Fernando Alvarez

# TAOS-II

## Transneptunian Automated Occultation Survey

- Located at San Pedro Martir Observatory.
- Three 1.3 m F/4 telescopes.
- CMOS Cameras.
- 20 Hz Imaging.
- 2.3 square degree field.

- ~10,000 stars per field.
- 3 Fields per night.
- Limit Magnitude R = 16.
- ~ 2.5 Tb data per night.

instituto de astronomía unam

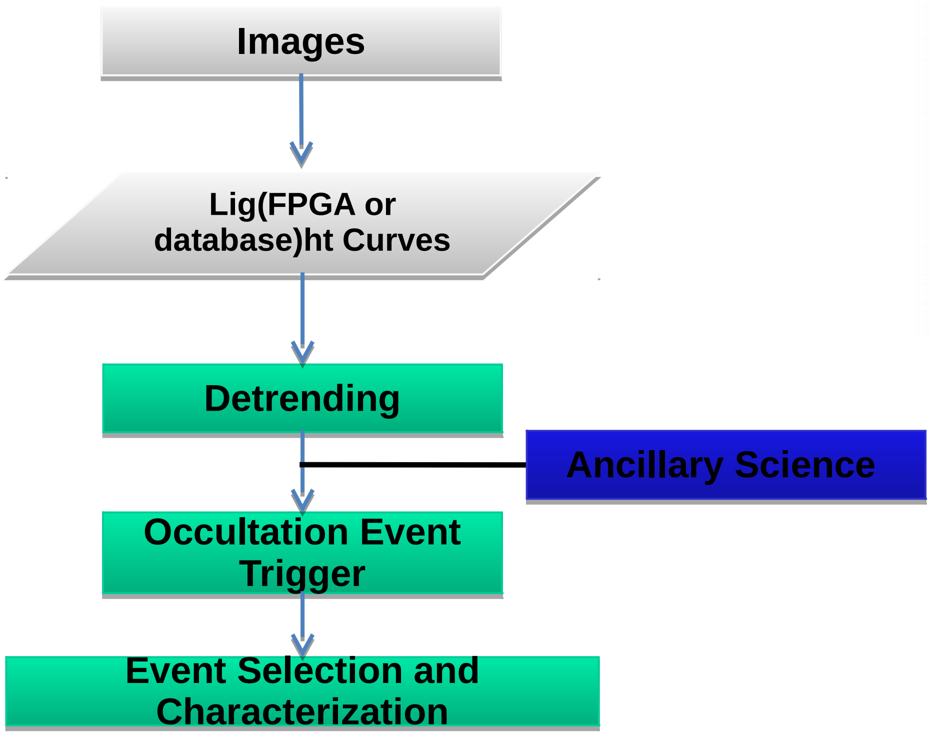
ASIAA

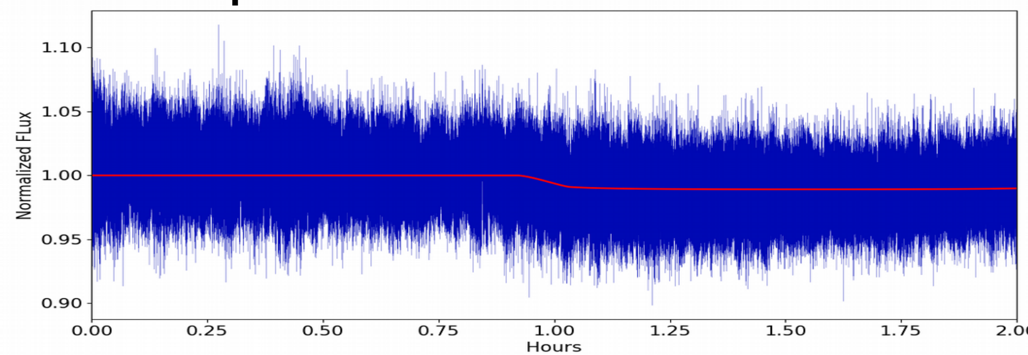
CfA

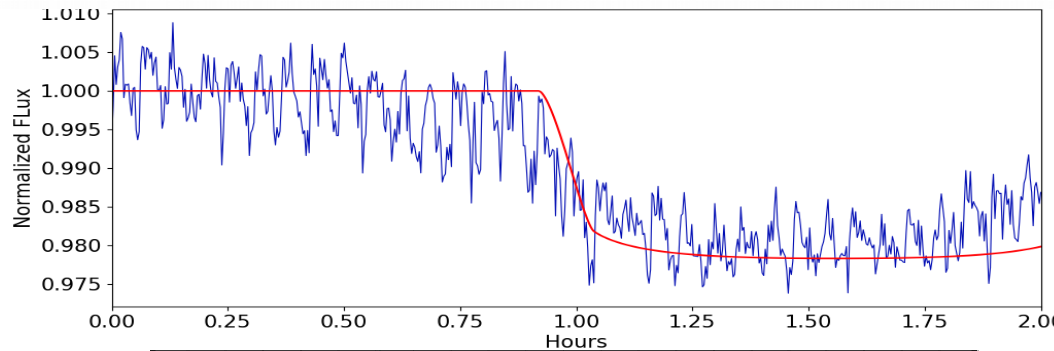
Canada NRC·CNRC

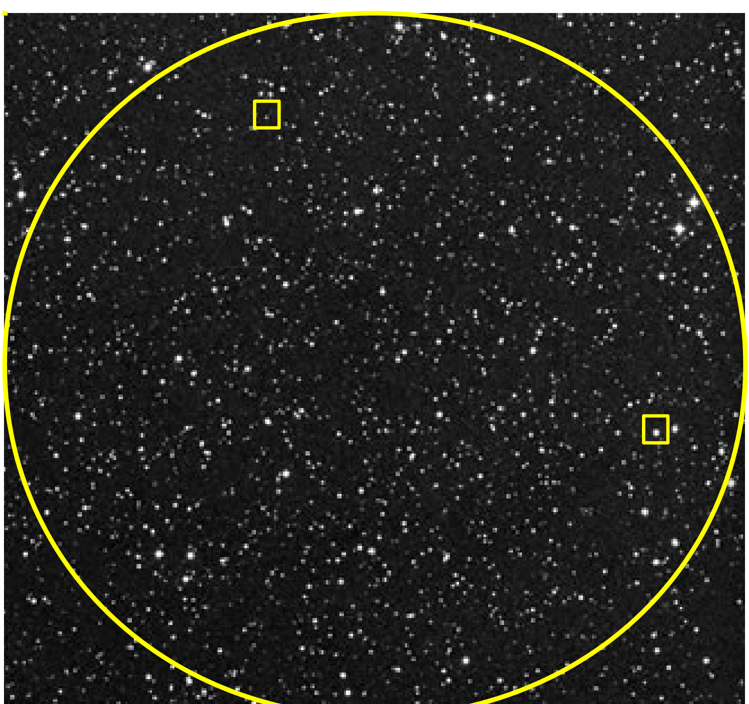
NRC

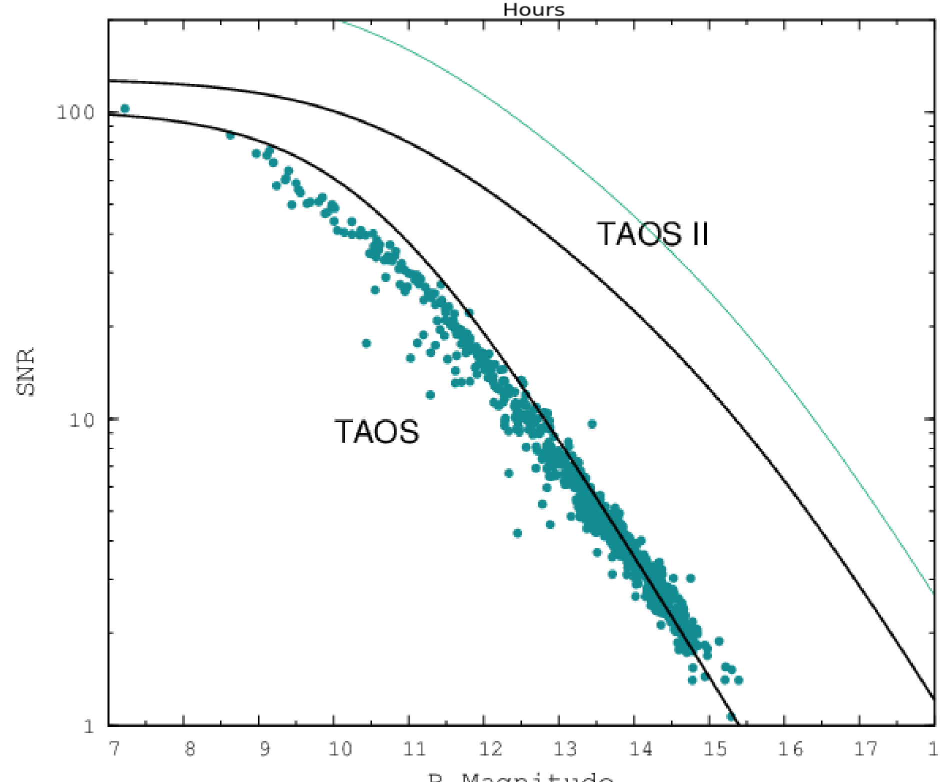
# We'll be able to detect exoplanet transits?



