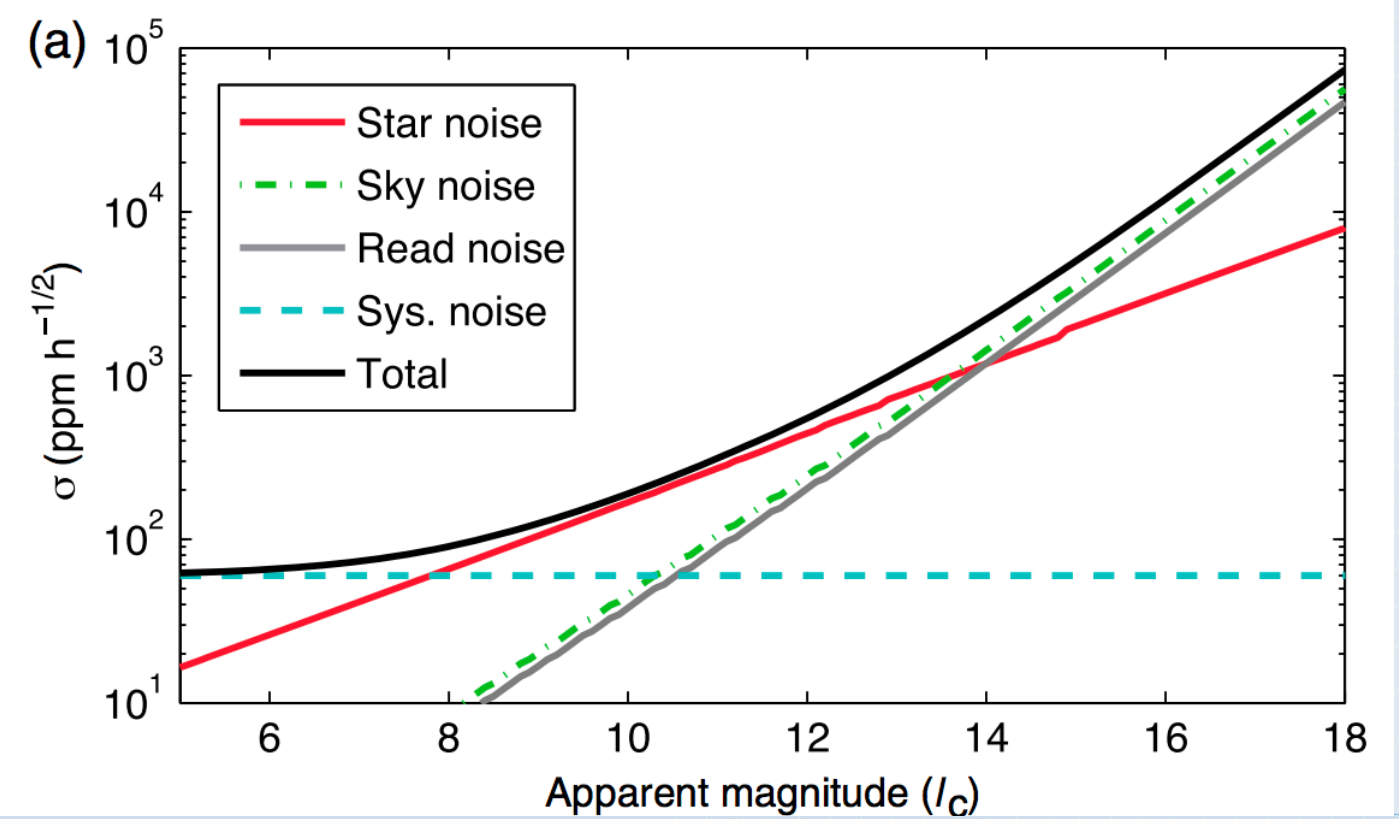

(a)
24°
96°
Ecliptic pole
Ecliptic latitude 6°
(b)
ECLIPTIC POLE
ECLIPTIC
11 OBSERVATION SECTOR
12 OBSERVATION SECTOR
13 OBSERVATION SECTOR
1 OBSERVATION SECTOR
(c)
27 days
54 days
81 days
108 days
189 days
351 days
JWST continuous viewing zone


75°
60°
45°
30°
15°
0°
−15°
−30°
−45°
−60°
−75°
Ecliptic Latitude
−150°
−120°
−90°
30°
60°
90°
120°
150°
Ecliptic Longitude
Milky Way

