Recent results of the Next Generation Transit Survey (NGTS)

Philipp Eigmüller, DLR Berlin, (TU Berlin)

PIs:

Mike Goad (University of Leicester)

Don Pollacco (University of Warwick)

Didier Queloz (University of Cambridge)

Heike Rauer (DLR Berlin)

Stéphane Udry (Université de Genève)

Christopher Watson (Queens University Belfast)

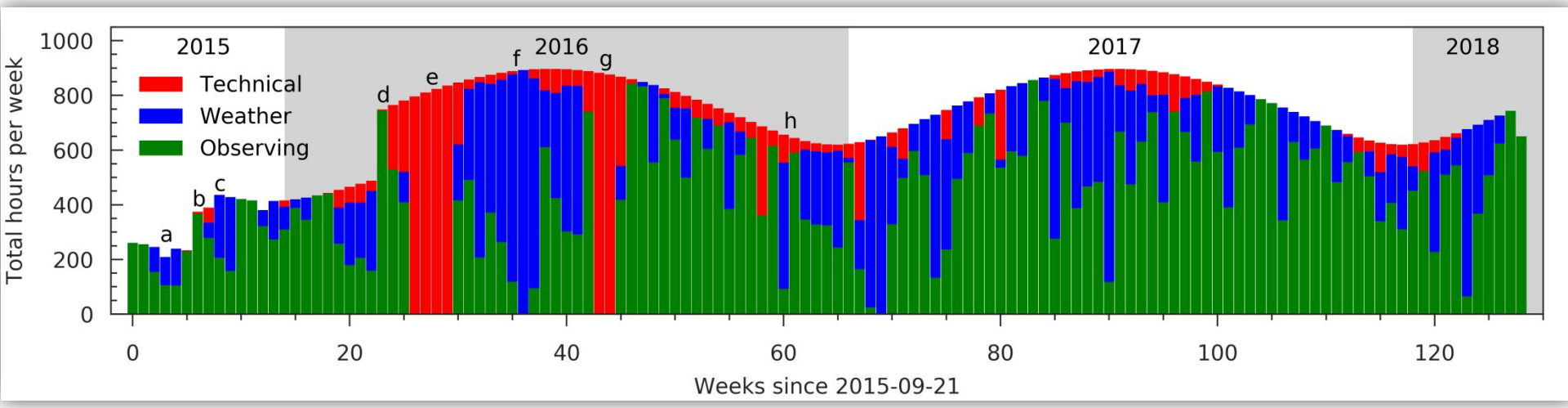
Richard West (University of Warwick)

Pete Wheatley (University of Warwick)

Instrument Setup

Parameter	Value
No. of Telescopes	12
Aperture	200mm
Filter	520nm - 890nm
Focal Ratio	f/2.8
Field of View	8 deg² / telescope
CCD	Andor IKON-L
CCD-size	2048 x 2048 pixel
Pixel size	13.5µm
Pixel scale	5 arcsec / pixel
CCD cooling	4 Stage Peltier (-70°C)

