Transiting Exoplanet Survey Satellite

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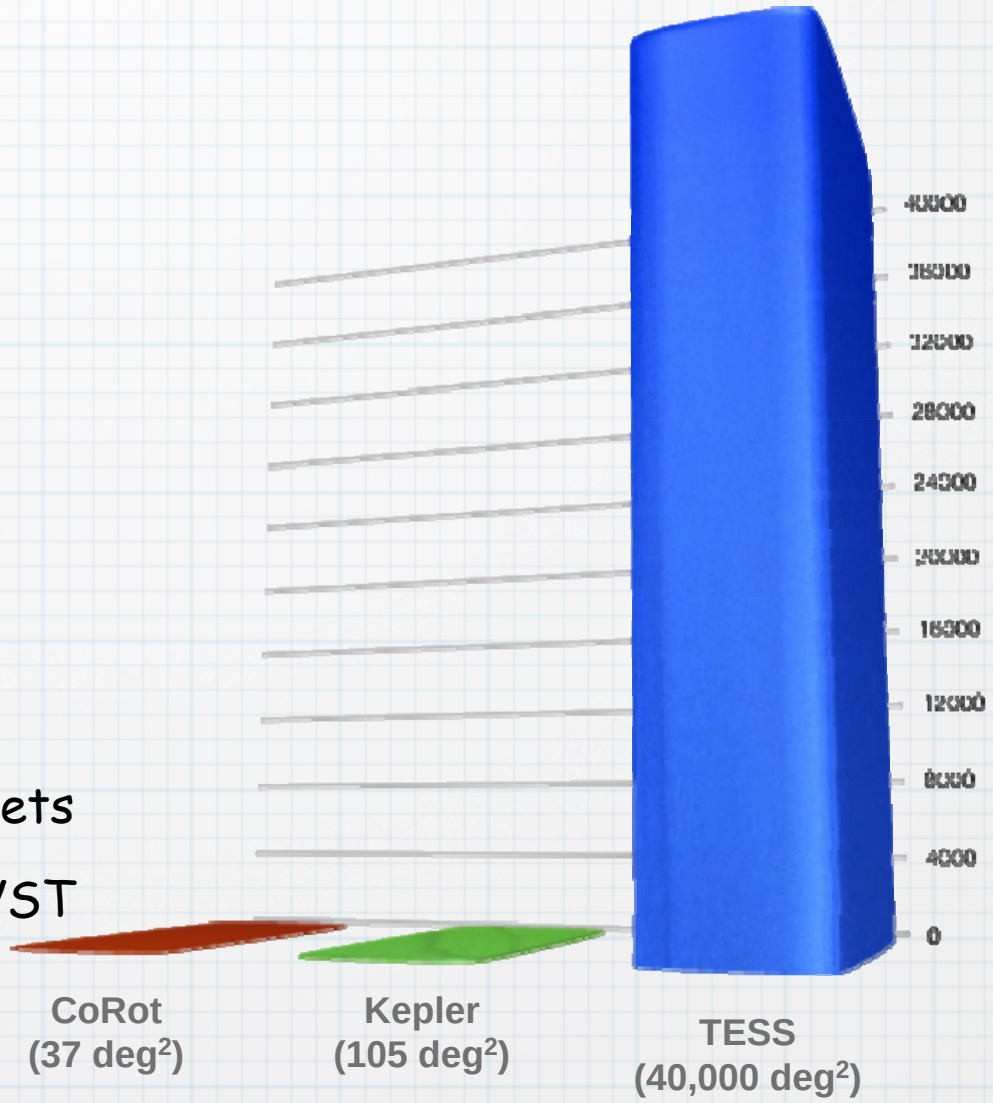
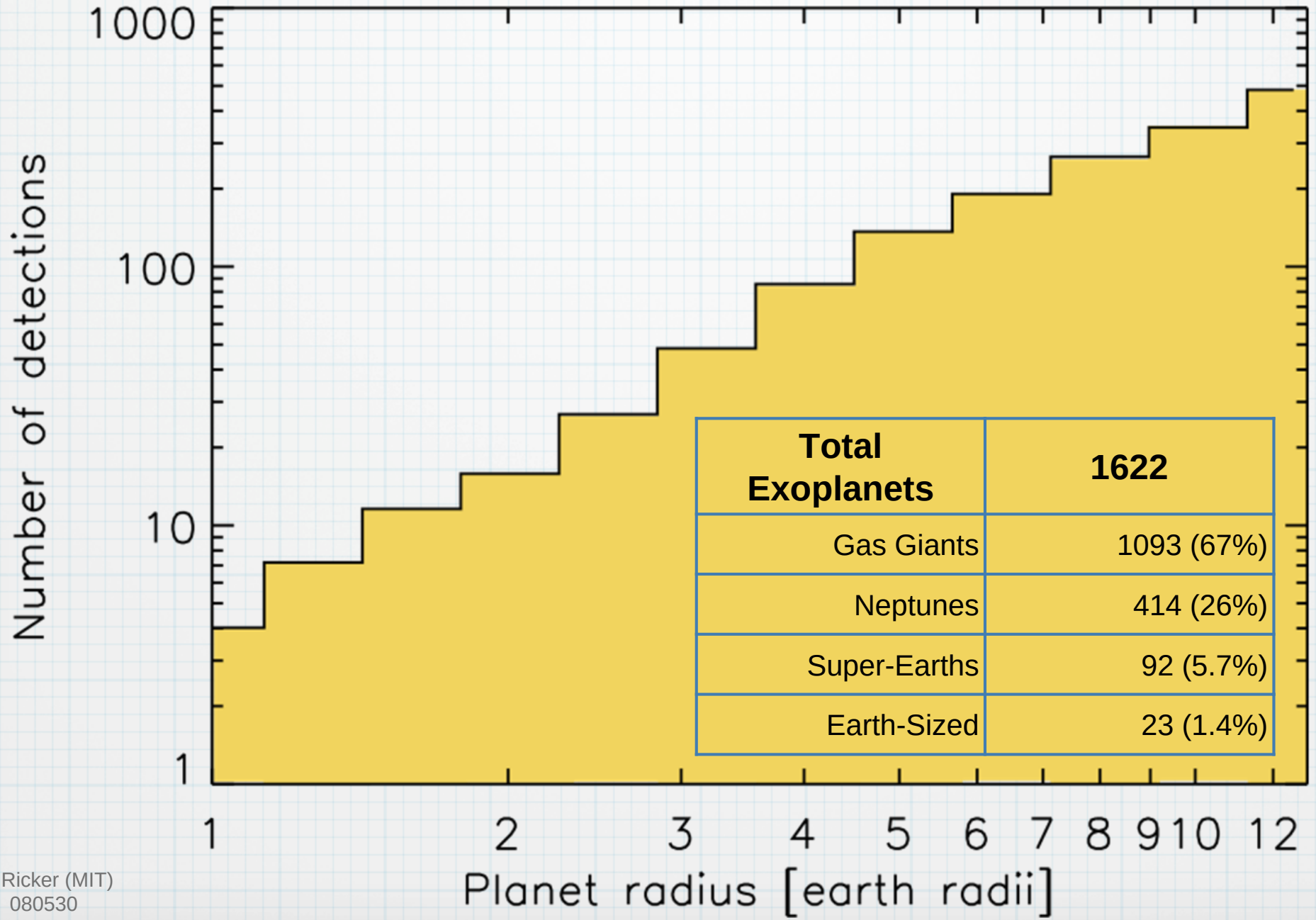
TESS Goals