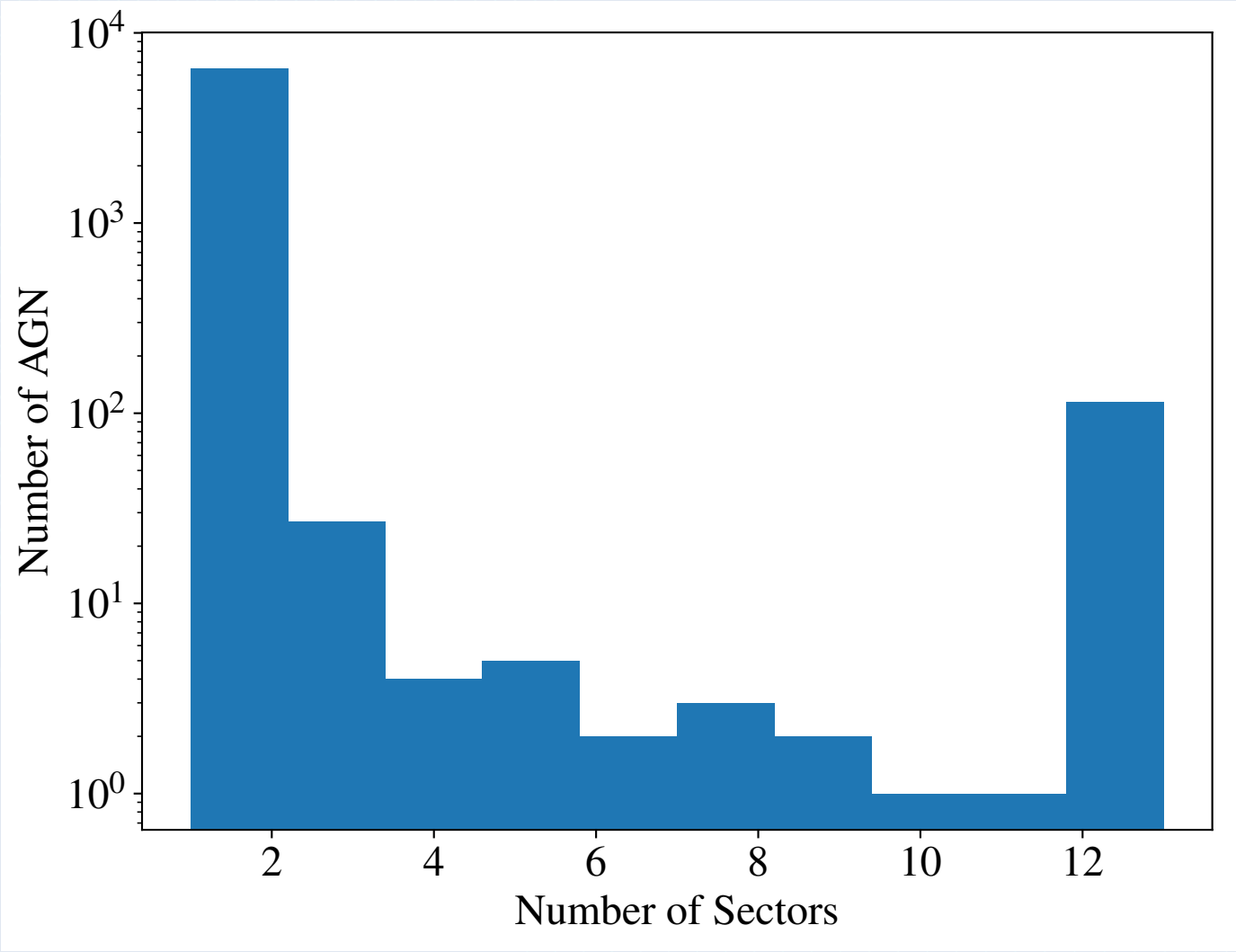

2018 May
75°
60°
45°
30°
15°
0°
−15°
−30°
−45°
−60°
−75°
Ecliptic Latitude
−150°
−120°
−90°
−60°
−30°
0°
30°
60°
90°
120°
150°
Ecliptic Longitude