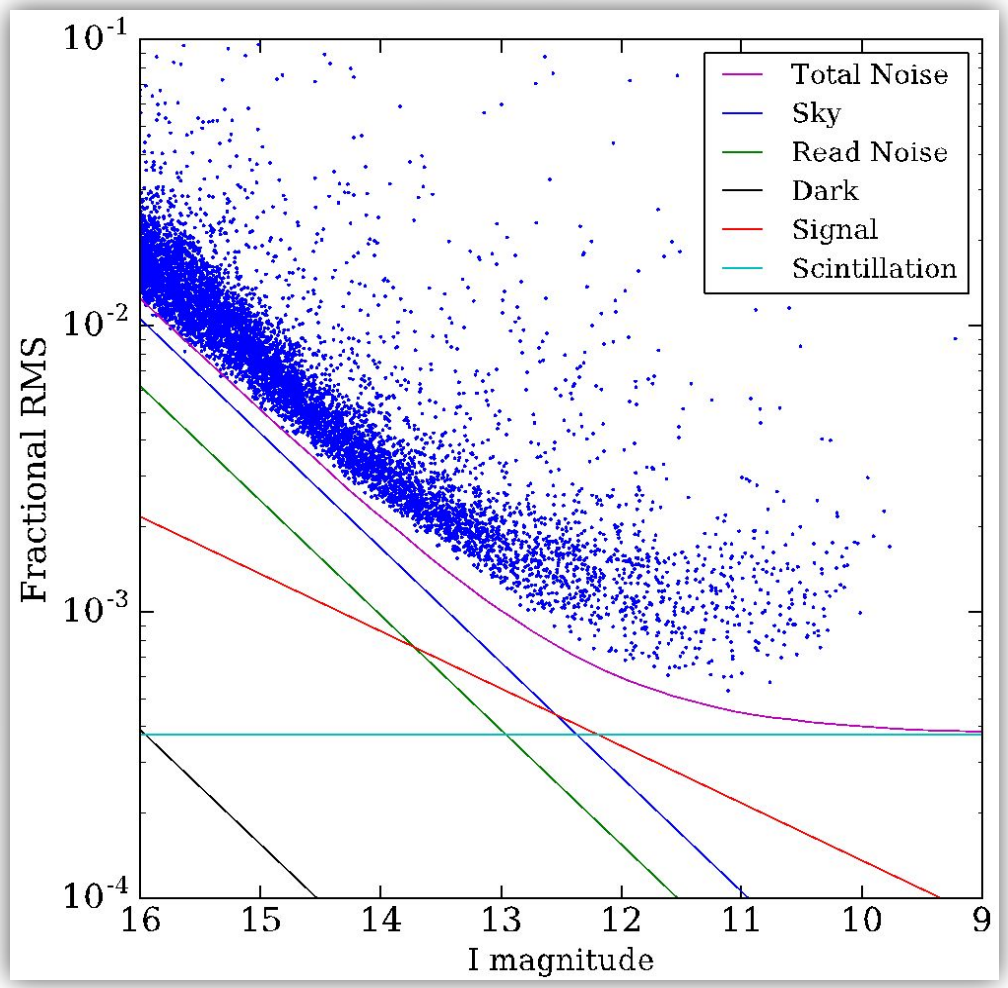
Survey Status



71 fields
12,328,254 images
595,895 sources
1.1×10^{11} data points

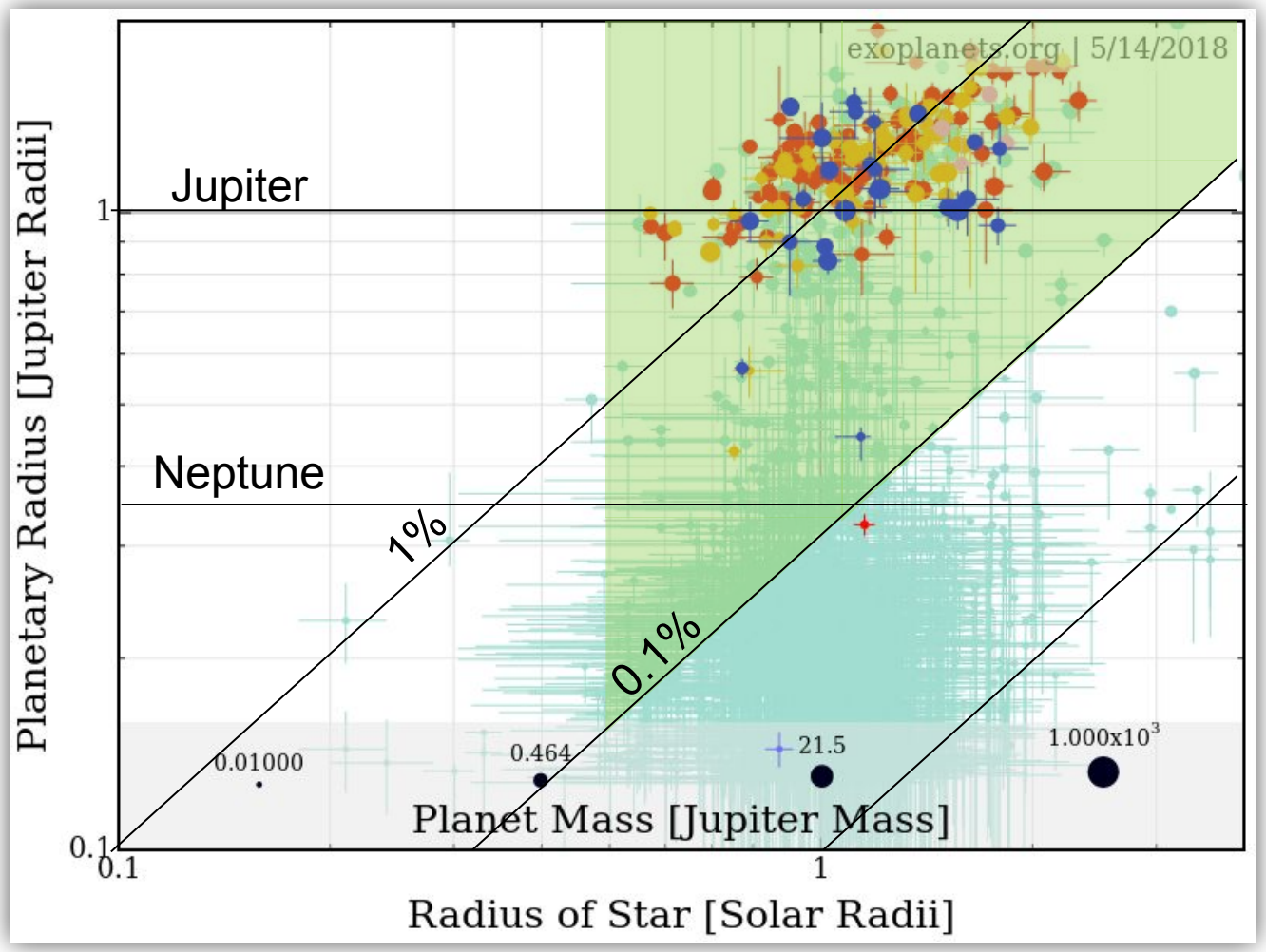
Phased start 2015/16
Technical / Weather issues 2016
Improved observability 2017/18

NGTS Photometric precision



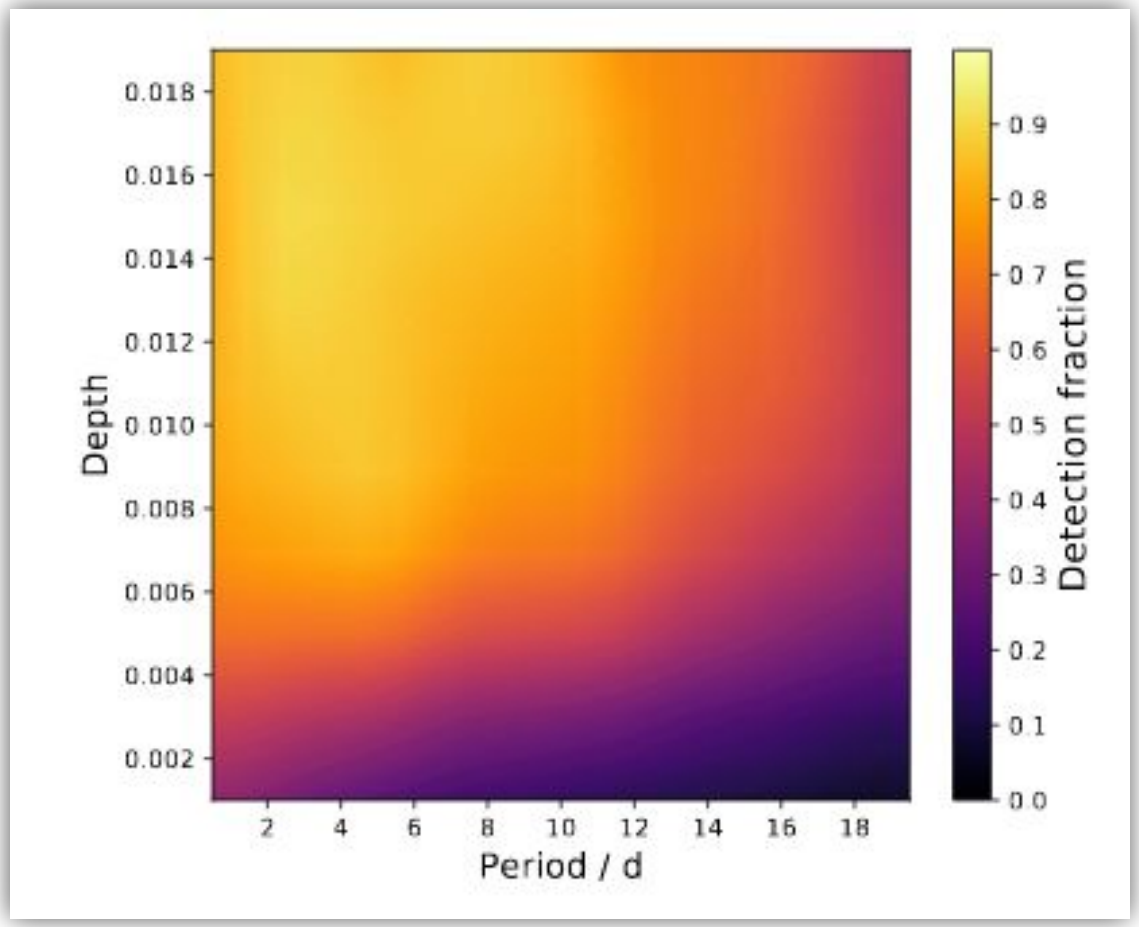
Example noise characteristics on 1h timescale over 156 nights , 695 hours, 208 500 images with 12s cadence