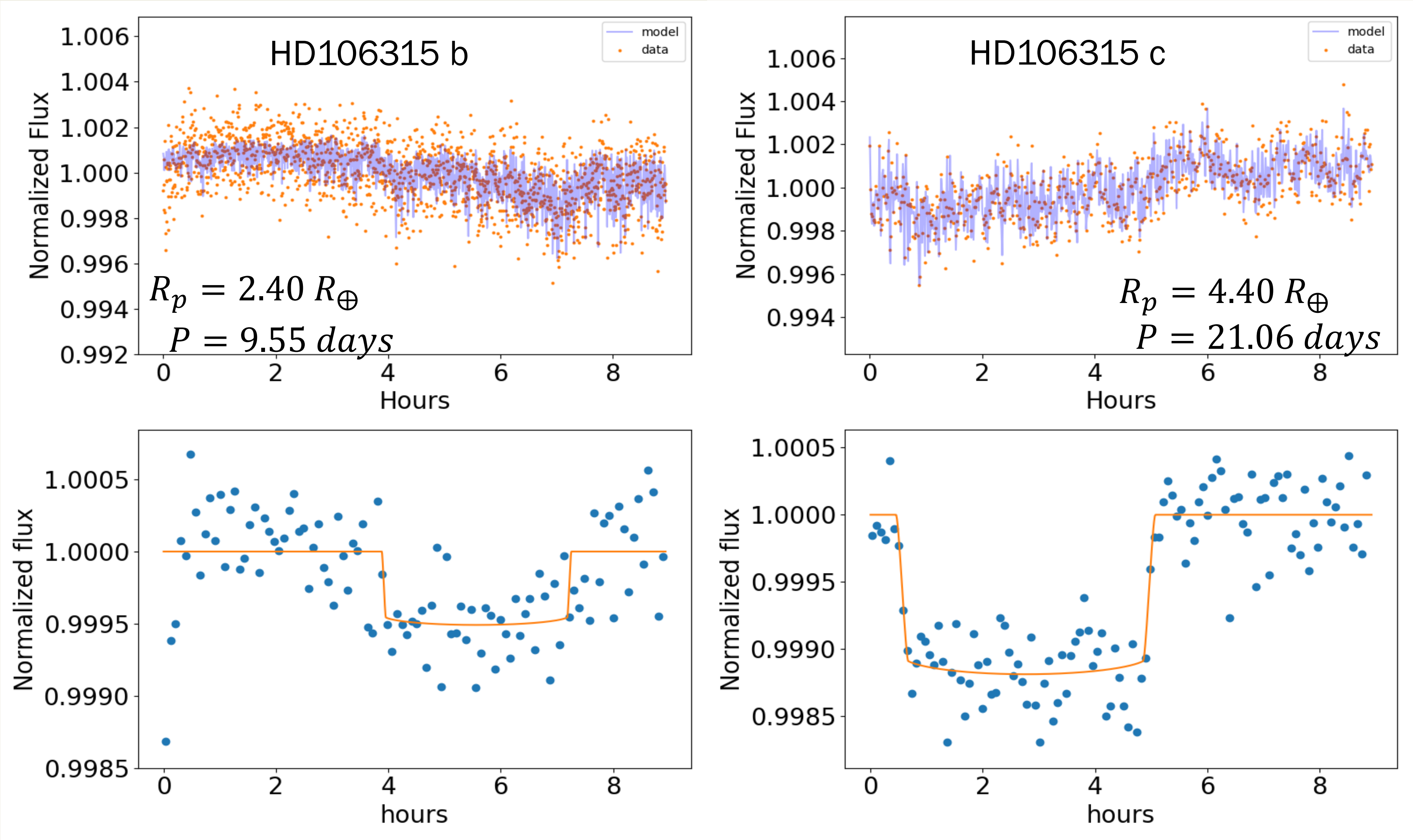





# Analyzing Spitzer follow-up data of K2 planets in preparation for the transition to TESS

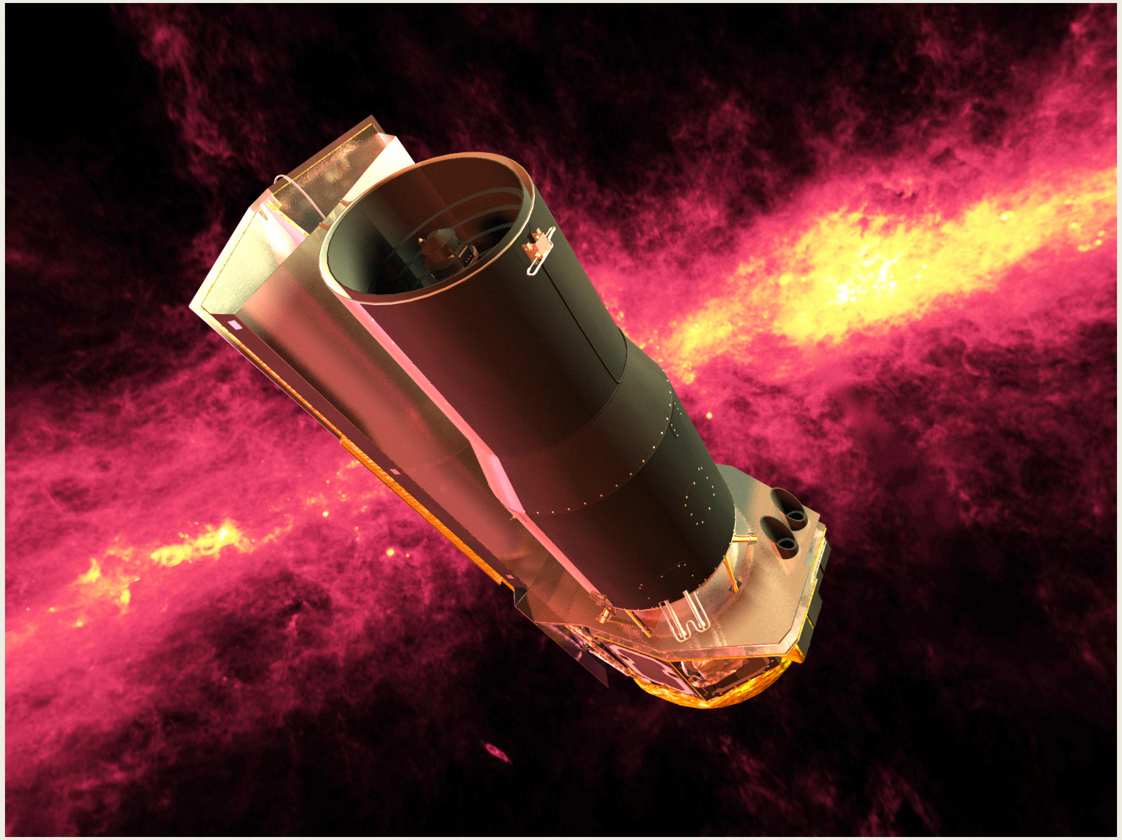



HD106315
V = 8.97 mag
PI: Mike Werner

David Berardo
MIT
Advisor: Ian Crossfield

# Analyzing Spitzer follow-up data of K2 planets in preparation for the transition to TESS

550 hour proposal accepted for Spitzer follow up of TESS data (PI: Ian Crossfield)



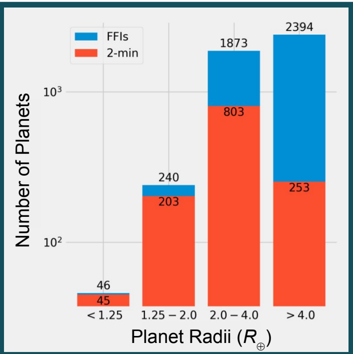
# A Validation Tool for TESS Exoplanet Candidates

Steven Giacalone[1,2] and Courtney D. Dressing[1]

[1]UC Berkeley Department of Astronomy [2]steven_giacalone@berkeley.edu

## Expected TESS Planet Yield

TESS is expected to detect thousands of exoplanets and even more eclipsing binaries.



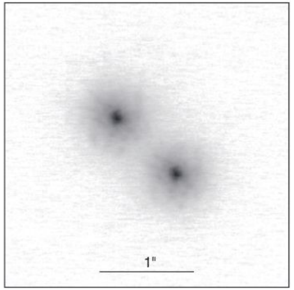

Credit: Barclay et al. 2018

## Leveraging Follow-Up Observations

Unknown star properties and the presence of binary companions can be revealed using follow-up high-resolution imaging, spectroscopy, and photometry.

KOI 2174

Keck/NIRC2 0.01''/pixel




Credit: Furlan et al. 2017

## Purpose of Validation

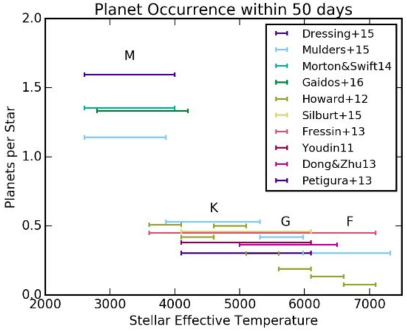
Determine the best targets for mass measurement and atmospheric characterization.

Facilitate growth of statistical sample of confirmed exoplanets.