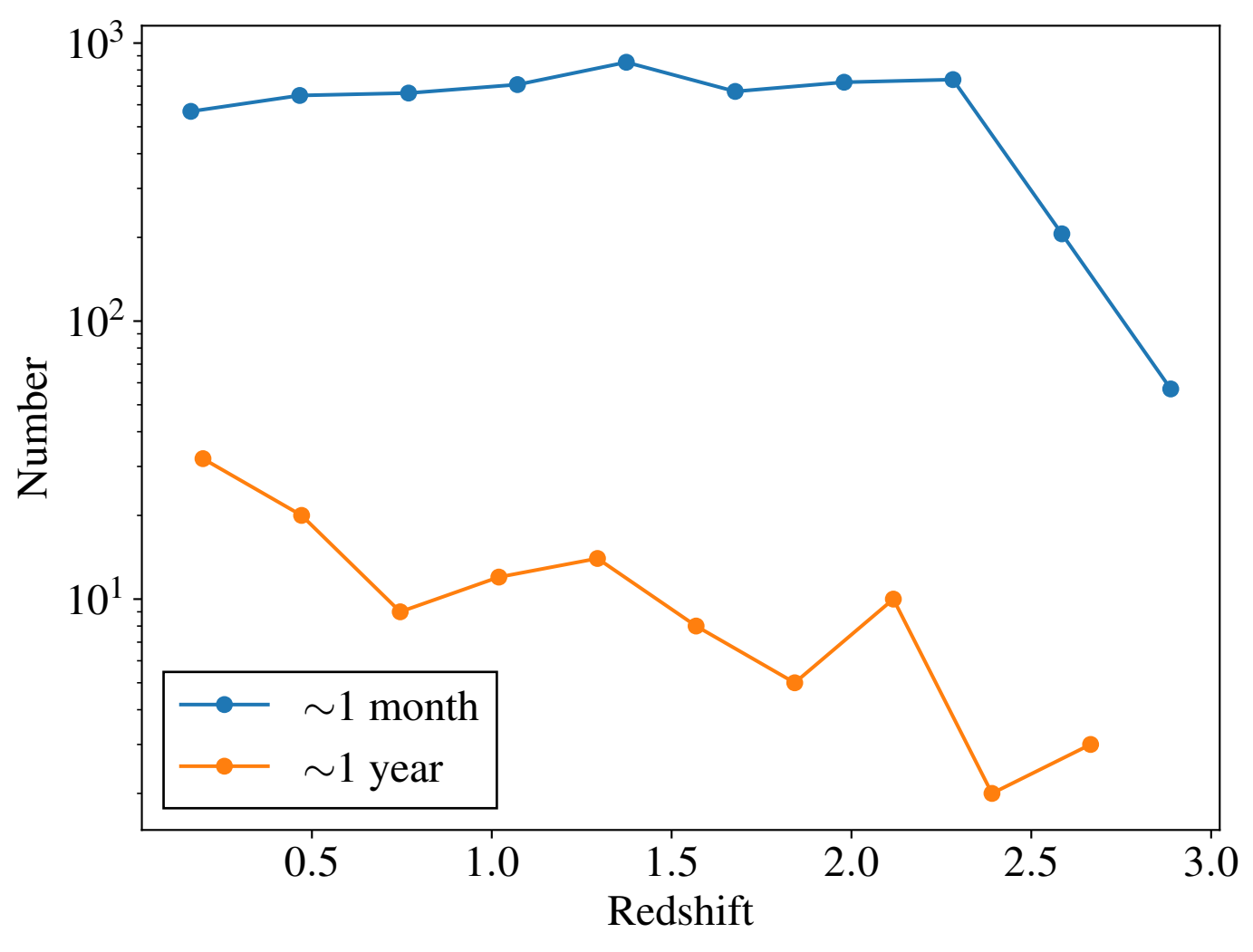
- 10.5 cm aperture
- 24x24 degree FOV (x4)
  - *2300 square degrees per pointing*
- Four 2048 x 2048 CCDs (x4)
- ~21 arcseconds/pixel