Discovery space of NGTS



WAS
P
HAT
KELT
Kepler
CoRot

NGTS detection efficiency

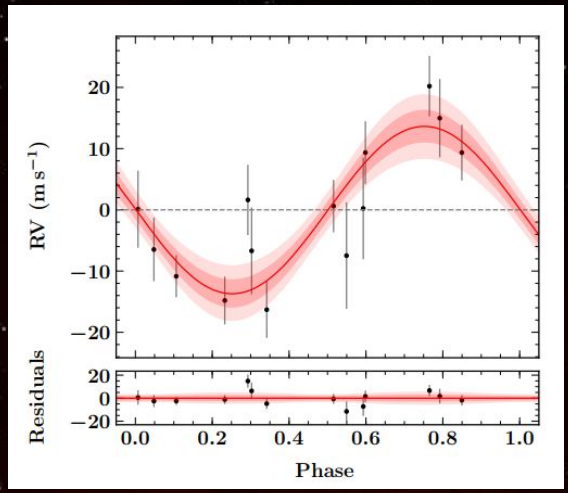


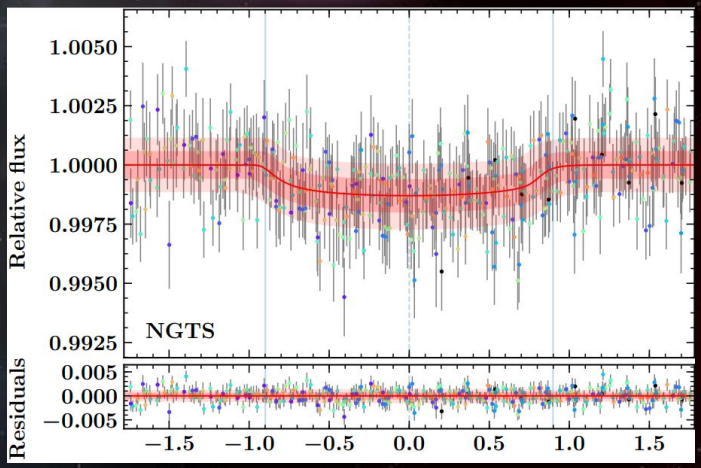
Artificial transits included into original data, and tried to retrieve

NGTS-4b

Next-Generation Transit Survey

- First Neptune discovered by NGTS





Star		Planet	
Teff	5143	Period	1,34
[M/H]	-0,28	a [AU]	0,019
log g	4,5	T_{eq}	1650
M_S [M_{Sun}]	0,75	M_P [M_E]	20,6
R_S [R_{Sun}]	0,84	R_P [R_E]	3,18

Credit: University of Warwick & Mark Garlick

West et al. 2018 (submitted arXiv)

