OBSERVING TRANSITING PLANETS WITH *WFIRST*

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NASA Sagan Fellow
University of Chicago
2017 Sagan Workshop, Pasadena, CA

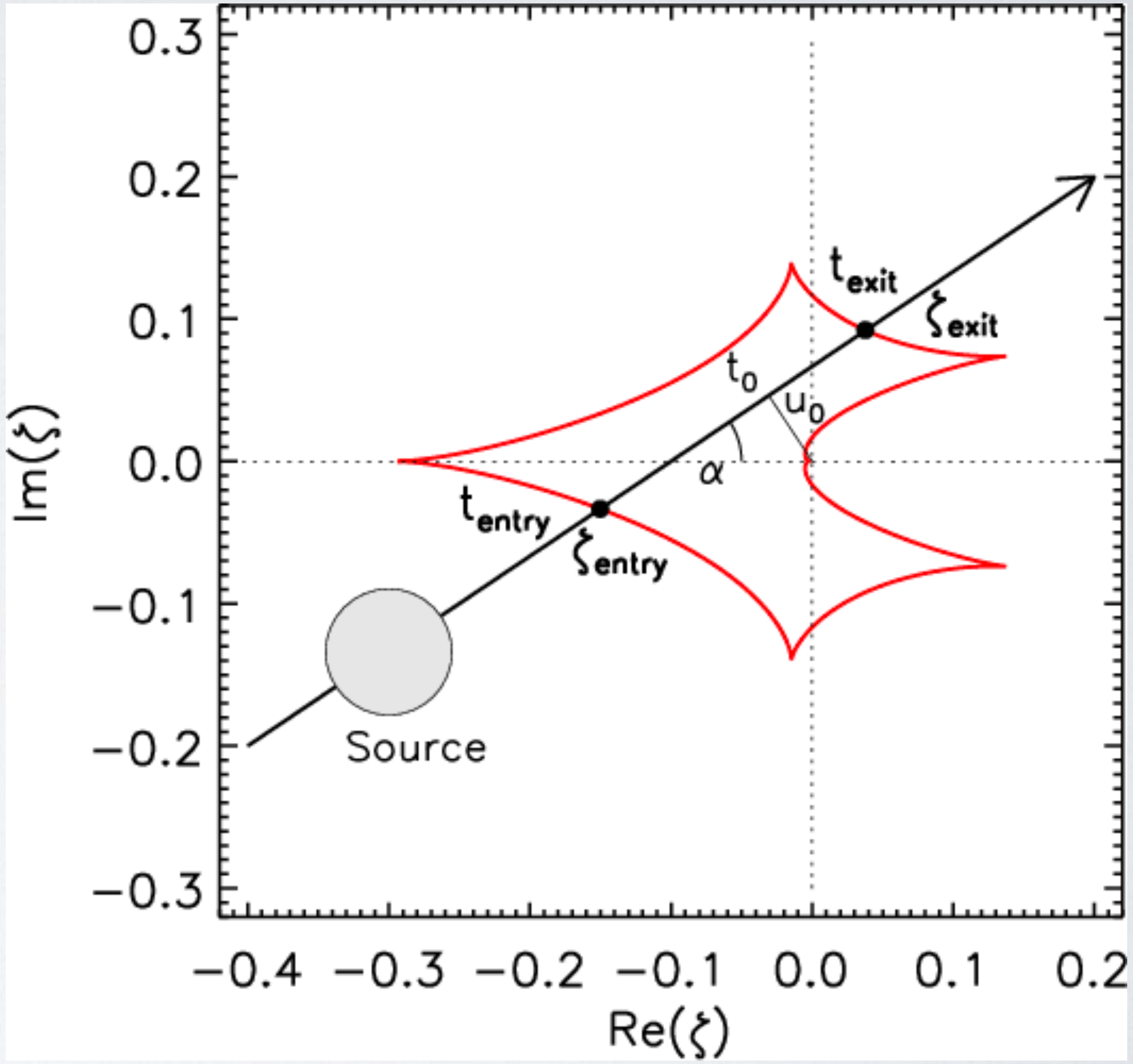
@benmontet

AUDIENCE PARTICIPATION

WHAT DOES MICROLENSING **NOT** TEACH US ABOUT PLANETARY SYSTEMS?