Credit: NASA/MIT/TESS

## Star-Specific Priors

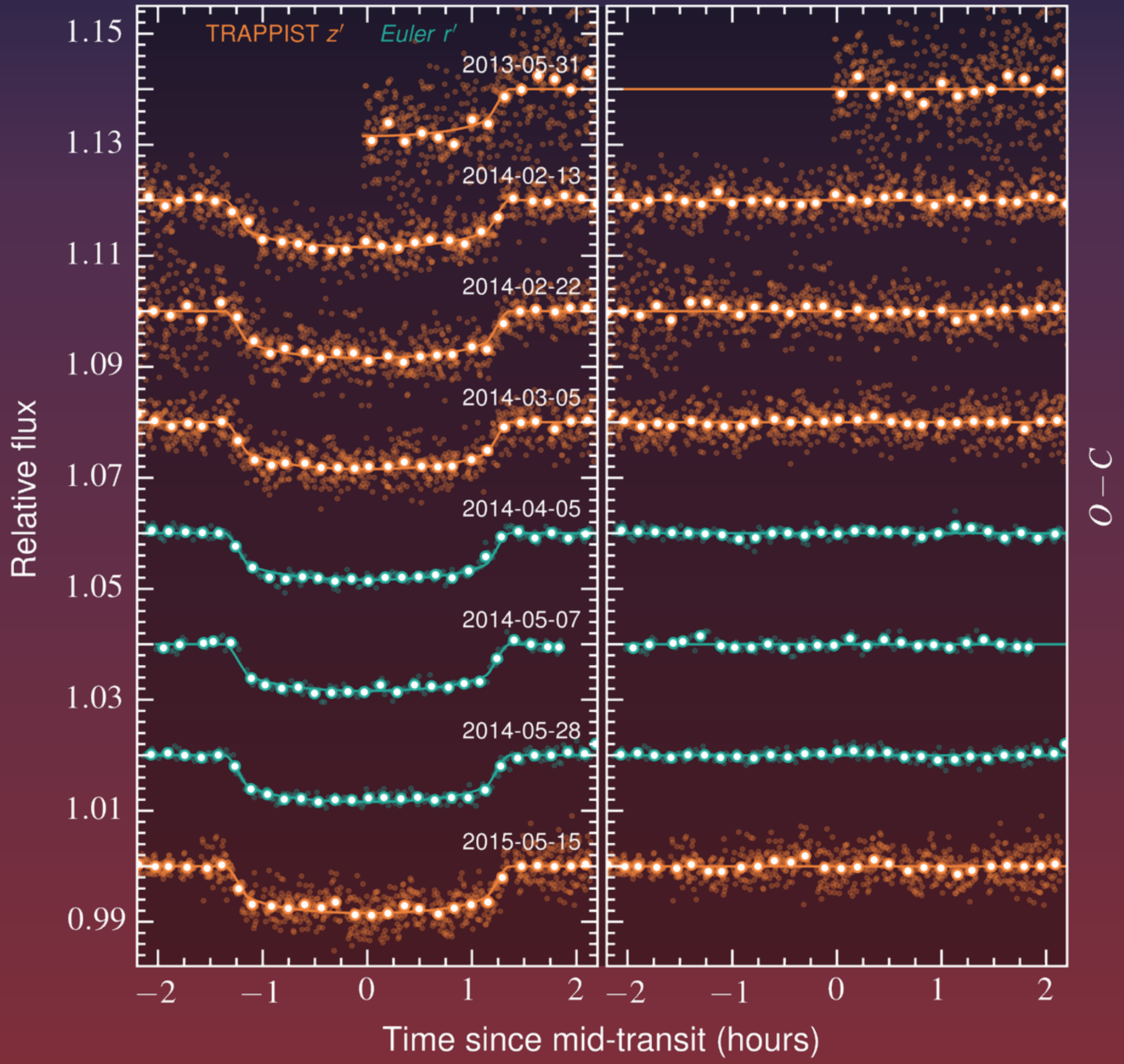
Planet occurrence and stellar multiplicity rates are dependent on the properties of the target star. Considering these properties allows more accurate validation.

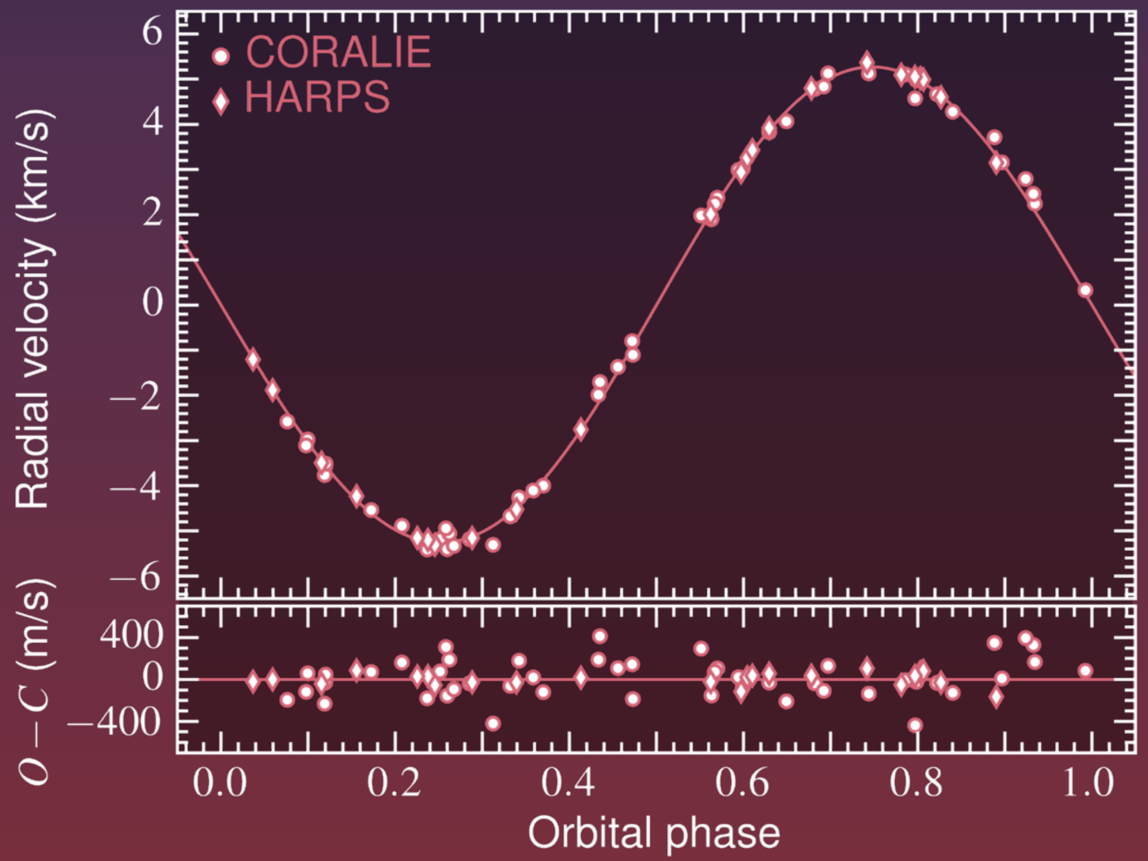



Credit: Mulders 2018

# WASP-128b: a short-period brown dwarf transiting a G0V host

Vedad Hodžić ● University of Birmingham

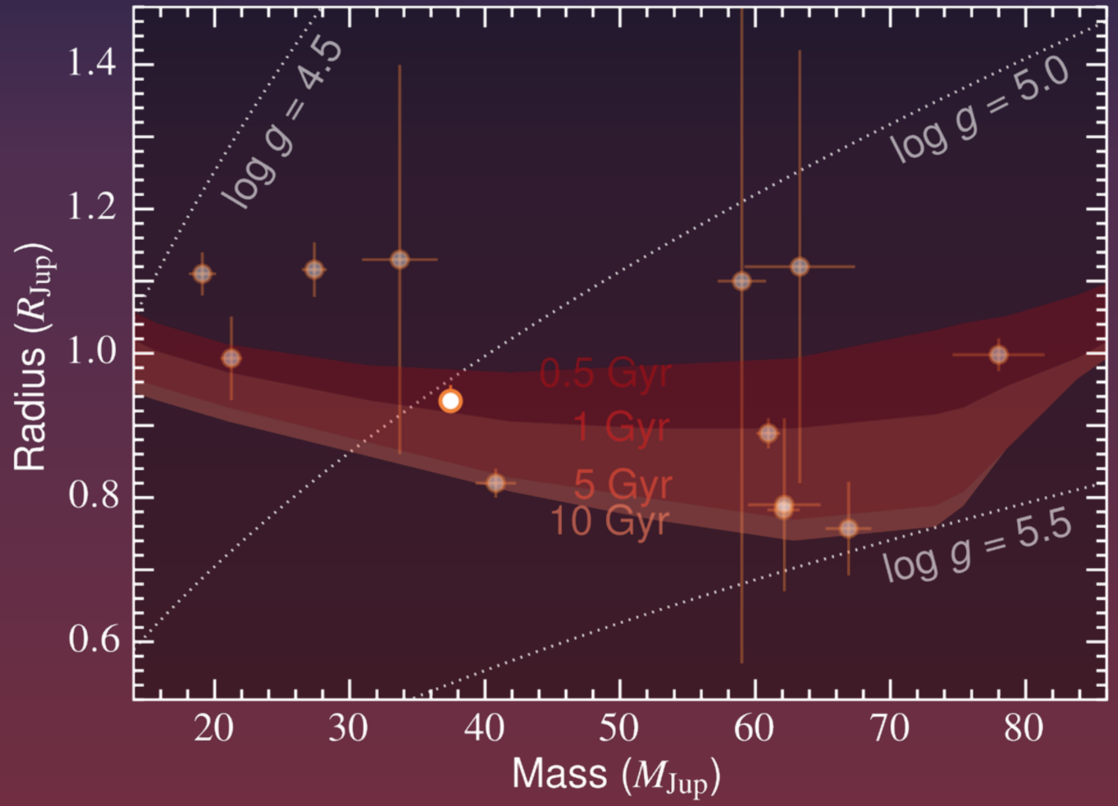



Hodžić et al. (*in prep.*)

# WASP-128b: a short-period brown dwarf transiting a G0V host

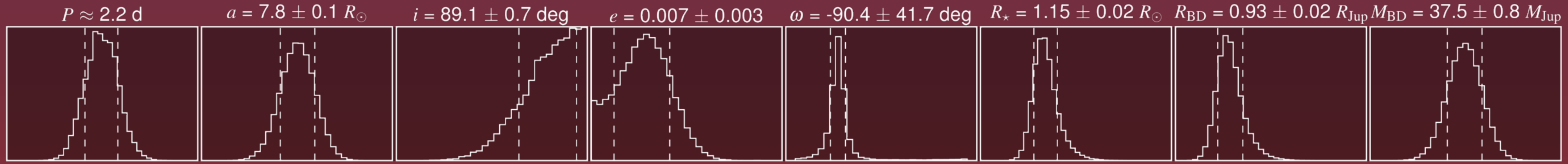
Vedad Hodžić ● University of Birmingham




Models from Baraffe et al. (2003)