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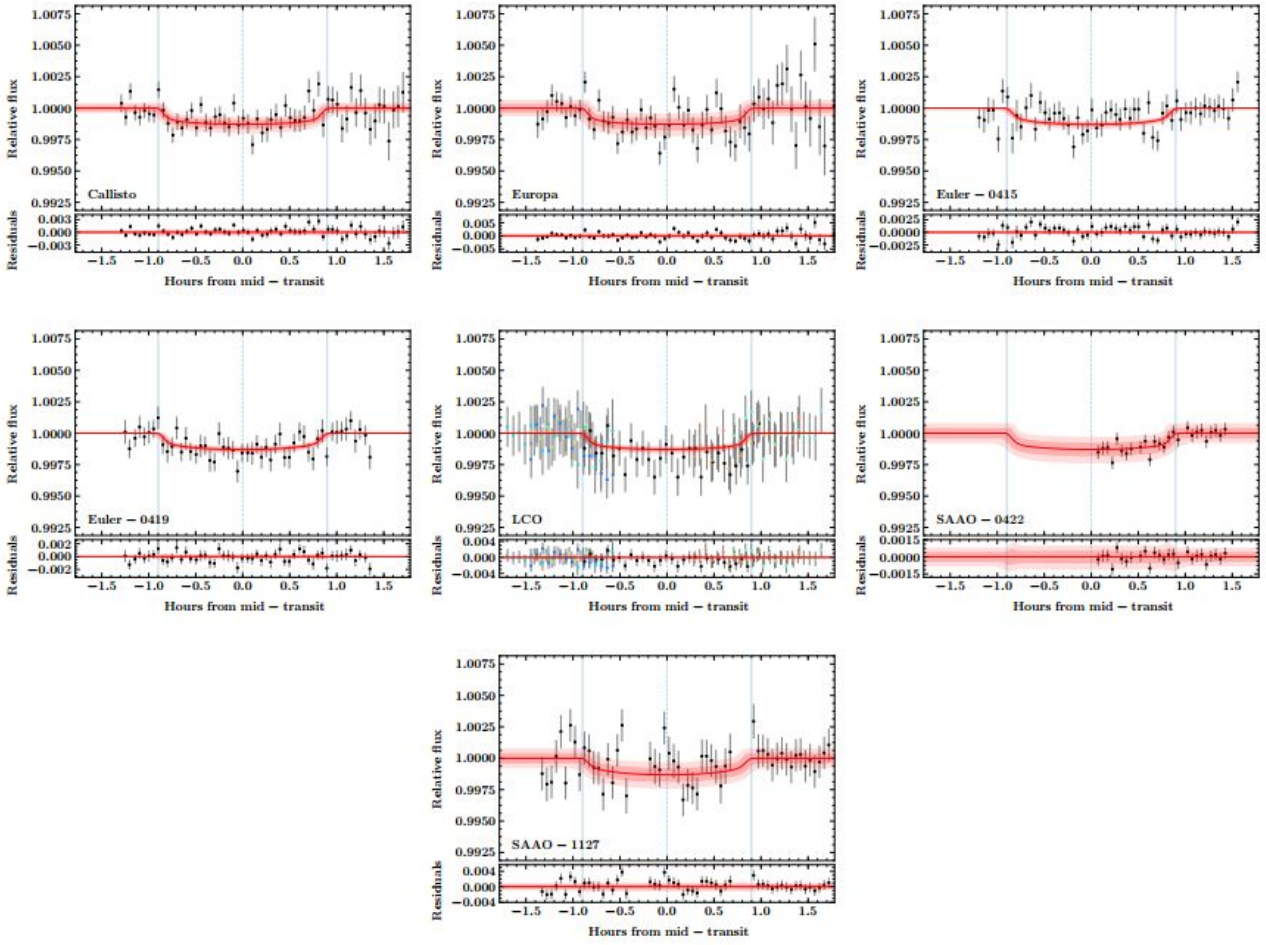
NGTS - 4b
Photometric Follow-Up Observation



NGTS - 4b

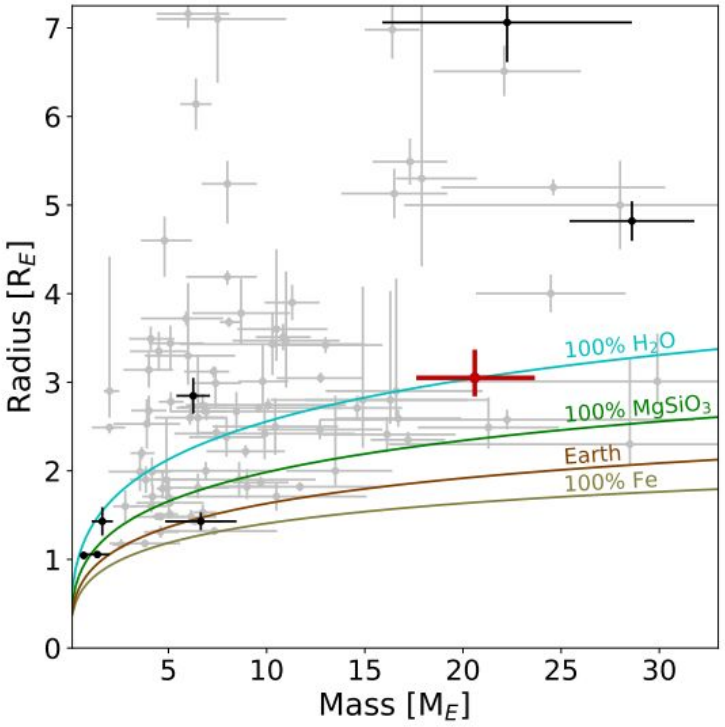


Figure 6. The mass and radius for all known transiting planets that have fractional errors on the measured planet mass better than 30 %. The black and grey points show discoveries from ground-based and space-based telescopes respectively. The coloured lines show the theoretical mass-radius relation for solid exoplanets of various compositions (Seager et al. 2007). NGTS-4b is highlighted in red.

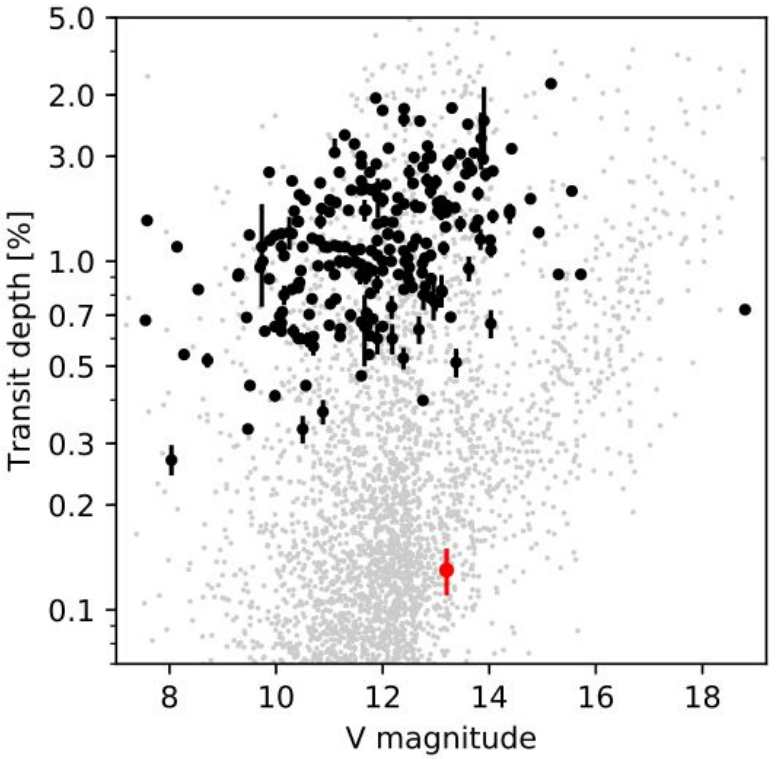
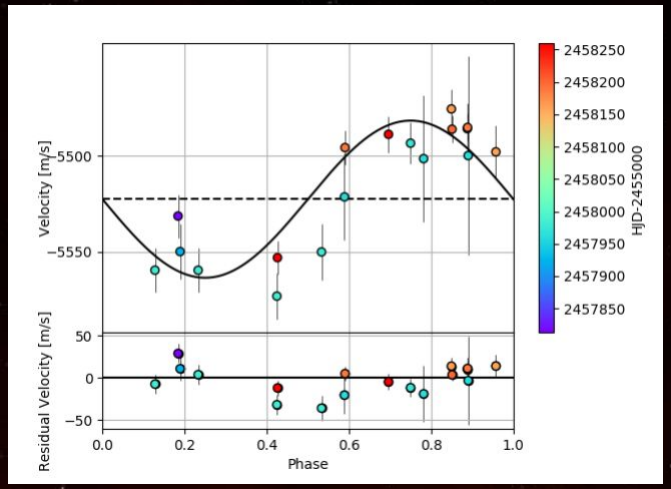