- **Bright Stars!**
  - FGK dwarfs: V= 4.5-13.5
  - M dwarfs: I < +13
- **All Sky Survey**
  - 40,000 deg^2
  - 2,500,000 target stars
  - Identify ~1000 transiting planets
  - Nearest and brightest for JWST
  - Proposed Jan 2012 launch



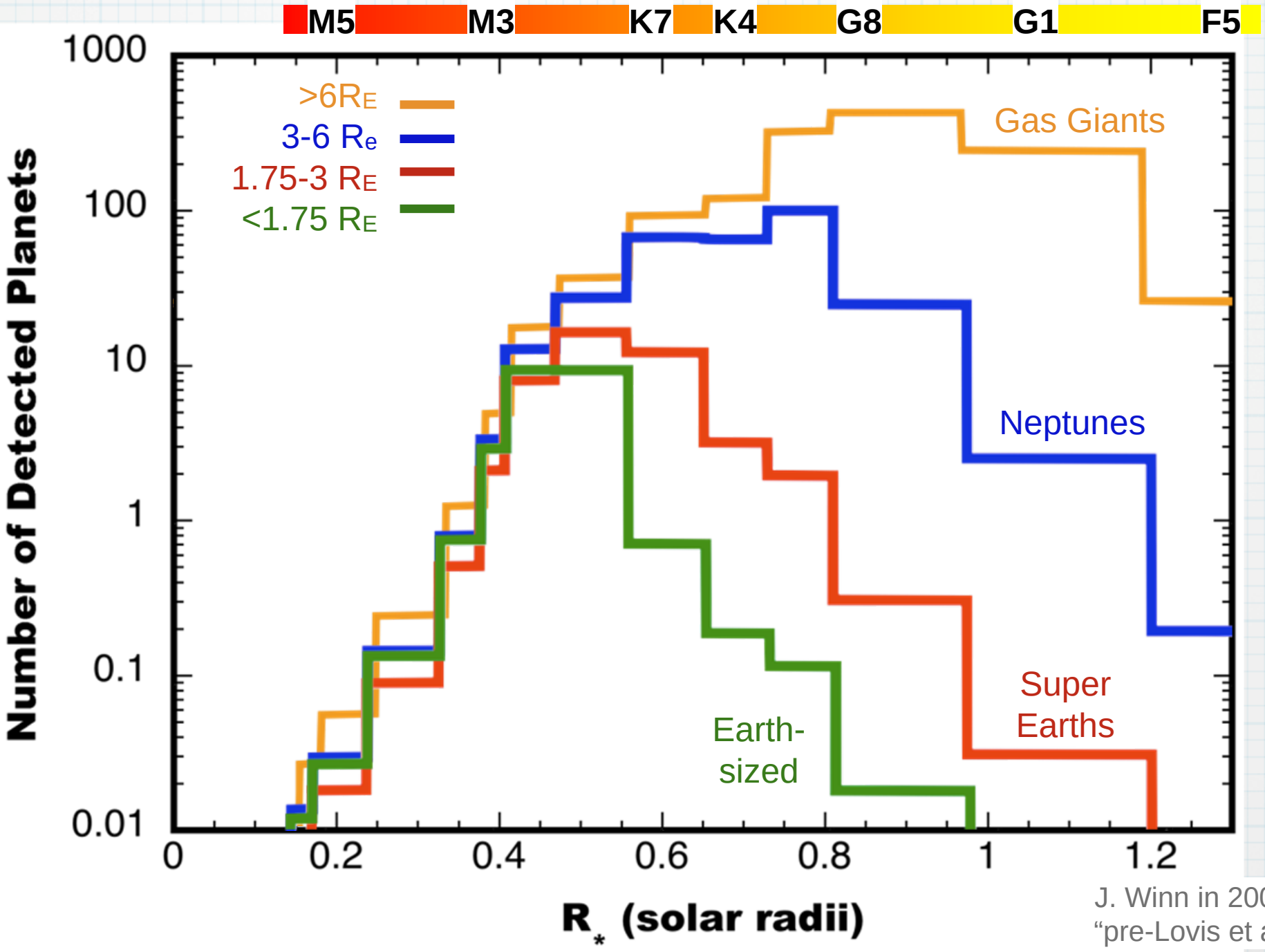
Mission Sky Coverage

Census of TESS detections vs. planetary radius



Total Exoplanets	1622
Gas Giants	1093 (67%)
Neptunes	414 (26%)
Super-Earths	92 (5.7%)
Earth-Sized	23 (1.4%)