Objects from Bayliss et al. (2017)

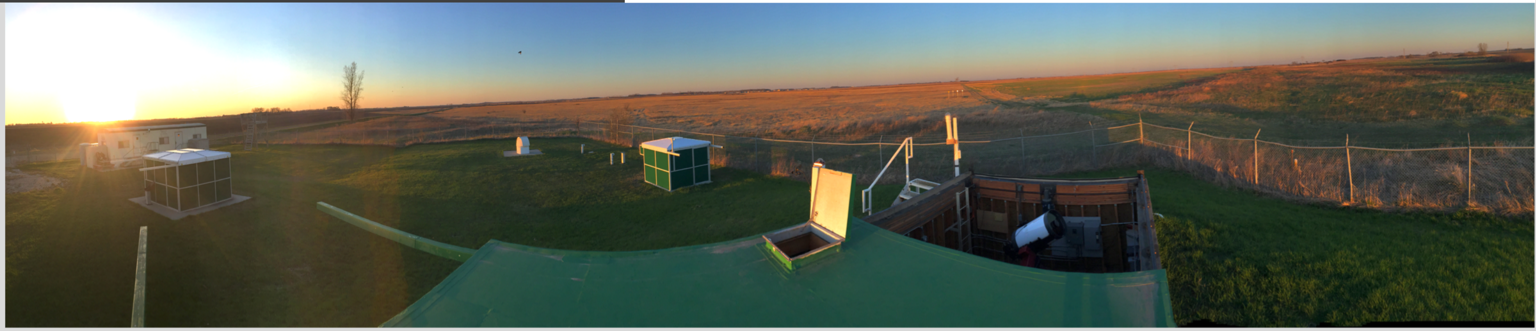
Figure adapted from von Boetticher et al. (2017)



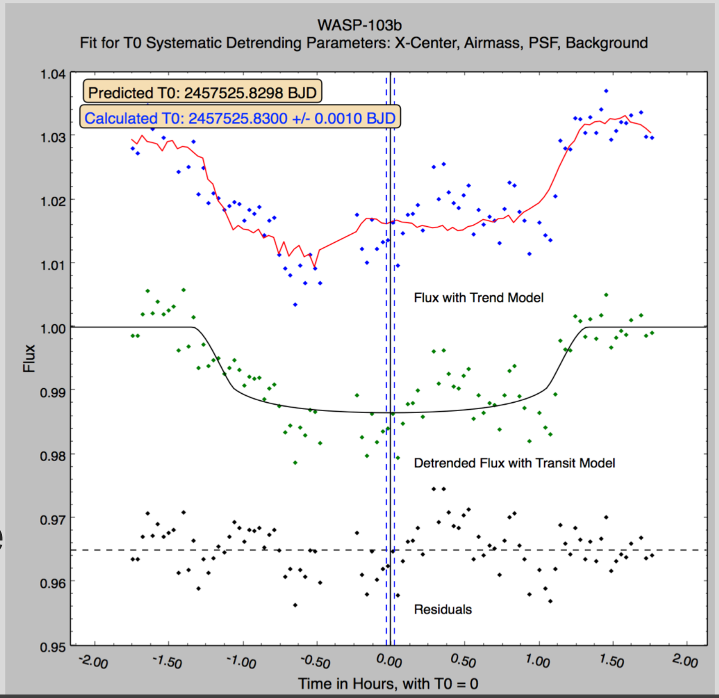
# Towards a Student-led TTV Research Program at the University of North Dakota

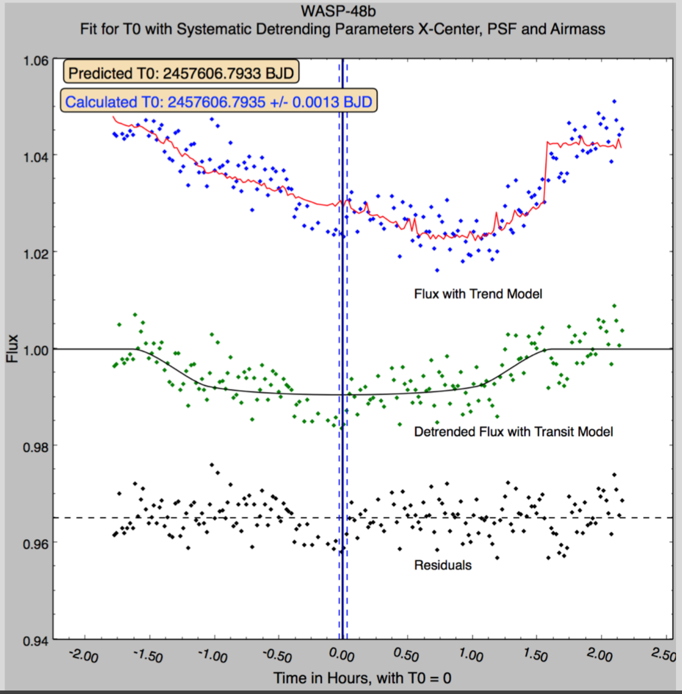
--Sean McCloat[1]--

UND SPACE STUDIES
UNIVERSITY OF NORTH DAKOTA



- Two 16” (0.4 m) SCTs
- FLI16803 & Apogee U9000
- 30’ x 30’ FOV, F/10
- UBVRI-RGB filters
- McCloat (2017) masters thesis first time observatory used to study exoplanets
- Observe recently discovered hot Jupiters, calibrate, model and attempt a transit timing variation analysis
- Calibration, modeling with IRAF, Python
- Successful in execution, justified keeping the observatory,  feasible to engage in longer term TTV effort




1 - MS Space Studies, University of North Dakota

# Towards a Student-led TTV Research Program at the University of North Dakota

--Sean McCloat[1]--

Recent and future efforts:

- Observe transits every clear night, without thesis target restrictions
  - What transits are visible and with what precision? How frequently can we realistically make observations?
- Working with Dr. Carolina von Essen on other ground support exoplanet opportunities, fitting in

Onward to the PhD!

- Pursuing PhD in Aerospace Sciences at UND, bringing exoplanets to the department and university
- Research interests –
  - Can there be a "smoking gun" biomarker?
  - If not, what could some novel biomarkers be?
  - Are habitable systems easier to find than individual planets?