WE WANT TO KNOW ABOUT...

- Planet radii
- Atmospheres
- Orbital Resonances
- Rings
- Planet-star spin-orbit (mis)alignment
- Planet inclinations
- Oblateness



Cassan+ 2008

TRANSITING PLANETS

PROVIDE INFORMATION

THAT MICROLENSING CANNOT

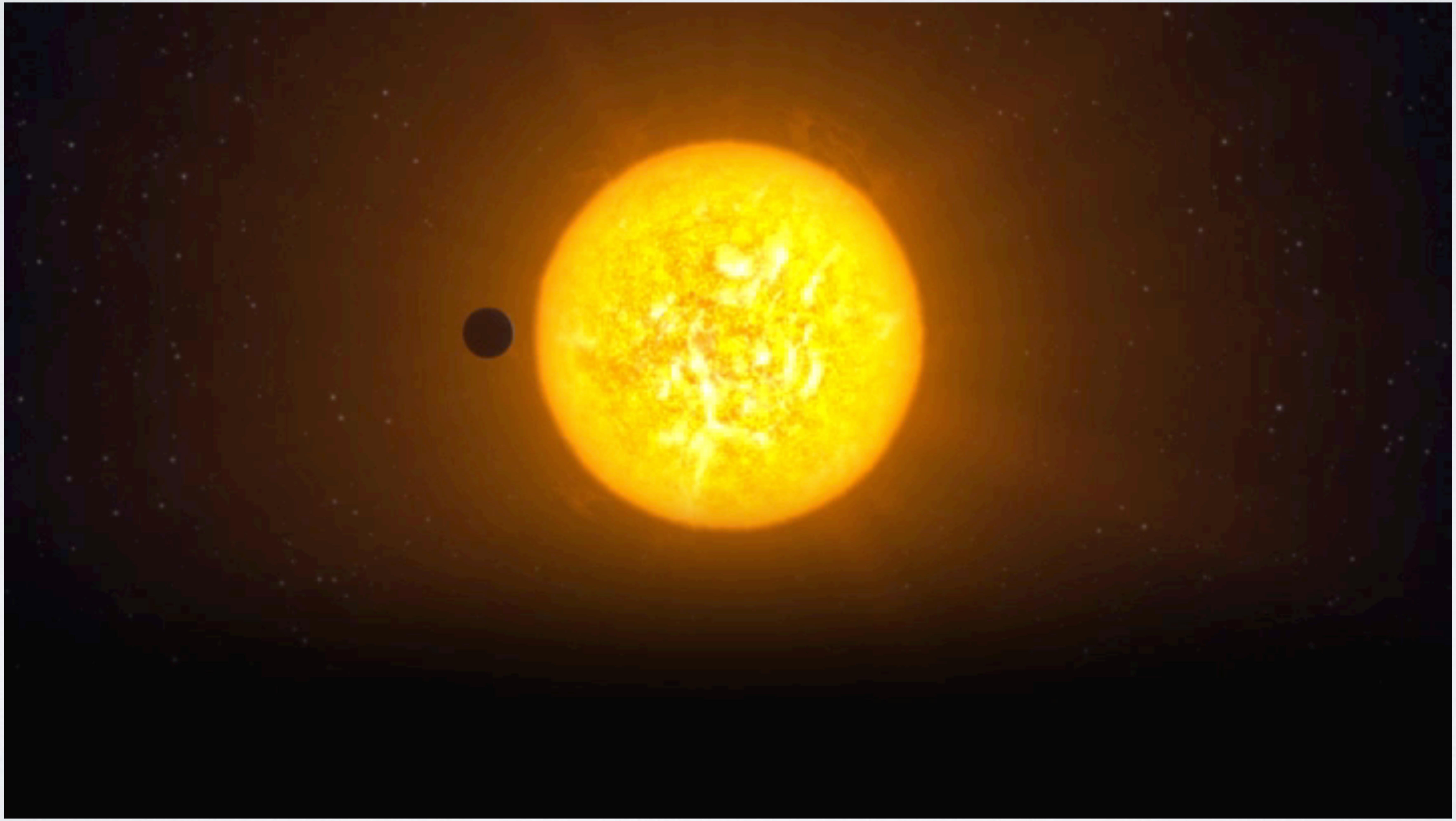
WFIRST WILL BE A

TRANSIT-FINDING MACHINE

ITS TRANSITING PLANETS WILL

CONSTRAIN PLANET FORMATION

WHAT IS A TRANSIT, ANYWAY?



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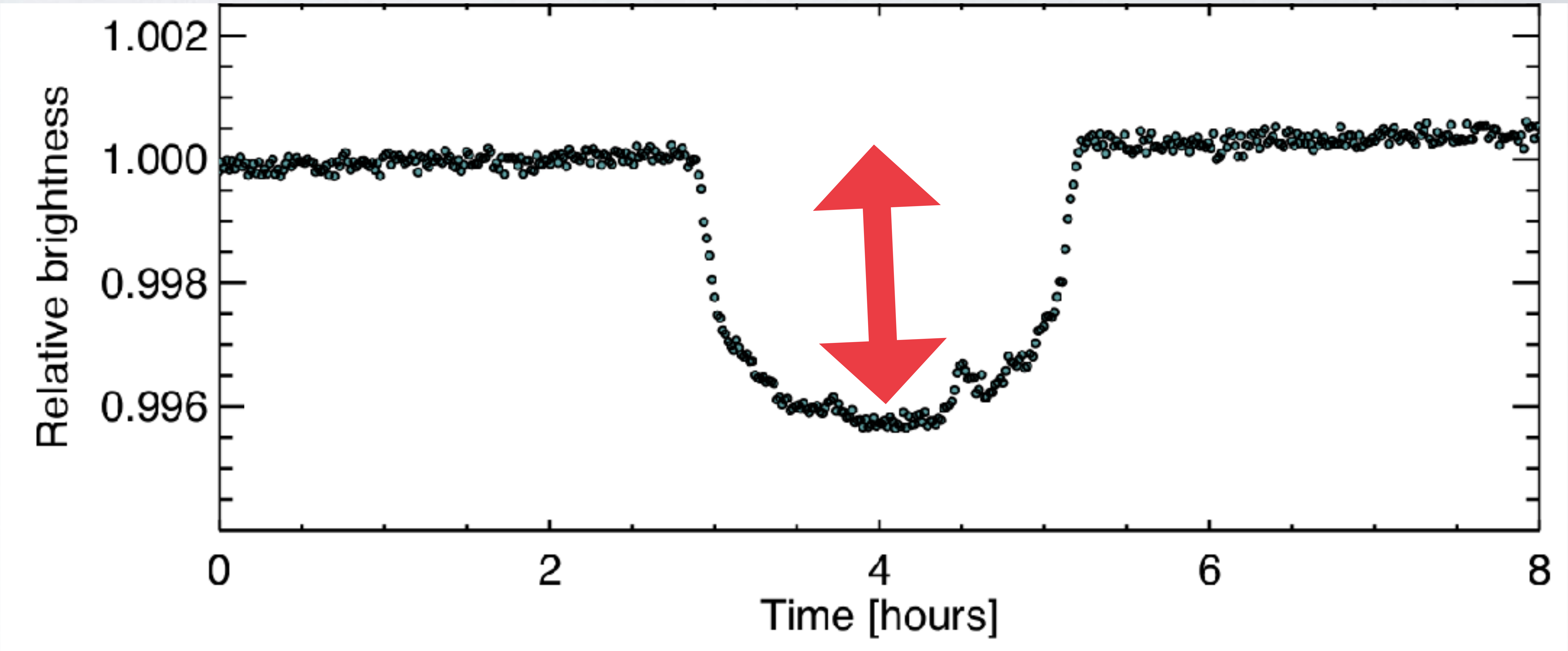