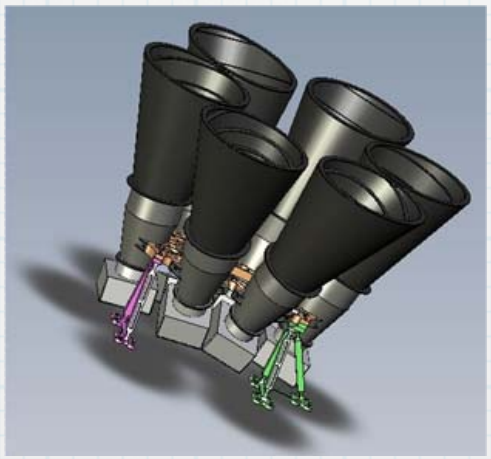
TESS Detections by Stellar Type



J. Winn in 2007; "pre-Lovis et al."

TESS Mission Design

TESS
"all-dressed up"

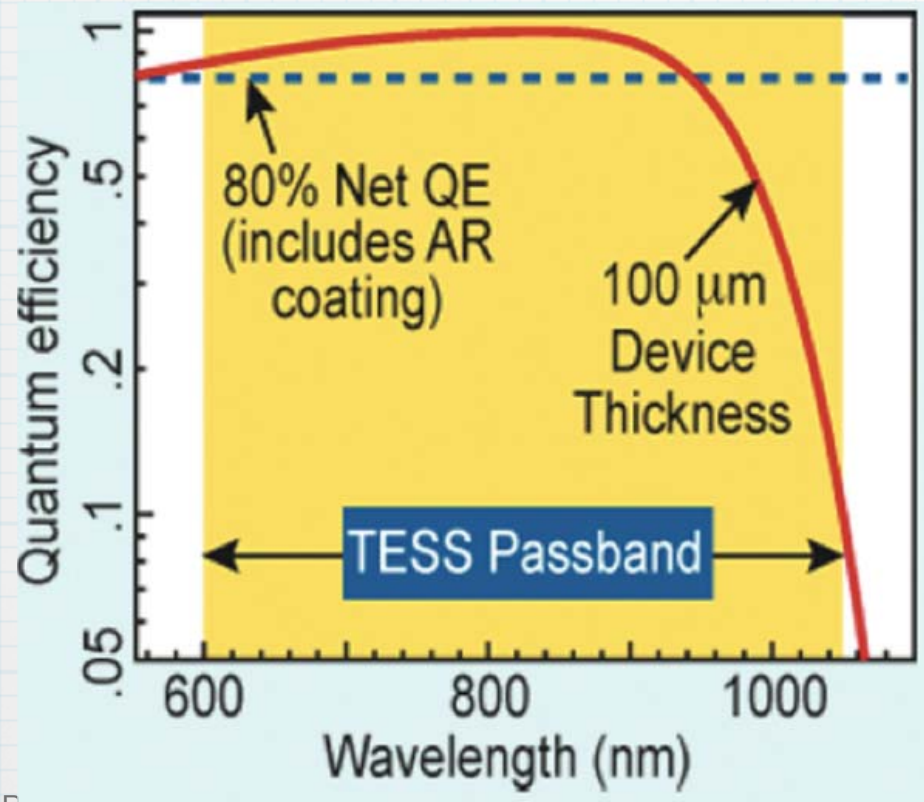


Six Camera Ass'y

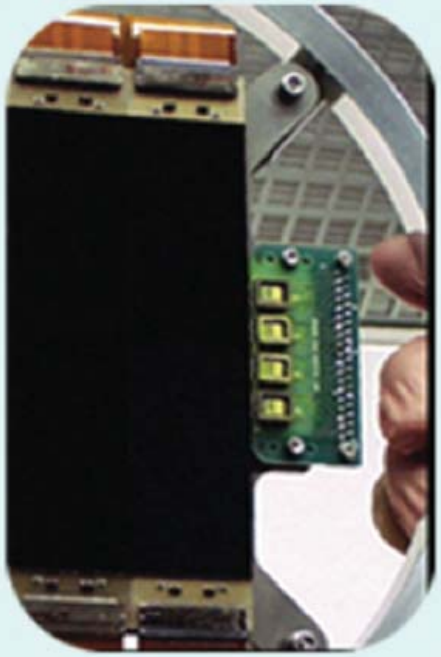
TESS Characteristic	Value or Range
CCD Detectors	Quad MIT/LL CCID-47s (4096x4096 imaging array @ 15μm/pixel)
CCD Mode	Shutterless: 1 s integrate, 2 ms frame transfer
CCD Space Flight History	6 years operation on HETE-2 (as CCID-20) Very low hot pixel rate in equatorial orbit
Lens Design	Petzval 6 element
Lens Aperture	12.7 cm
Pixel Scale	16.3" pixel^{-1}
Camera Field-of-View	18° x 18°
Number of Cameras	6
Ensemble Field-of-View	54° x 36° = 1944 deg^2
Pass Band	600-1000 nm
Sensitivity (I band)	I = 11.7 (600s integration, S/N = 1000)
Photometric Precision (1σ)	190 μmag at I=+8 in 600s
Data Downlink Rate	10 Gbytes day^{-1}
Launch Date	2012
Survey Duration	2 years for All Sky

MIT/LL CCDs Selected for TESS

- **MIT/LL CCID20 variant:** 4K x 4K imager; 15 μm x 15 μm pixels
- **Live Time: >99%**
  - 1s integration
  - Frame store with 2ms transfer
- **Flight qualified on HETE-2**
  - Very low hot pixel rate in equatorial orbit