Sean McCloat
spmccloat "at" gmail.com

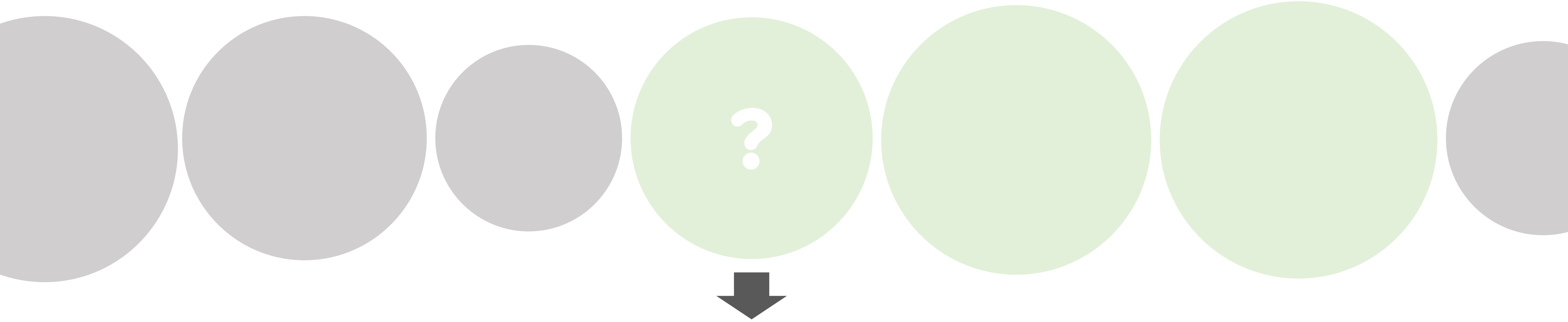
*Come talk to me!*

1 - MS Space Studies, University of North Dakota

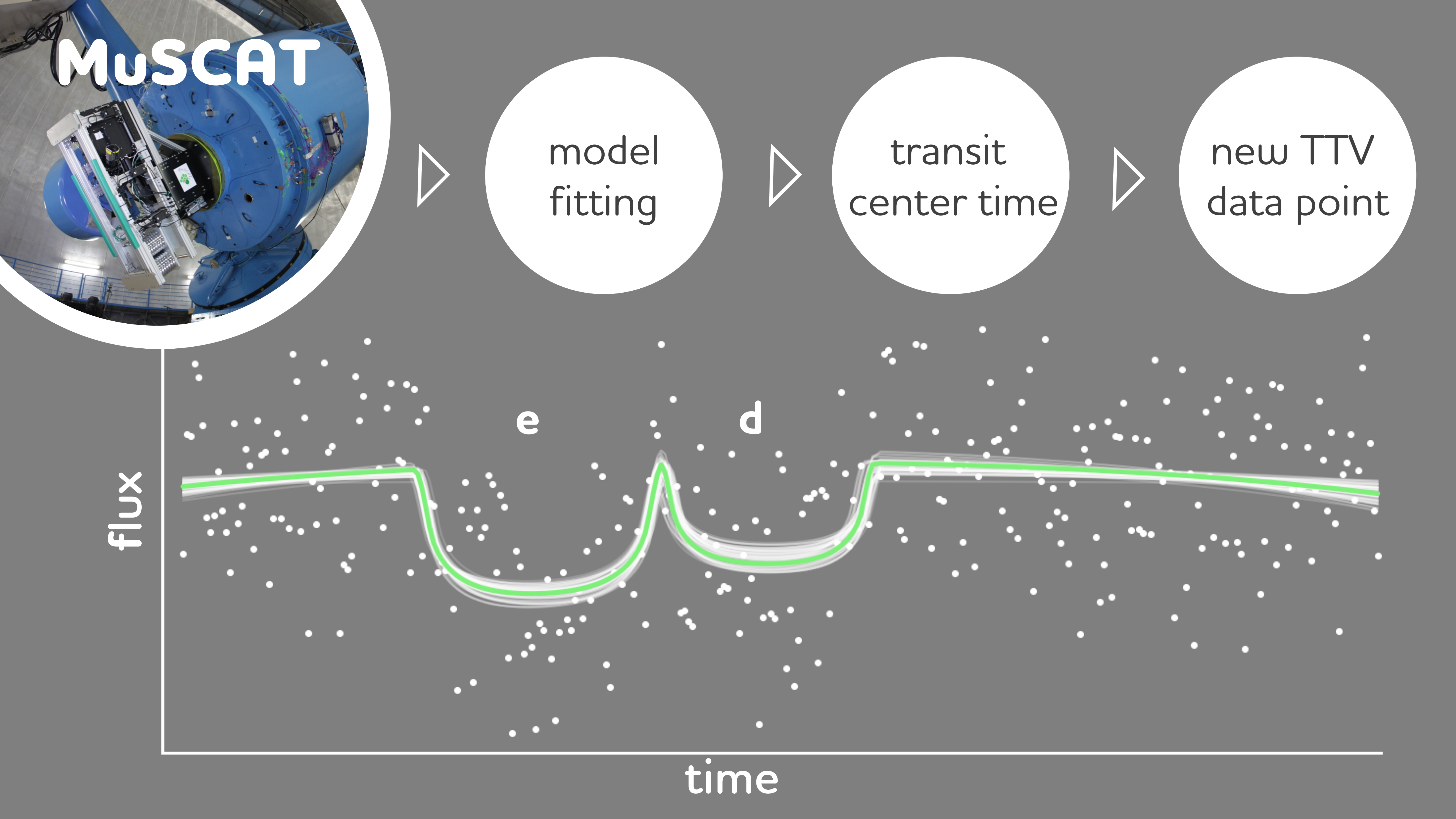
# Light-curve Analyses on TRAPPIST-1 d & e for Mass Estimation

**Mayuko Mori**
The University of Tokyo / M1

#transit #observation #TRAPPIST-1 #Habitability #MuSCAT




**T**ransit **T**iming **V**ariation


MuSCAT
model fitting
transit center time
new TTV data point
e
d
flux
time

# Wolf 503b: A 2R⊕ Planet Orbiting a Bright, Nearby K-dwarf

**Merrin Peterson, Université de Montréal, supervised by Björn Benneke**

- Newly found this May in K2 Campaign 17
- One of few planets at its radius with a bright host, amenable to RV follow-up and transit spectroscopy with JWST

## System Facts:

Distance = 44.58 pc

$M_* = 0.688^{+0.023}_{-0.016}\ M_\odot$

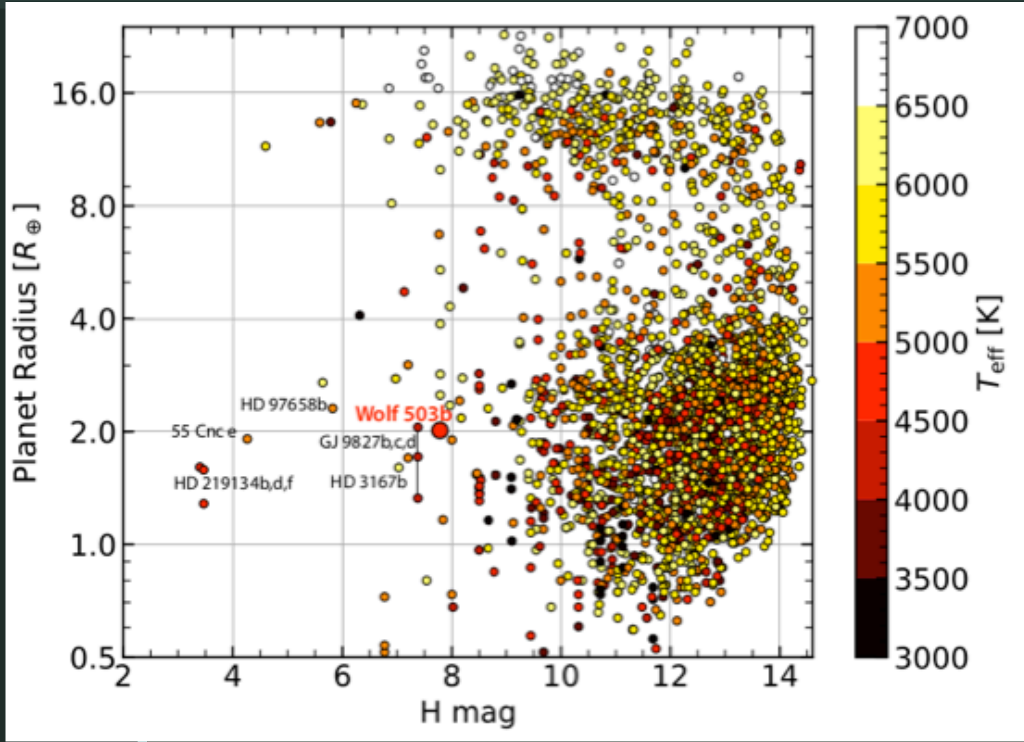
$R_* = 0.690^{+0.023}_{-0.024}\ R_\odot$

$R_p = 2.030^{+0.076}_{-0.073}$ 08 $R_\oplus$

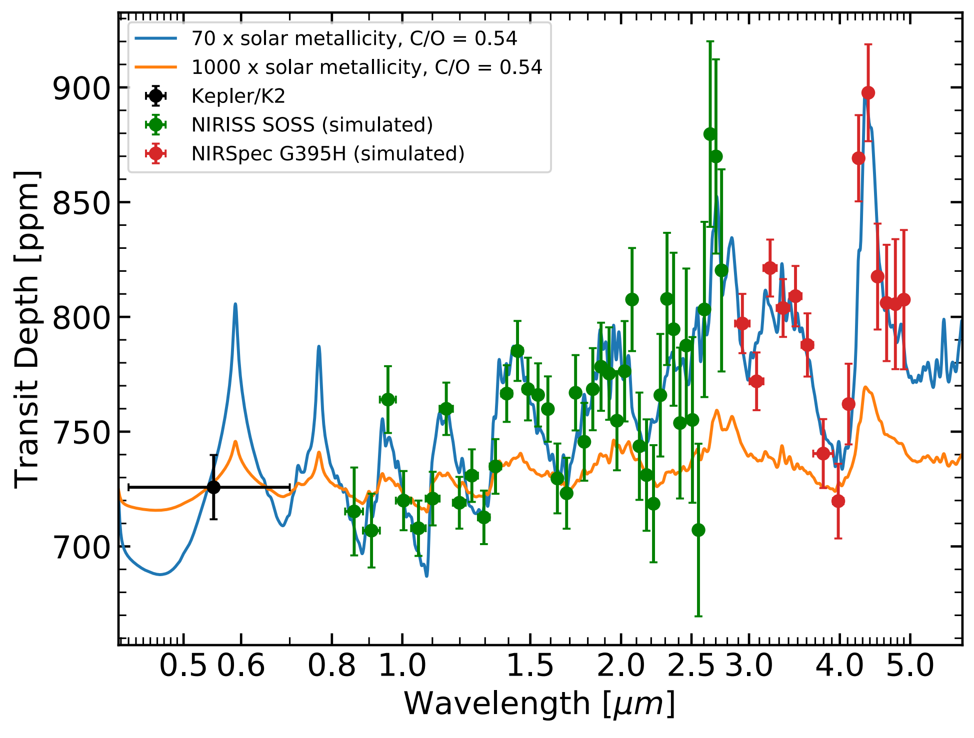
$P = 6.00118^{+0.00008}_{-0.00011}$ days