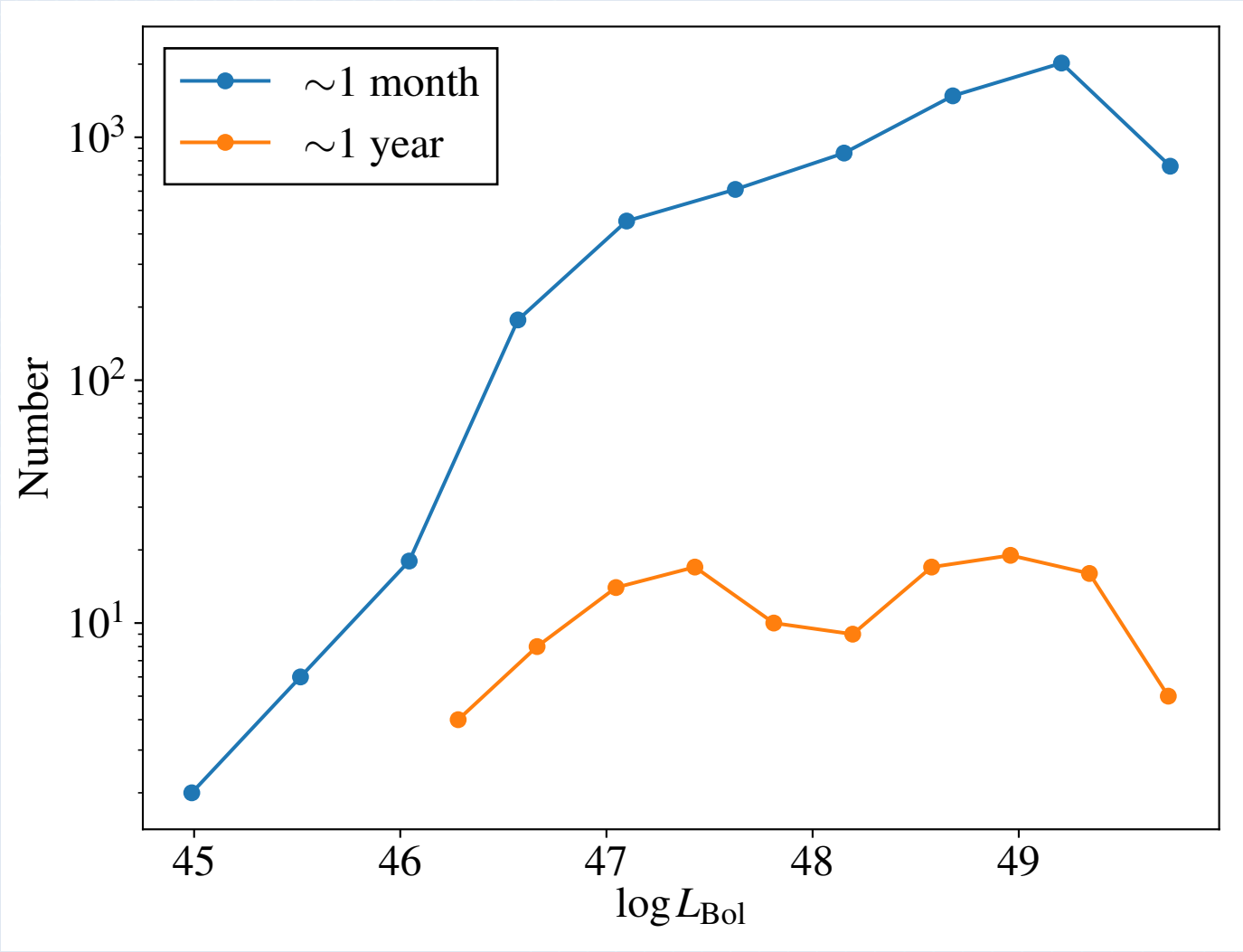
- 0.6 to 1.0 microns (like I_c)
- Targeted pixels
  - *2 minute cadence*
- Full Frame Images (FFIs)
  - *30 minute cadence*
- No propriety period



- Possible Science Cases?
- Variability Catalog
  - *RM campaigns have been inefficient (50% ”success”)*
  - *Identify variable ones (high amplitude) for future planning*
    - *Even if it fails, a questions about what changed*
  - *No need to trace past null results (though long baseline is great!)*
    - *occasionally comes up with referees*
  - *Find odd behavior (flares, changing-look, non-stationary states….)*
  - *Why are some variable and others aren’t?***
    - *Large sample*