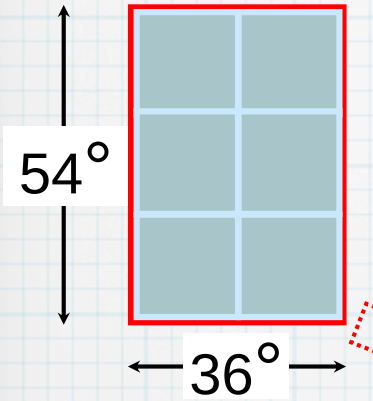
Dual CCDs with
Hybrid Video Circuits



2 x 2 Arrays
of MIT/LL
CCID20 Sensors

TESS "Stare & Step" Survey

Array of
Six Cameras



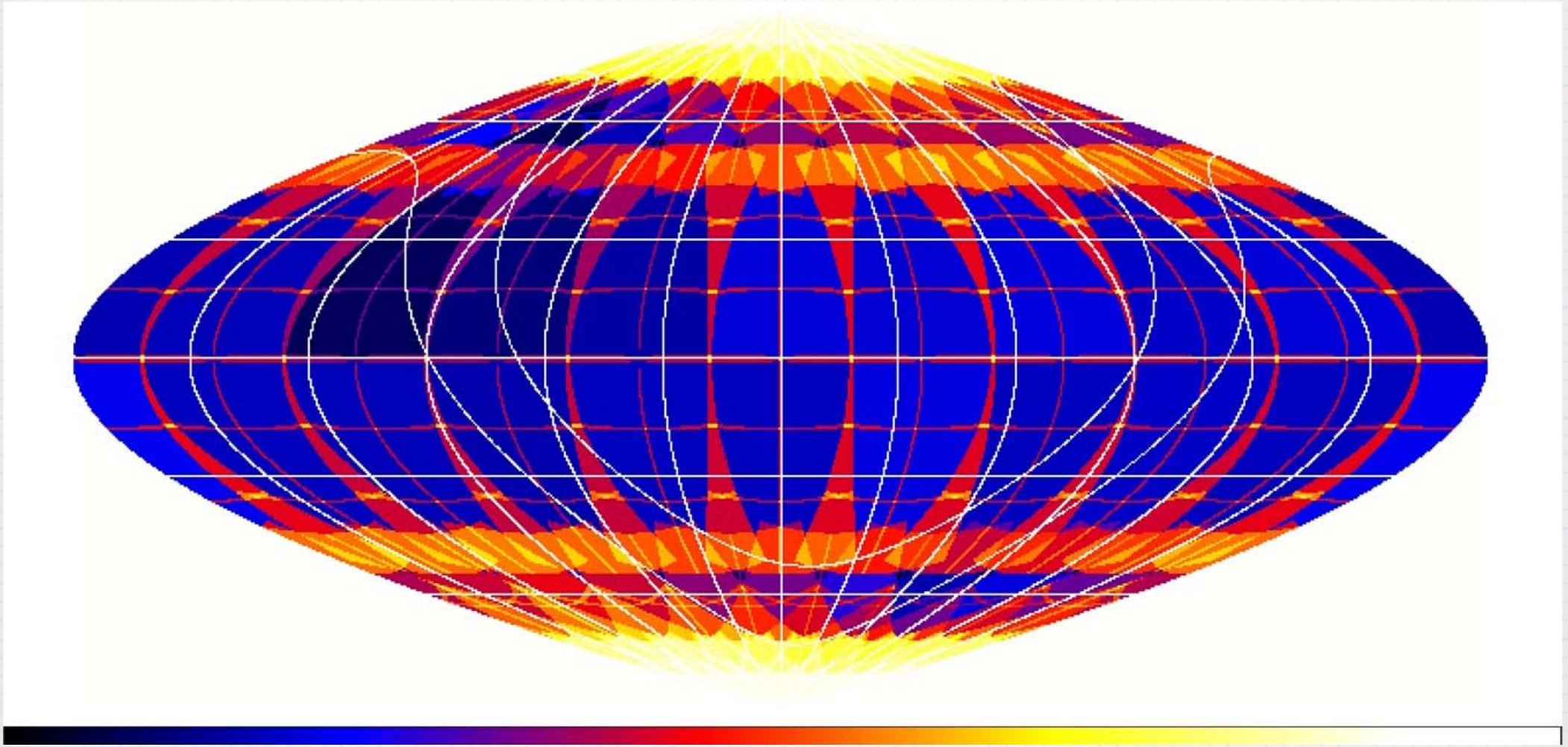
Sky Coverage:
~6000 sq. deg. per 96 min orbit