$a = 0.057 \pm 0.002$ AU

## Wolf 503b and the NASA Exoplanet Archive Planets




## Simulated NIRISS and NIRSpec Data

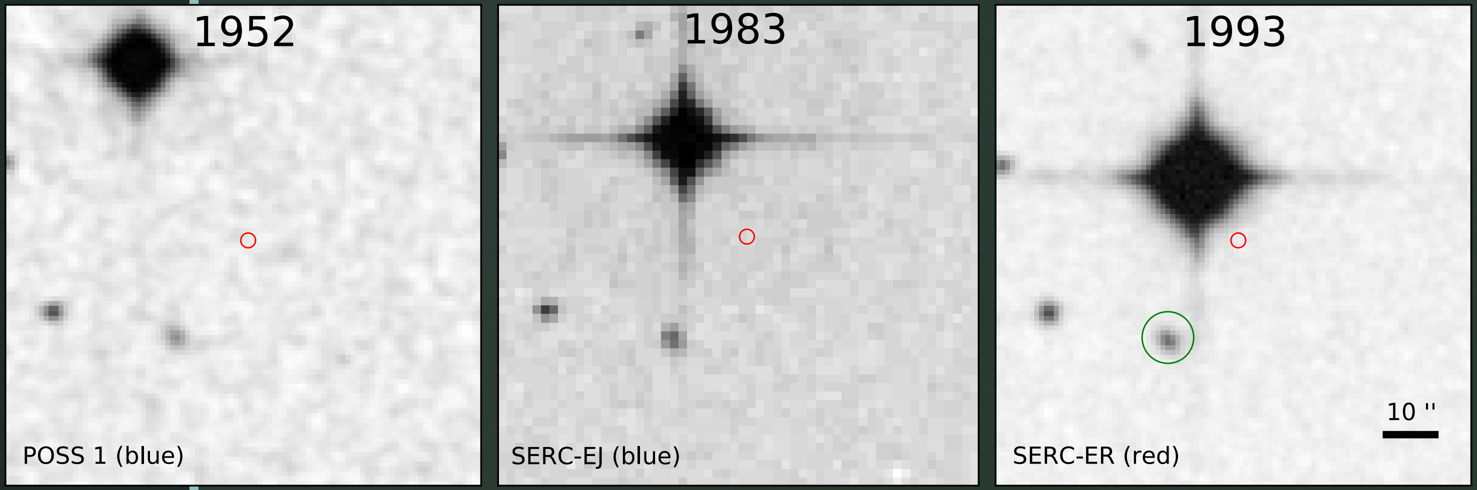



iREx

Université de Montréal

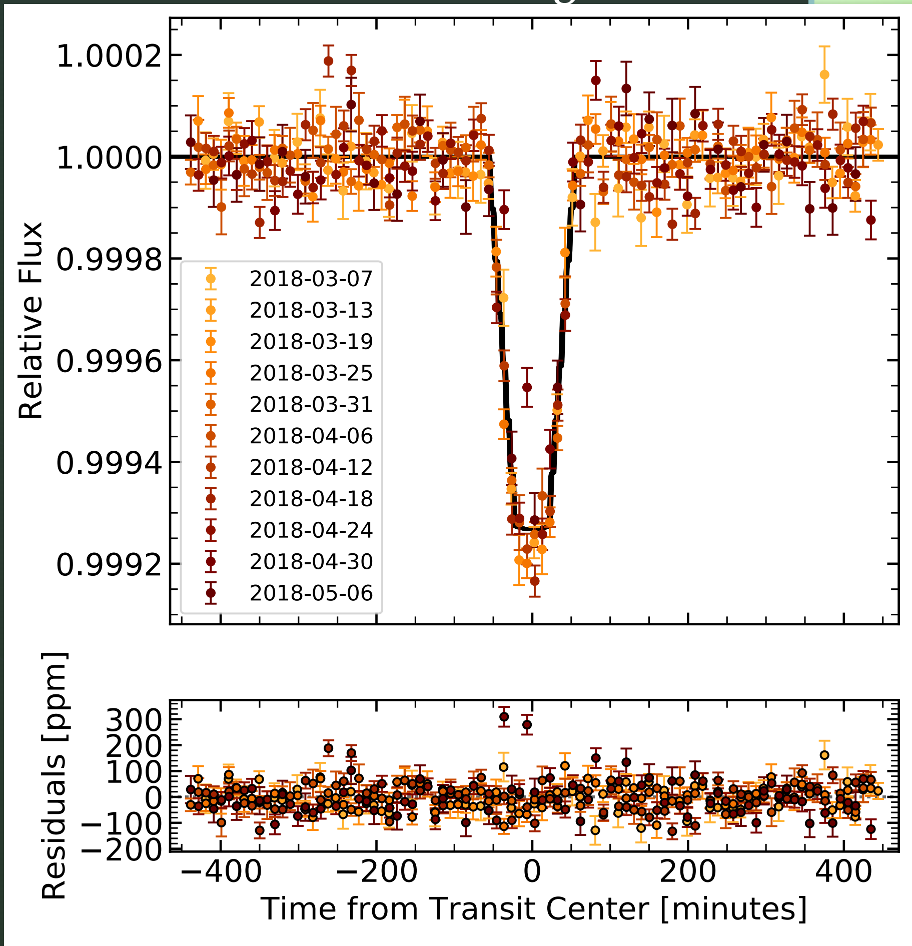
# Candidate Validation

Archival Sky Survey Images of Wolf 503's 2018 location




- Background source contamination eliminated to 19 mag using archival images

Phasefolded lightcurve



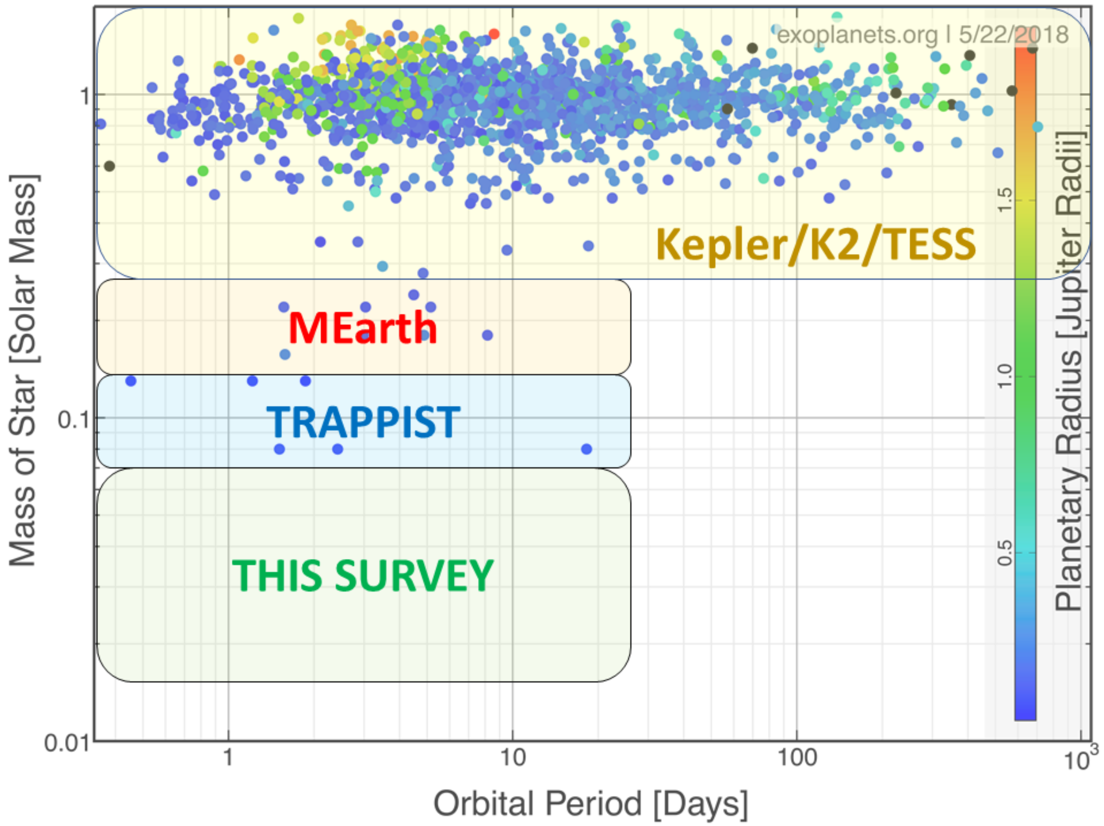

- Adaptive Optics limits possible companion separation to 4.4 AU, eliminating ~90% of binary or multiple star systems

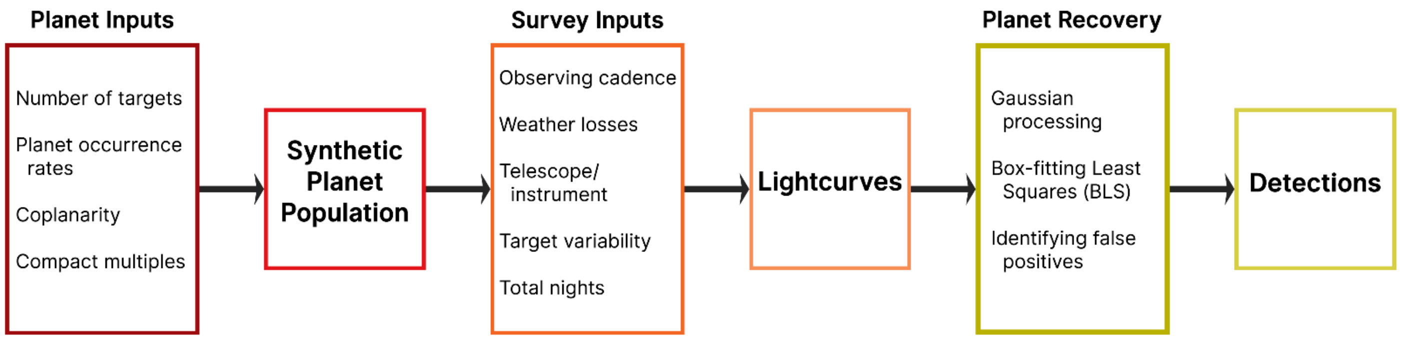
- Flat-bottomed, diluted lightcurve of consistent depth: indicates a transiting planet, or a highly specific multiple star system

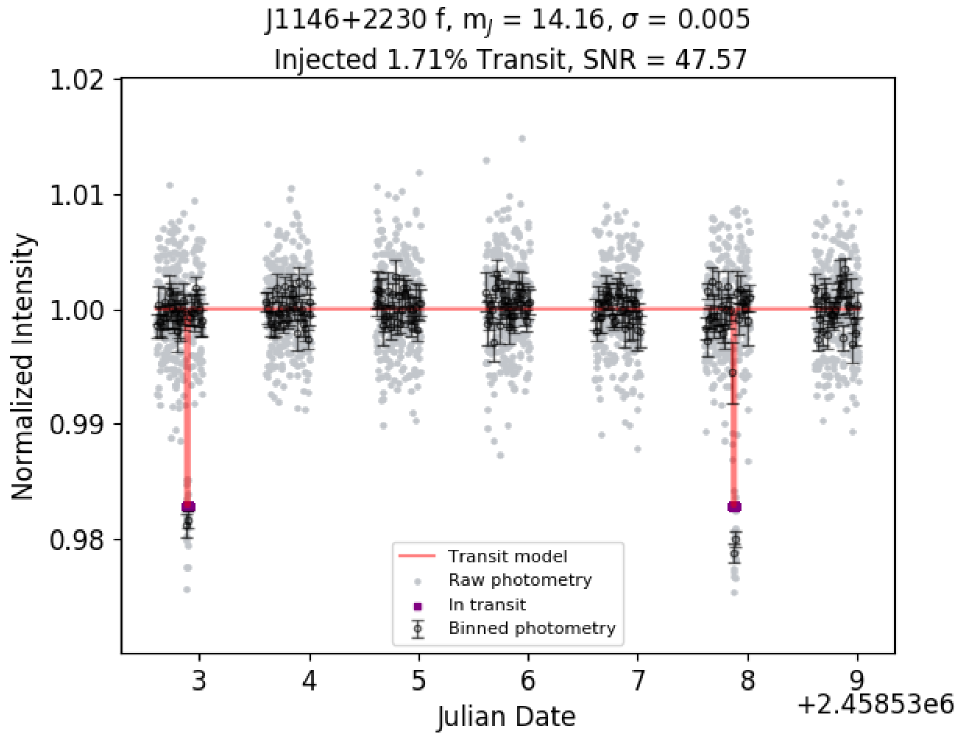
- Template and RV curve started at HIRES June 14