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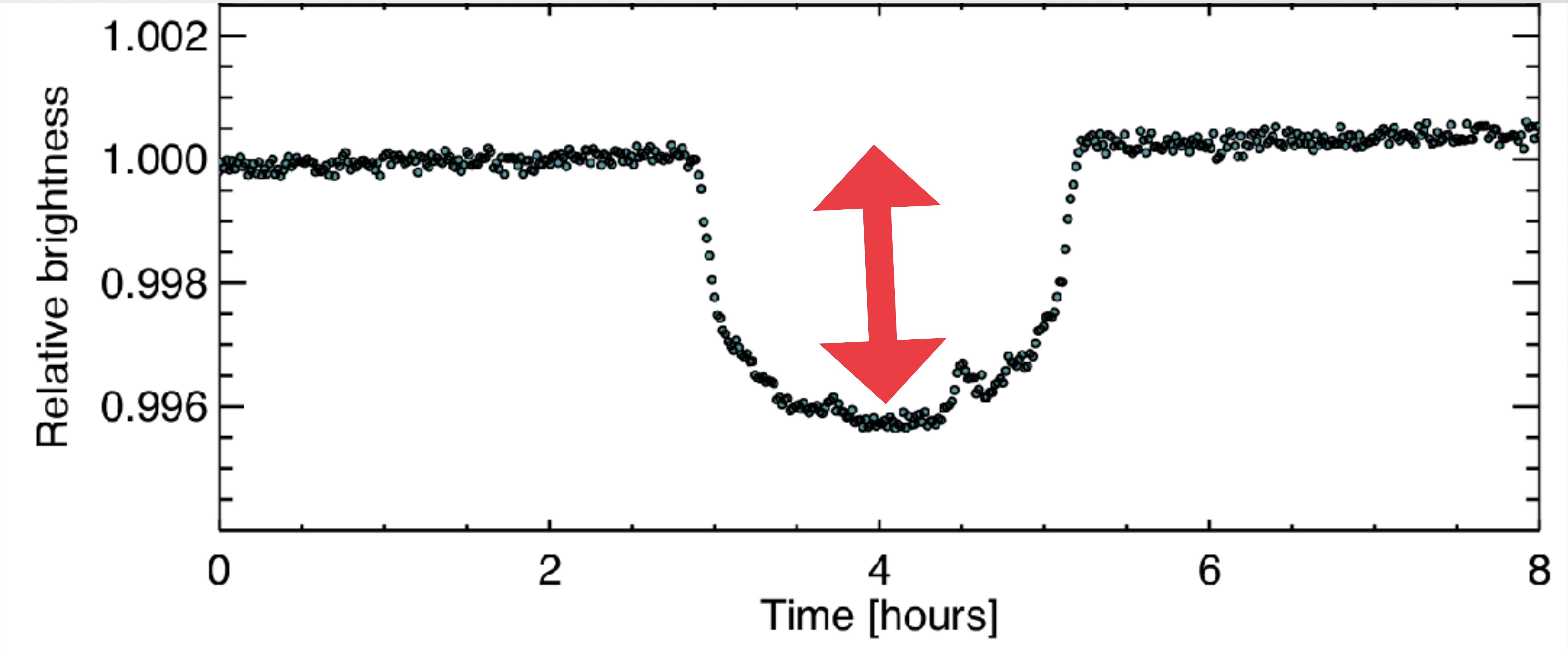