t_{int}=600s

t_{int}=600s

t_{int}=600s

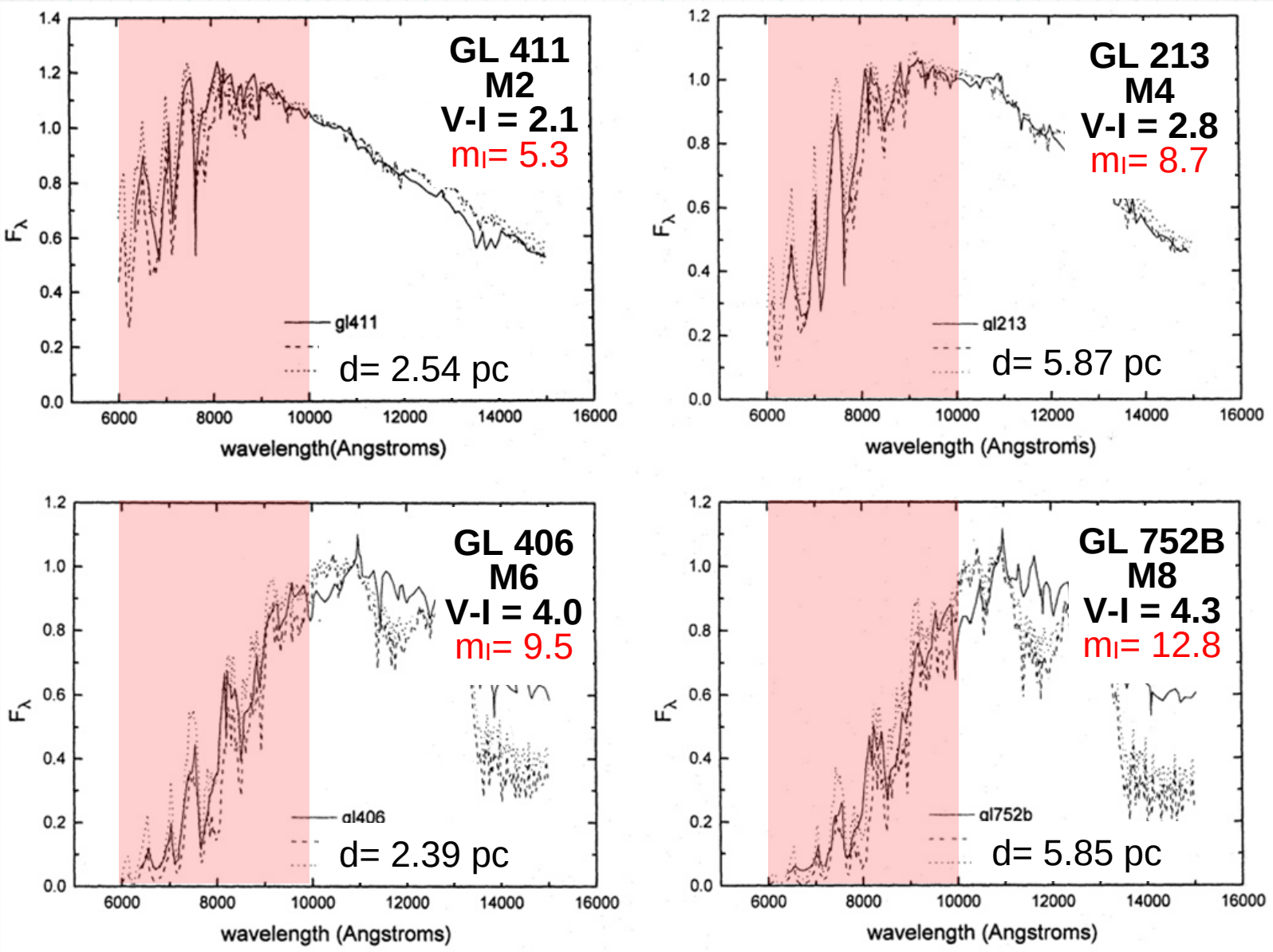
TESS 2 yr Sky Coverage in Celestial Coordinates



total time of exposure (in seconds) in a Two Year Mission

The TESS pointing strategy results in the exposure map shown here. Plotted are the total time of exposure (in seconds) of each part of the celestial sphere during the baseline two-year TESS mission as a function of right ascension (horizontal axis) and declination. The two curved white lines indicate a ±10° band along the Galactic Equator.