# A Near-Infrared Search for Transiting Exoplanets around Brown Dwarfs with the 1.8-m Perkins Telescope

Patrick C. Tamburo & Philip S. Muirhead

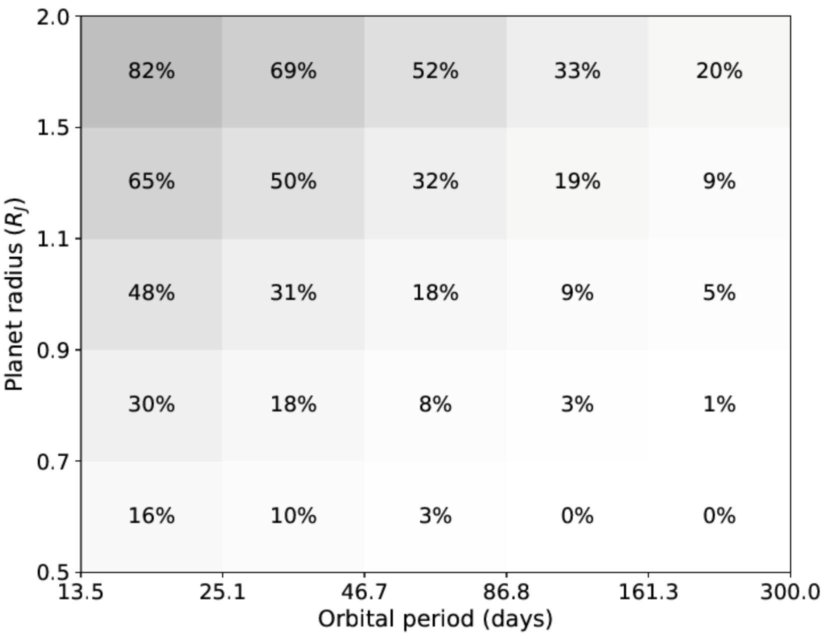


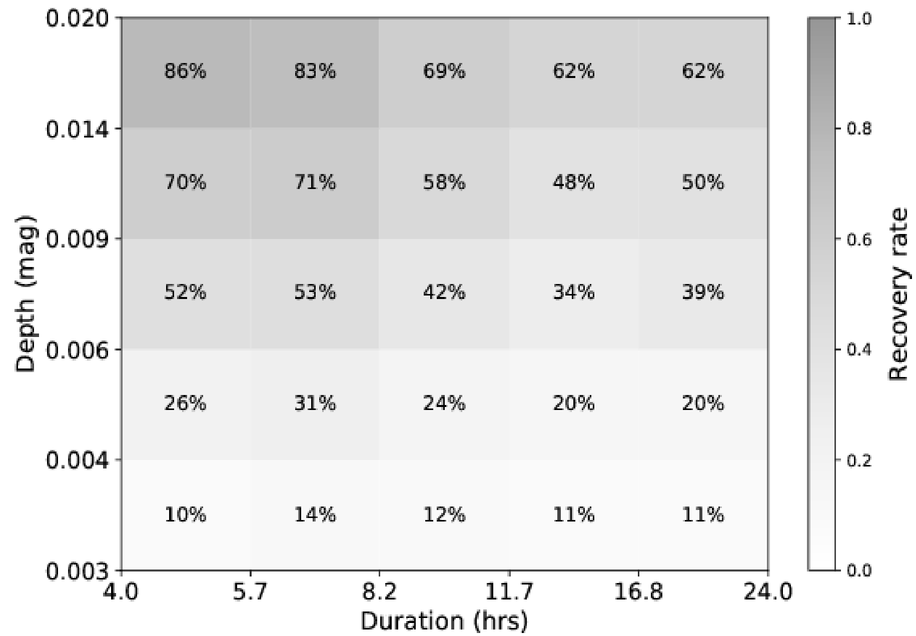



# Precovery of TESS single transits with KELT

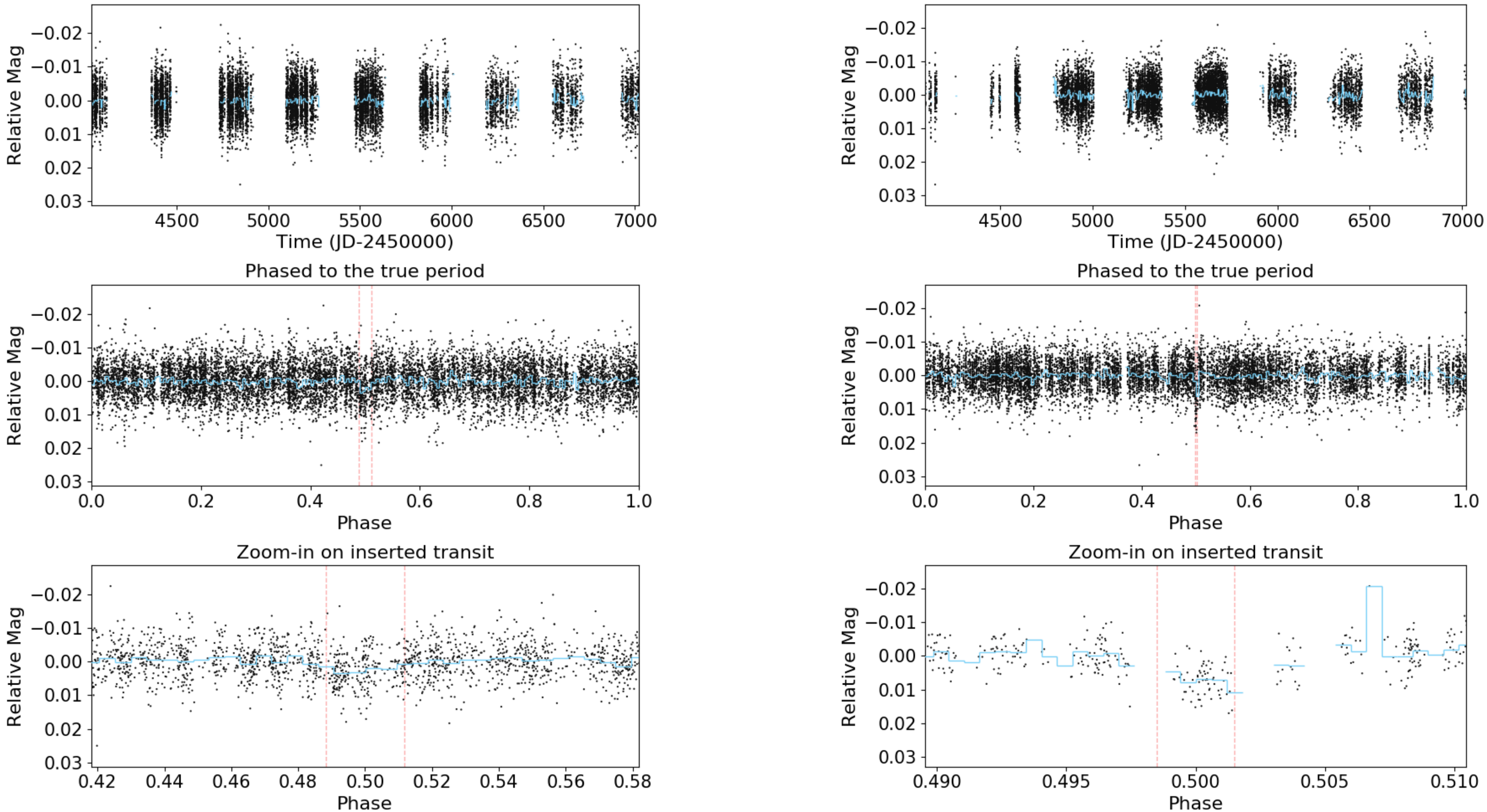
Xinyu Yao (Lehigh University)