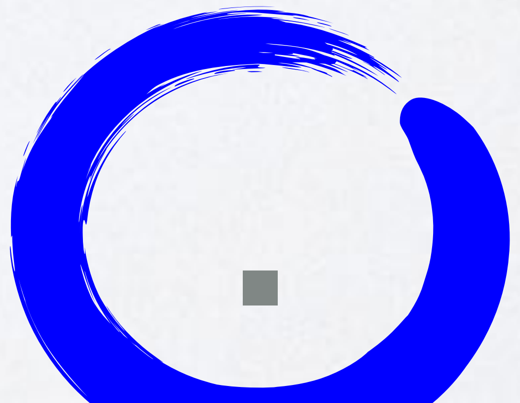

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Image credit NASA (really)

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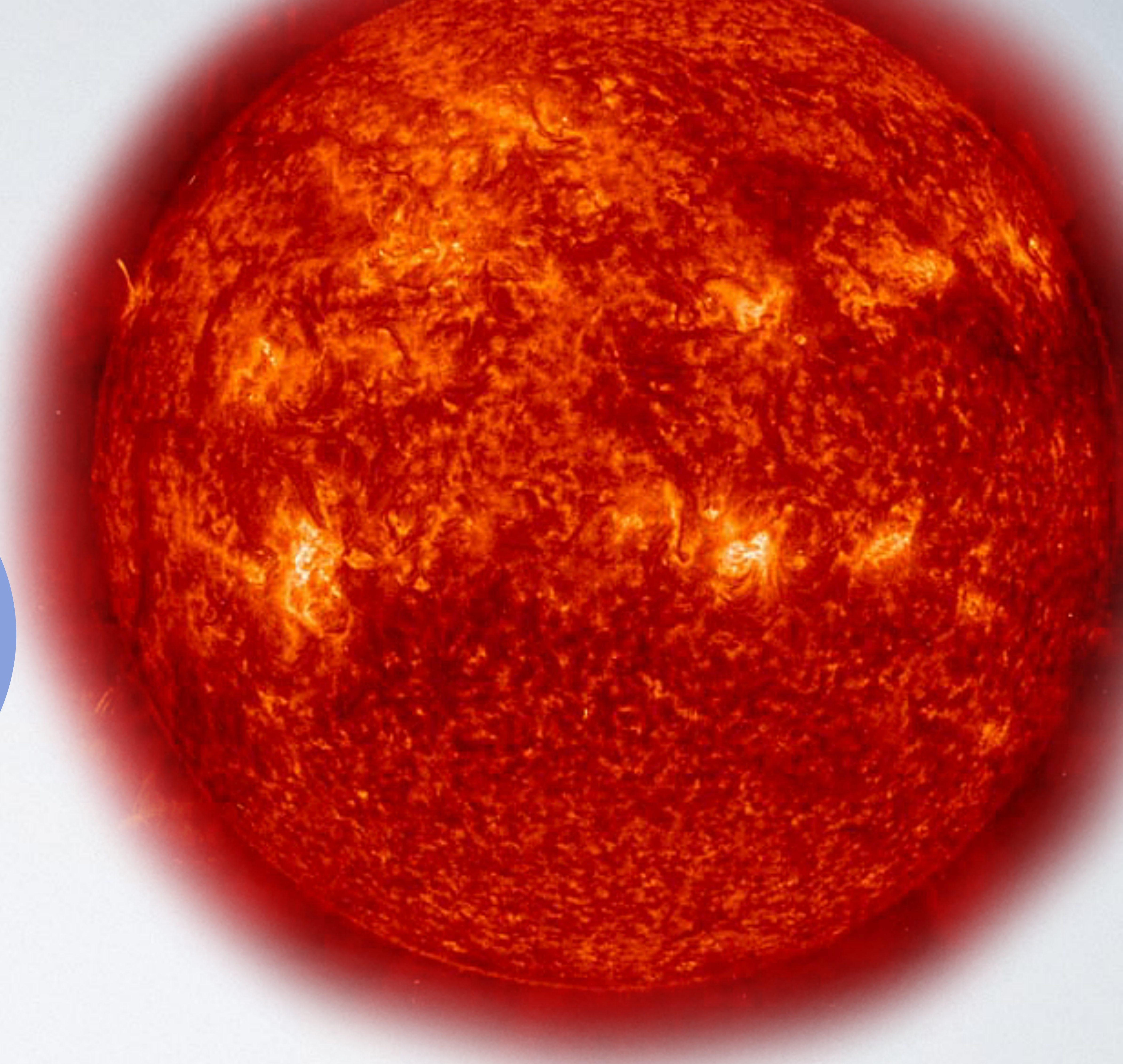