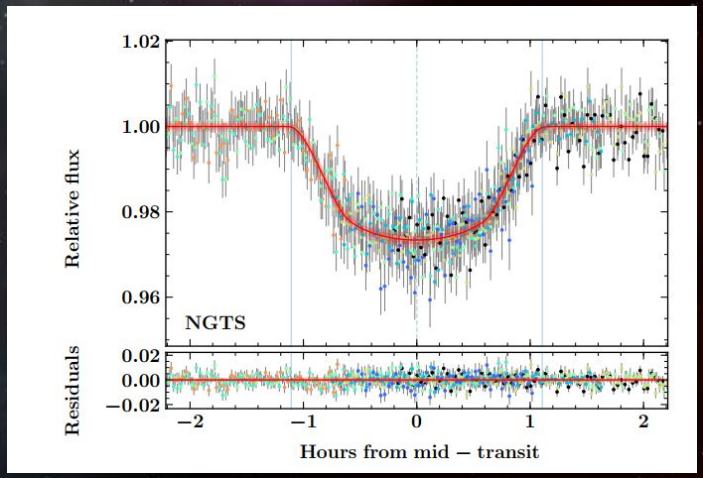
Figure 5. Transit depth versus host star brightness for all transiting exoplanets discovered by wide-field ground-based transit surveys. NGTS-4b is marked in red. Data from NASA Exoplanet Archive (Akeson et al. 2013) accessed on 2018 May 10. The grey dots show the simulated distribution of planet detections from *TESS* (Barclay et al. 2018).

NGTS-5b

NEXT-GENERATION TRANSIT SURVEY

- Low density planet





Star		Planet	
Teff	4987	Period	3,36
[M/H]	0,12	a [AU]	0,038
log g	4,52	T_{eq}	952
M_S [M_{Sun}]	0,661	M_P [M_J]	0,229
R_S [R_{Sun}]	0,739	R_P [R_J]	1,136

Credit: University of Warwick & Mark Garlick

Eigmüller et al. submitted.

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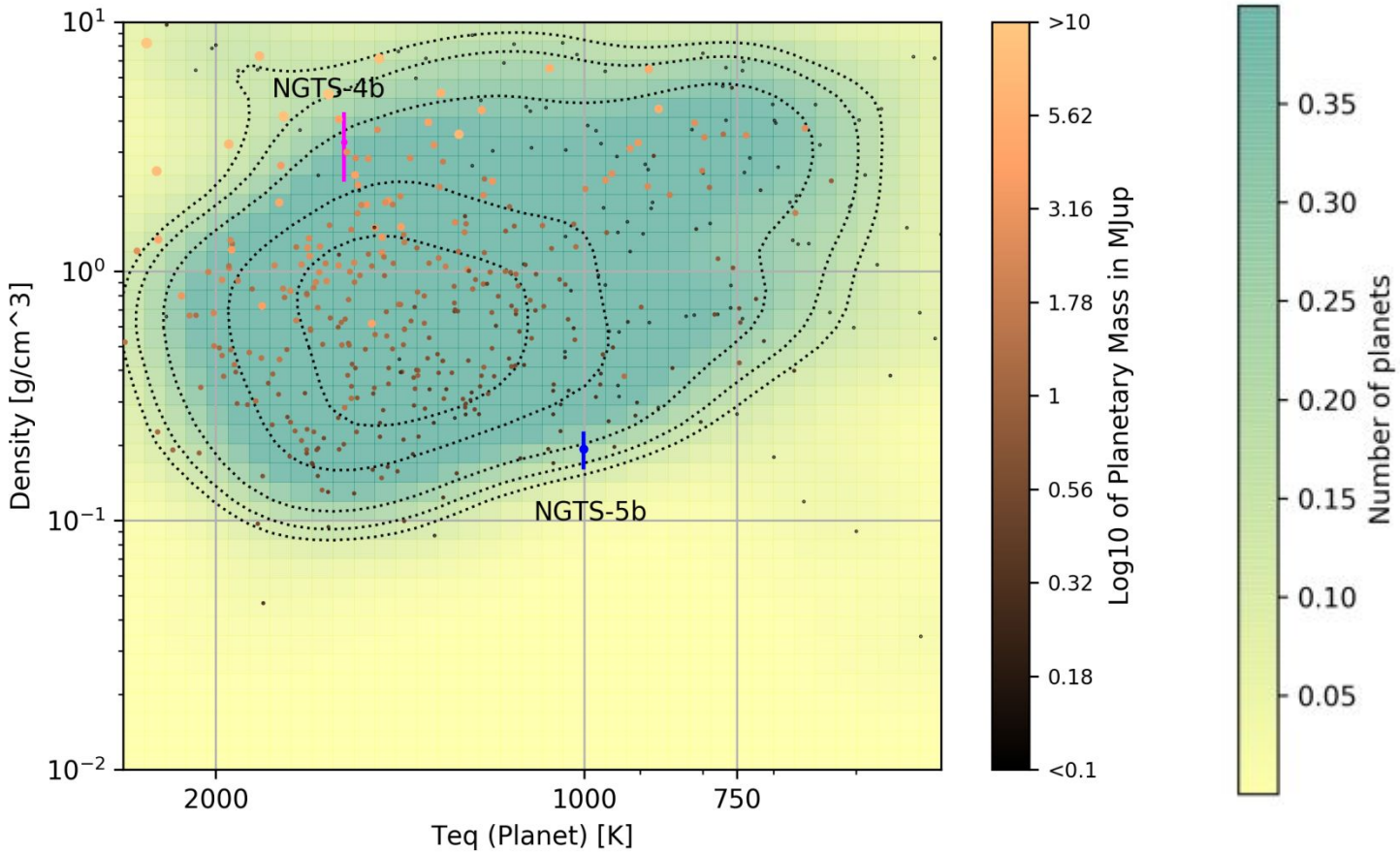
NGTS - 5b