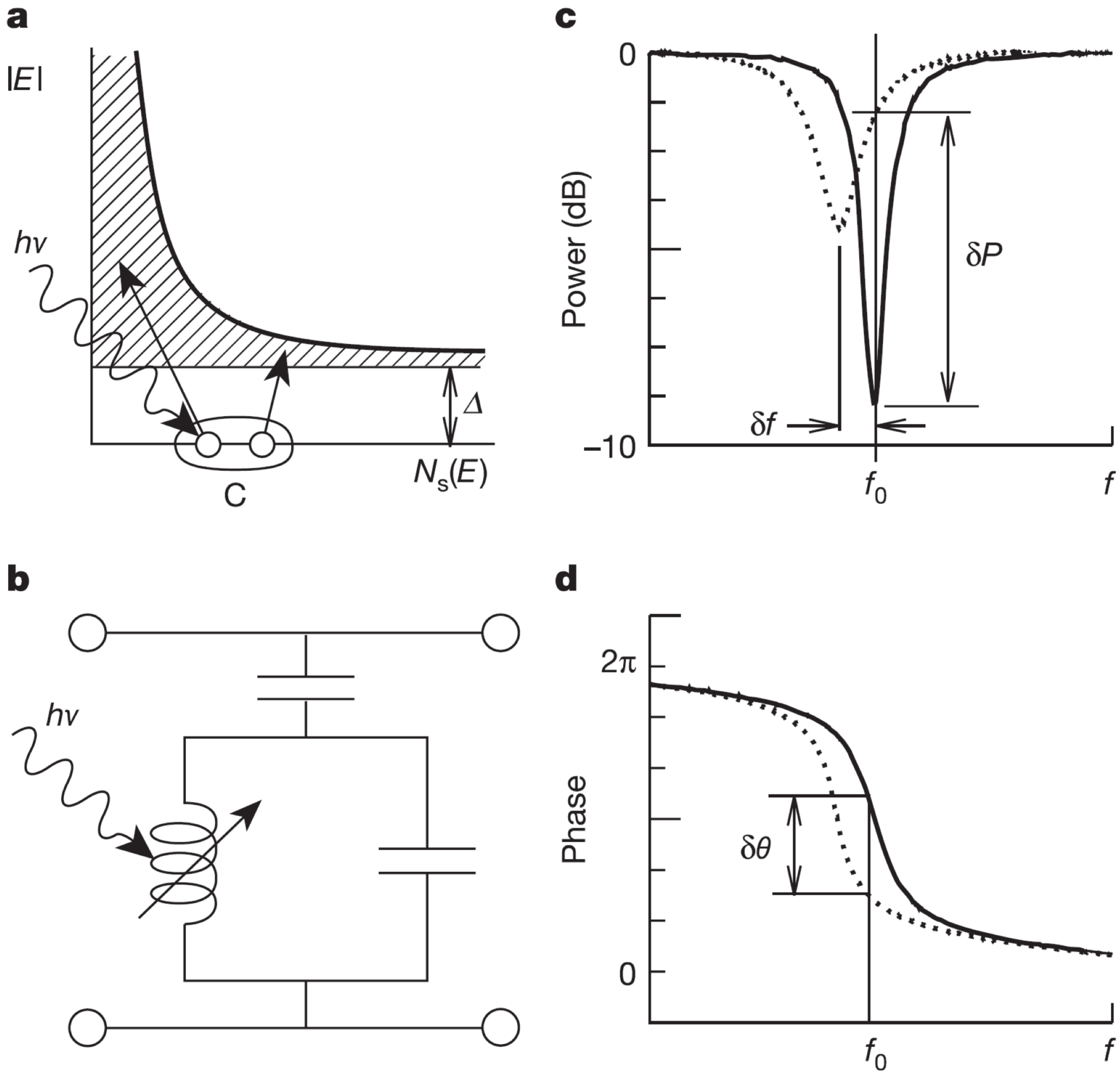

Recovery rate distributions across Period vs. planetary radius space (left) and transit duration vs. transit depth space (right) for the KELT North light curves.

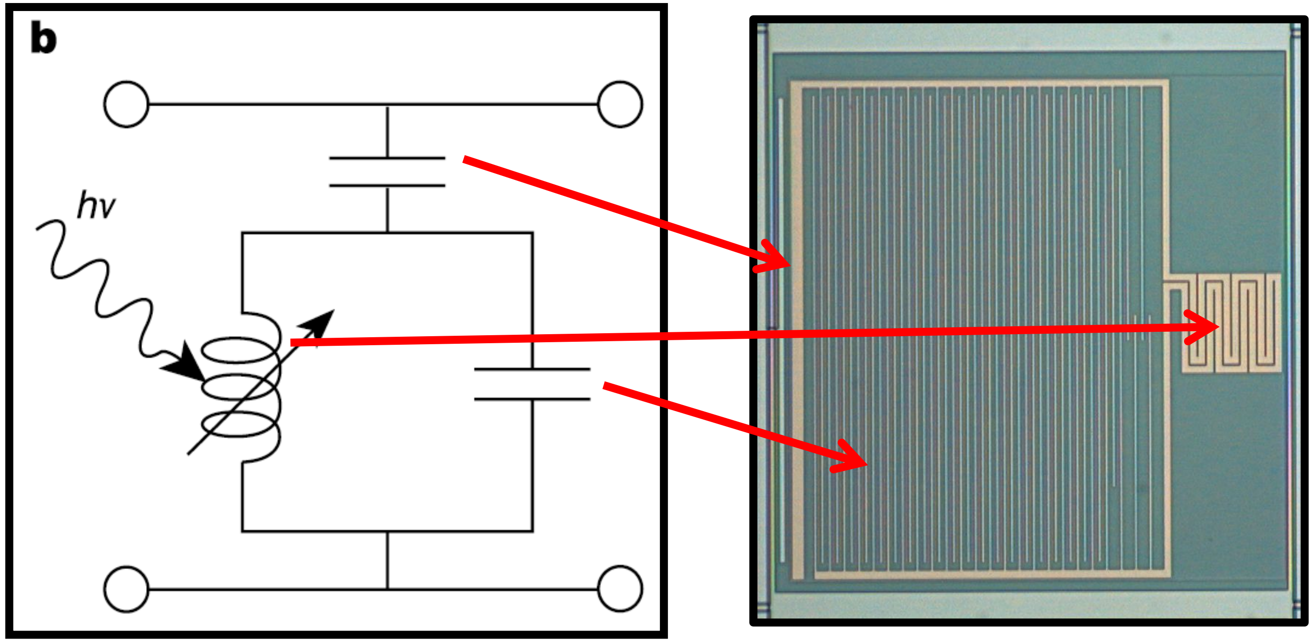
# Successfully recovered light curves

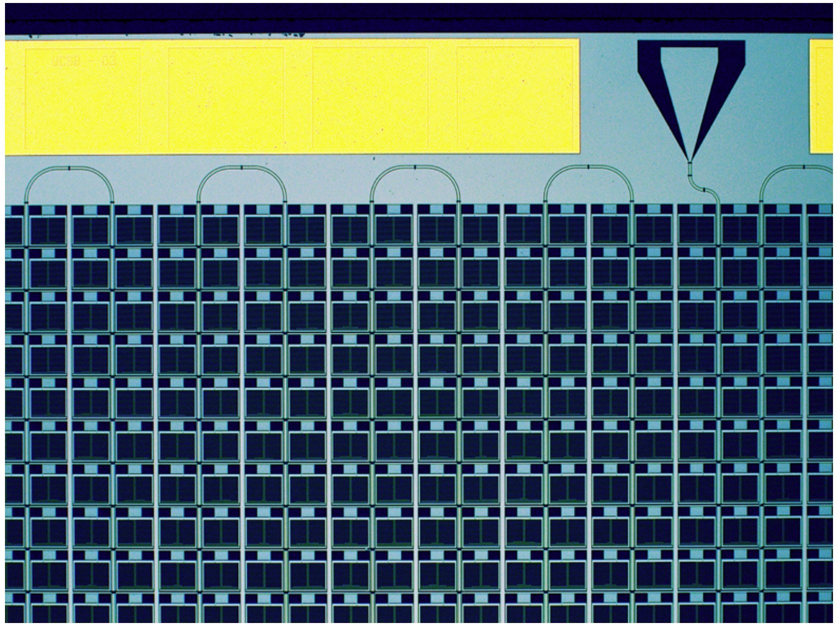


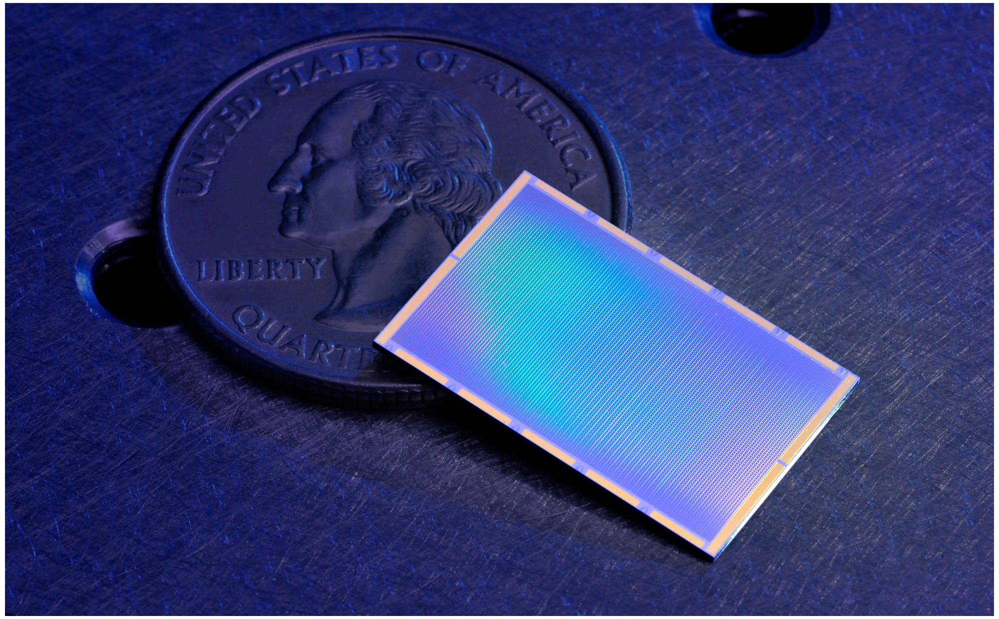

P=35.3 d, τ=19.8 h, δ=3 mmag

P=250.2 d, τ=17.9 h, δ=7 mmag


a
|E|
hν
Δ
C
$N_s(E)$
b
hν
c
0
−10
Power (dB)
δP
δf
$f_0$
f
d
2π
0
Phase
δθ
$f_0$
f


b
hν




STATES OF AMERICA
LIBERTY