10^4
10^3
10^2
10^1
10^0
Number of AGN
2
4
6
8
10
12
Number of Sectors

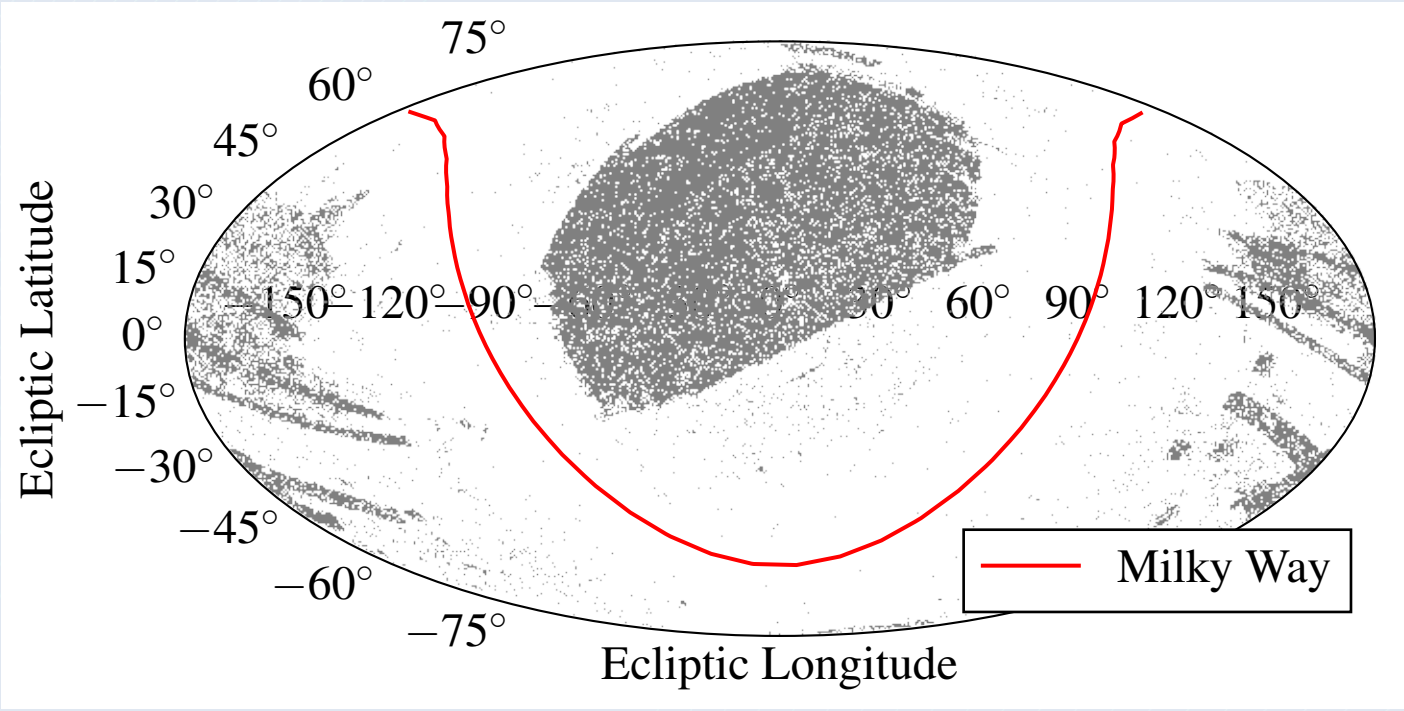

10^3
10^2
10^1
Number
~1 month
~1 year
0.5
1.0
1.5
2.0
2.5
3.0
Redshift


~1 month
~1 year
Number
10^3
10^2
10^1
45
46
47
48
49
$\log L_{\mathrm{Bol}}$

- Possible Science Cases?
- Structure functions/PSD estimation
  - *Hours to days have been examined for only ~20 objects (Kepler [?])*
  - *Will (still) have systematics*
    - *Thermal impulses every 2 weeks*
    - *Thermal/focus variations along orbit*
    - *Differential Velocity Aberration*
  - *baseline is generally short*
  - *Not independent of noise (and therefore mag)*

- Possible Science Cases?
- Individual Targets
  - *TESS images/light curves are free and public!*
  - *Light curves will (probably) be excellent*
    - *30 minutes*
    - *S/N ~100 at I = 16 (?)*
  - *Easy to point: where is the sun?*
  - *Very red pass-band (dust emission my contaminate)*
  - *Pixels are large (crowded/blended photometry)*

- Possible Science Cases?
- Discovery
  - *A small fraction of AGN that exist are known, esp. in the Southern Hemisphere*
  - *Variability selection (follow-up to confirm)*
  - *Needs rapid variability (so, low mass/luminosity….)*
  - *Or maybe fill out the south ecliptic pole in advance with traditional techniques?*
    - *Sufficiently easy? How much area/depth before interesting/useful?*


75°
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30°
60°
90°
120°
150°
Ecliptic Longitude
Milky Way

- Guest Investigator Program
- Due Sept. 29, 2017
- Nominal awards of $50k -- $200k to use TESS data for aux. science
- Can propose new 2-minute targets or use FFIs
- Some grey areas:
  - *E.g., early access to data?*
- Technical questions: Patricia Boyd patricia.t.boyd@nasa.gov.
- NASA point of contact: Martin Still martin.still@nasa.gov.