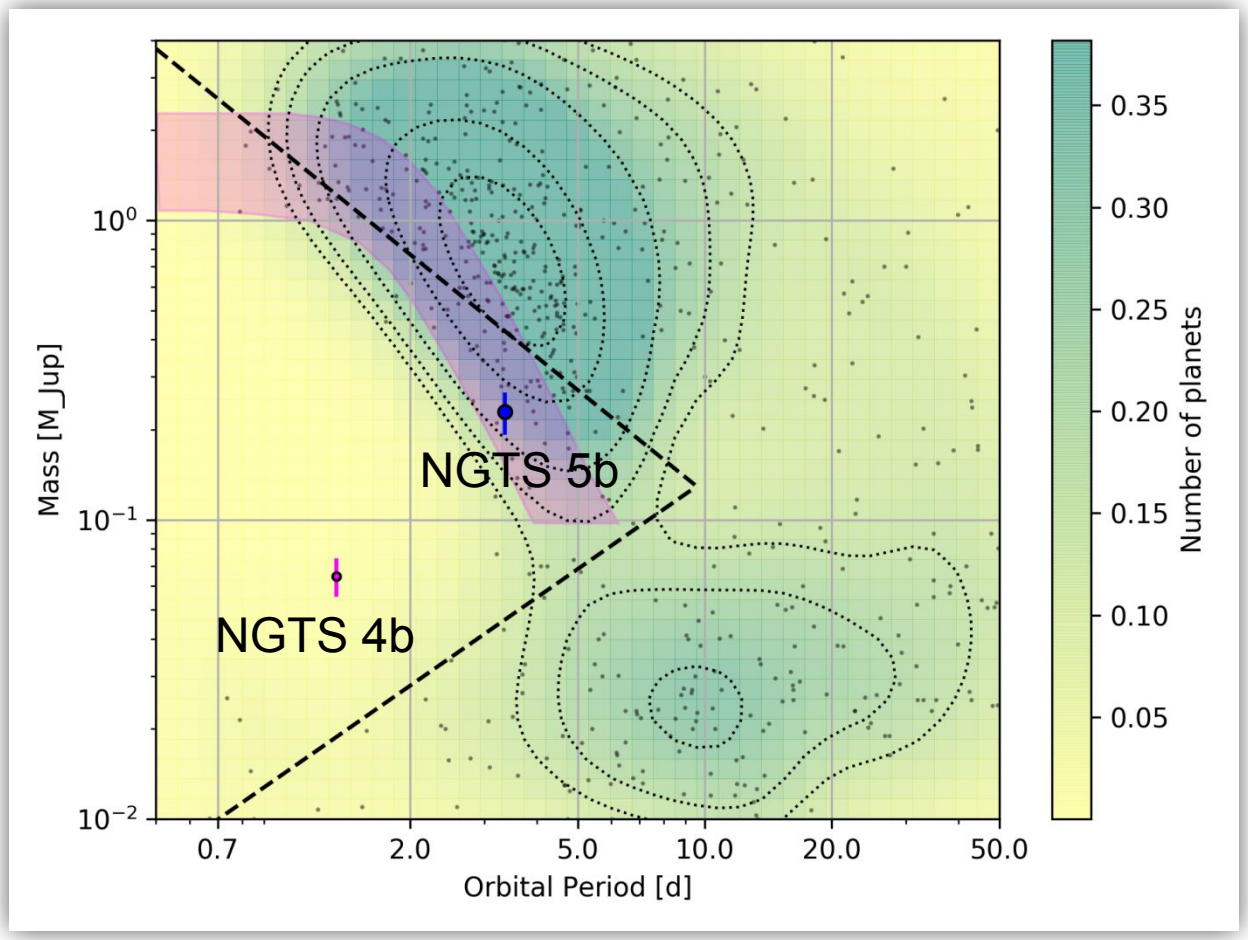

NGTS-4b
NGTS-5b
Density [g/cm^3]
Teq (Planet) [K]
2000
1000
750
Log10 of Planetary Mass in MJup
>10
5.62
3.16
1.78
1
0.56
0.32
0.18
<0.1
Number of planets
0.35
0.30
0.25
0.20
0.15
0.10
0.05

The Sub-Jovian Desert

Border of sub-jovian desert:

Black dashed line:
Mazeh2016+

Magenta region:
Owen&Lai 2018



First NGTS data is public

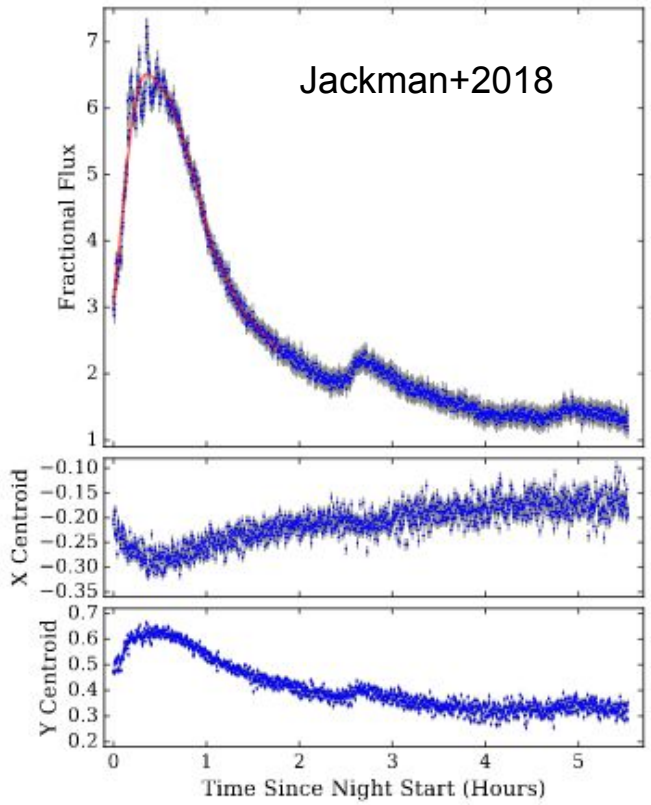
Survey data from
April 2016 to April 2017

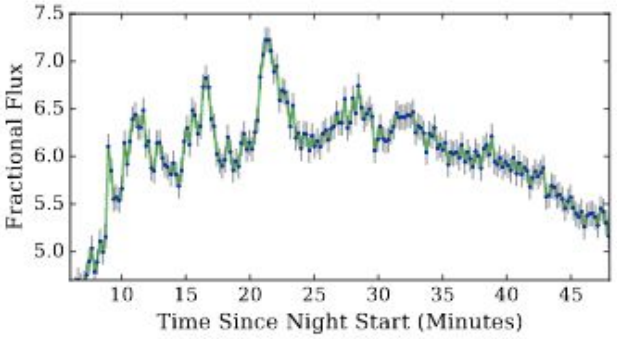
Light curves down to I=16

Available via ESO archive

Future data releases will include
raw images.

- High spatial resolution
- High cadence data
- High photometric precision





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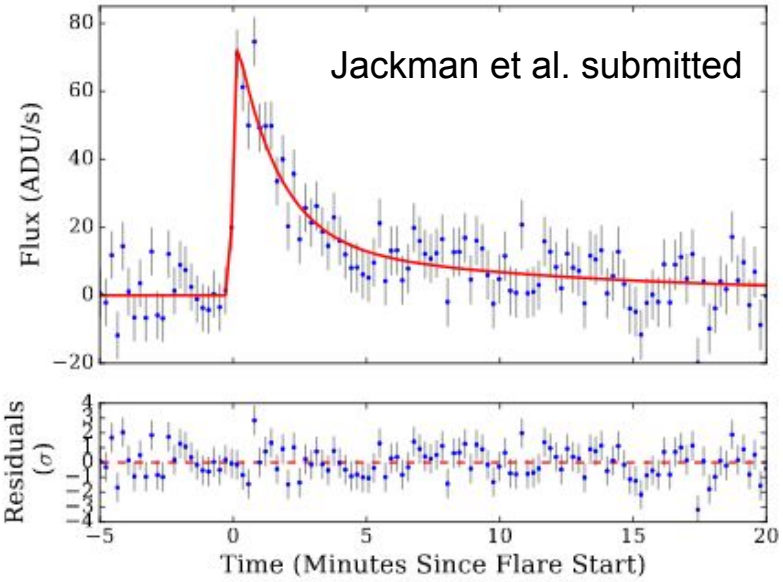
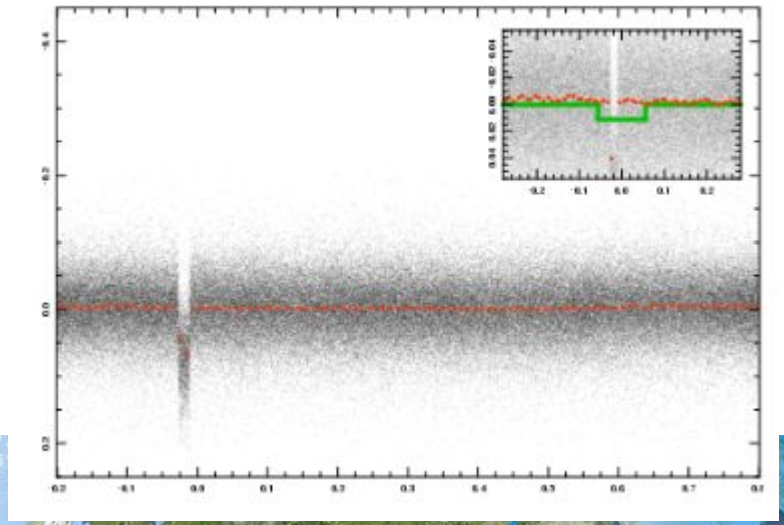
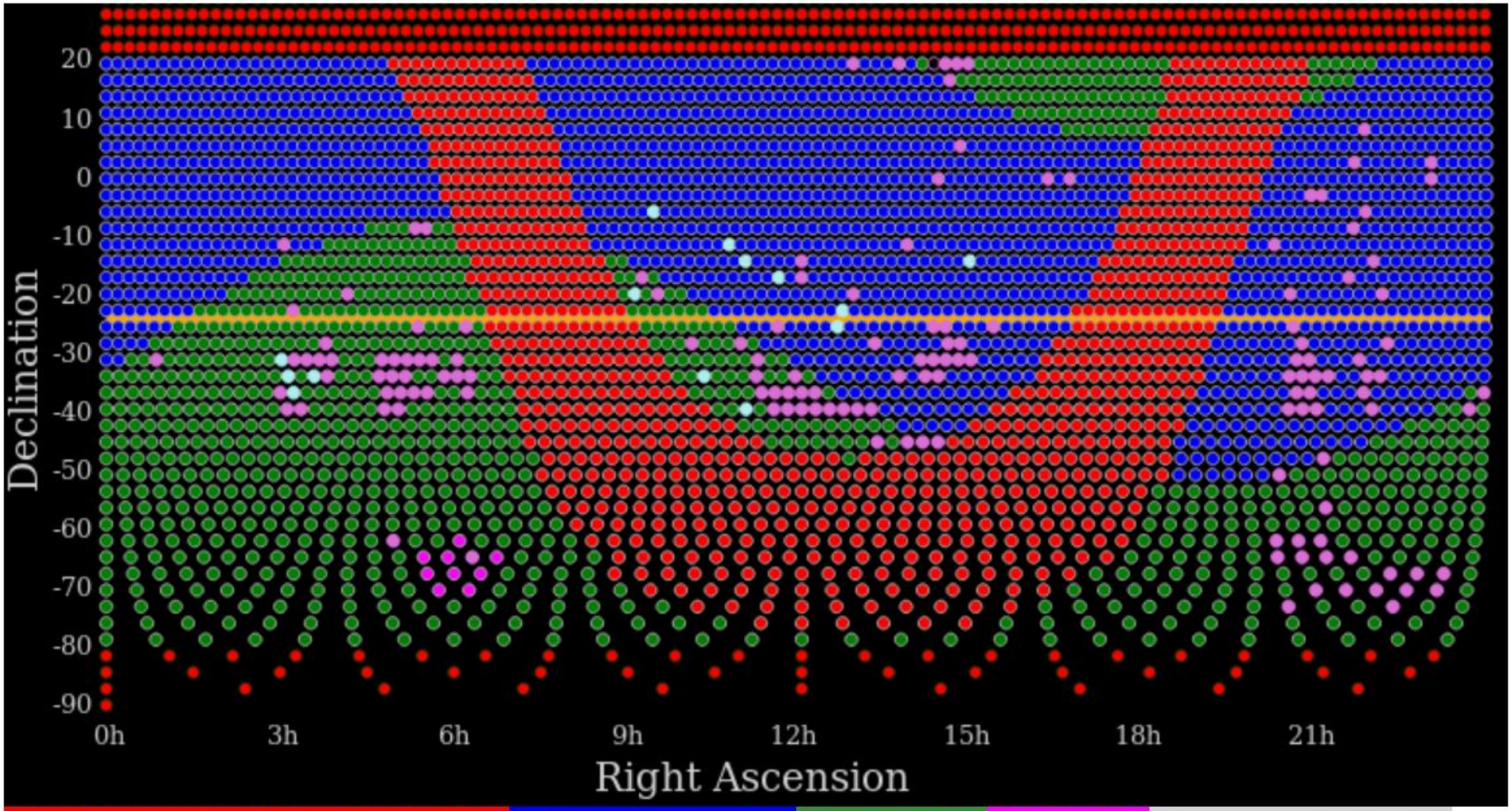