M Dwarf Spectra & TESS Passband

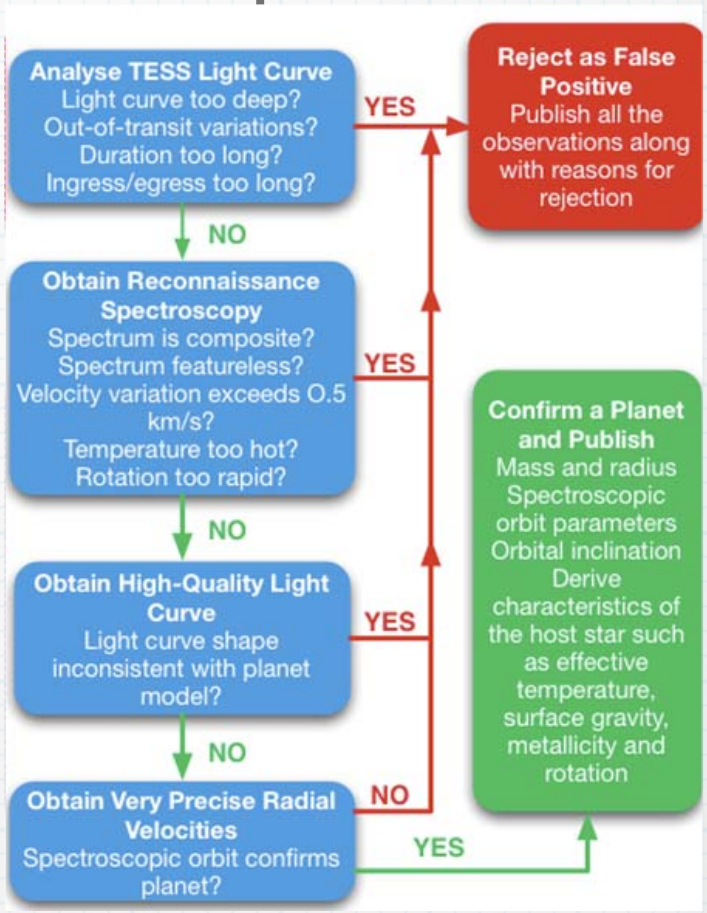


TESS Follow Up Plans & Contributors

Contributors

Harvard
SAO
Las Cumbres Observatory
Tokyo Inst of Tech
SUPAERO
Geneva Observatory

Followup Decision Tree



Observing Facilities

LCOGT (1m x 18; 0.4m x 40)
FLWO (1.5m + TRES)
Euler (1m + Coralie)
Magellan (6.5m x 2)
HARPS-S
HARPS-NEF

We hope you agree that TESS should have a high priority

TESS Science Team

Name	Institution	TESS Responsibility
G. R. Ricker	MIT	Principal Investigator
D. W. Latham	CfA	Chief Mission Scientist; Follow-up science
K. A. Ennico	NASA Ames	NASA Project Scientist
R. Vanderspek	MIT	Payload Project Scientist; SOC Manager
G. Bakos	CfA	Transit detection algorithms
T.M. Brown	Los Cumbres	LCOGT spectroscopic & photometric follow-up
A.J. Burgasser	MIT	Target selection; MIT IR follow-up
L.D. Deming	NASA GSFC	JWST spectroscopic follow-up
J. P. Doty	Espace/ MIT	Payload systems engineer; SOC staff
E.W. Dunham	Lowell Observatory	Optical Design; Camera ground testing; SOFIA followup
J. L. Elliot	MIT	MIT follow-up photometry
M.J. Holman	CfA	CfA photometric follow-up (Mt. Hopkins)
S. Ida	Tokyo Tech	Theory of exoplanets
J.M. Jenkins	SETI	Adaptation of Kepler transit detection methods
J.G. Jernigan	Espace	Transit algorithms; SEO Serendipitous Science
N. Kawai	Tokyo Tech	Ground followup
J.J. Lissauer	NASA Ames	Theory of exoplanets
F. Martel	Espace/ MIT	Ground station network manager
D.D. Sasselov	CfA	Modeling of super-Earths; HARPS-N facility
R. H. Schingler	NASA Ames	Partnership and Public Participation Manager
S. Seager	MIT	Exoplanet modeling; SC Lead; JWST follow-up
G. Torres	CfA	CfA spectroscopic follow-up
S. Udry	Geneva Observatory	Radial velocity follow-up with Coralie and HARPS-S
J.S. Villasenor	MIT	CCD Scientist; SOC staff
J. N. Winn	MIT	Light curve analysis; MIT follow-up photometry