Exoplanet Diversity
DFG SPP-1992

NGTS
Next-Generation Transit Survey



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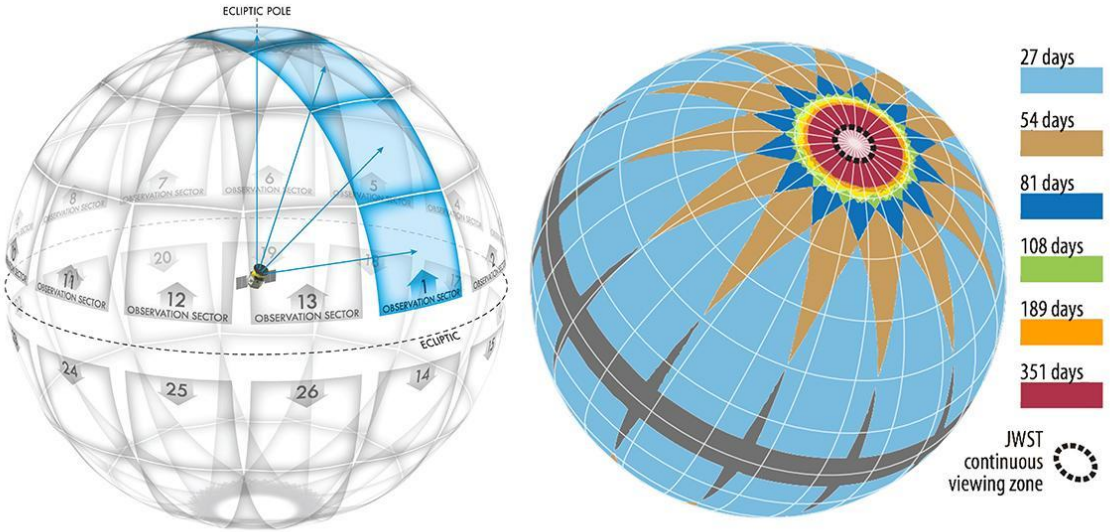
NGTS in TESS era

- 12 high-precision follow up telescopes
- Unravel blend scenarios
- Long period / single transit follow-up
- TTVs / Stellar rotation periods
- Noise in NGTS = TESS at I=12.5 (30 m)
- High spatial resolution



Roland Vanderspek, Massachusetts Institute of Technology

TESS & NGTS

Table 1. Comparison of *TESS* and *NGTS* telescopes/cameras. Combined FOV excludes overlapping regions (BI: back-illuminated, DD: deep depleted, FT: frame-transfer)

Specifications	*TESS*	*NGTS*
Telescopes	$4\times f/1.4$ lenses	$12 \times 4/2.8$ Modified Newtonian
Aperture	10.5cm	20cm
CCDs	$16 \times$ MIT/Lincoln Lab CCID-80 FT-BI-DD	$12 \times 2K \times 2K$ E2V CCD42-40 BI-DD
Focal Plane Format	$4\times(2K \times 2K)$, 15 μm	$2K \times 2K$, 13.5 μm
Bandpass	600-1000nm	500-900nm
Readout time	0	3s
Exposure time	2s raw stacked to 2 or 30 minutes	10s
Plate scale	21 arcsec/pixel	4.97 arcsec/pixel
Single telescope FOV	24×24 deg^2	2.8×2.8 deg^2
Combined FOV	2304 deg^2	95 deg^2