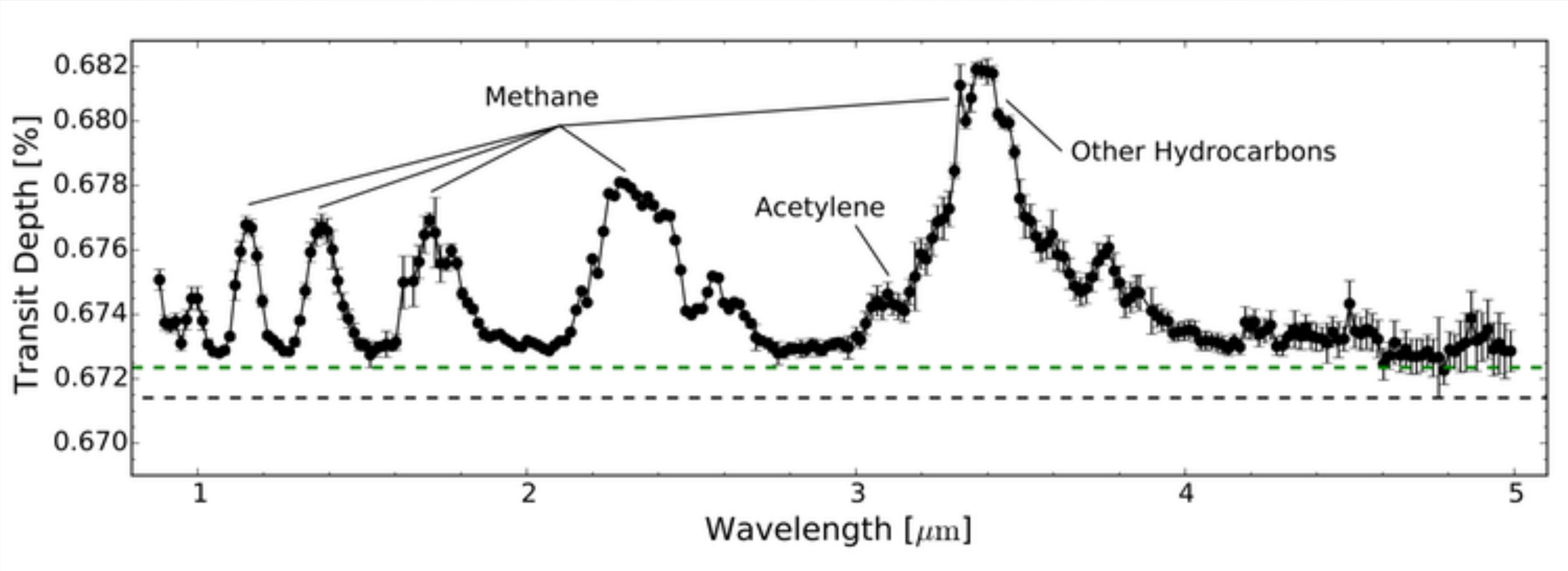


Image credit NASA (really)

PLANET SIZE IS A FUNCTION OF WAVELENGTH



Dalba+ 2015

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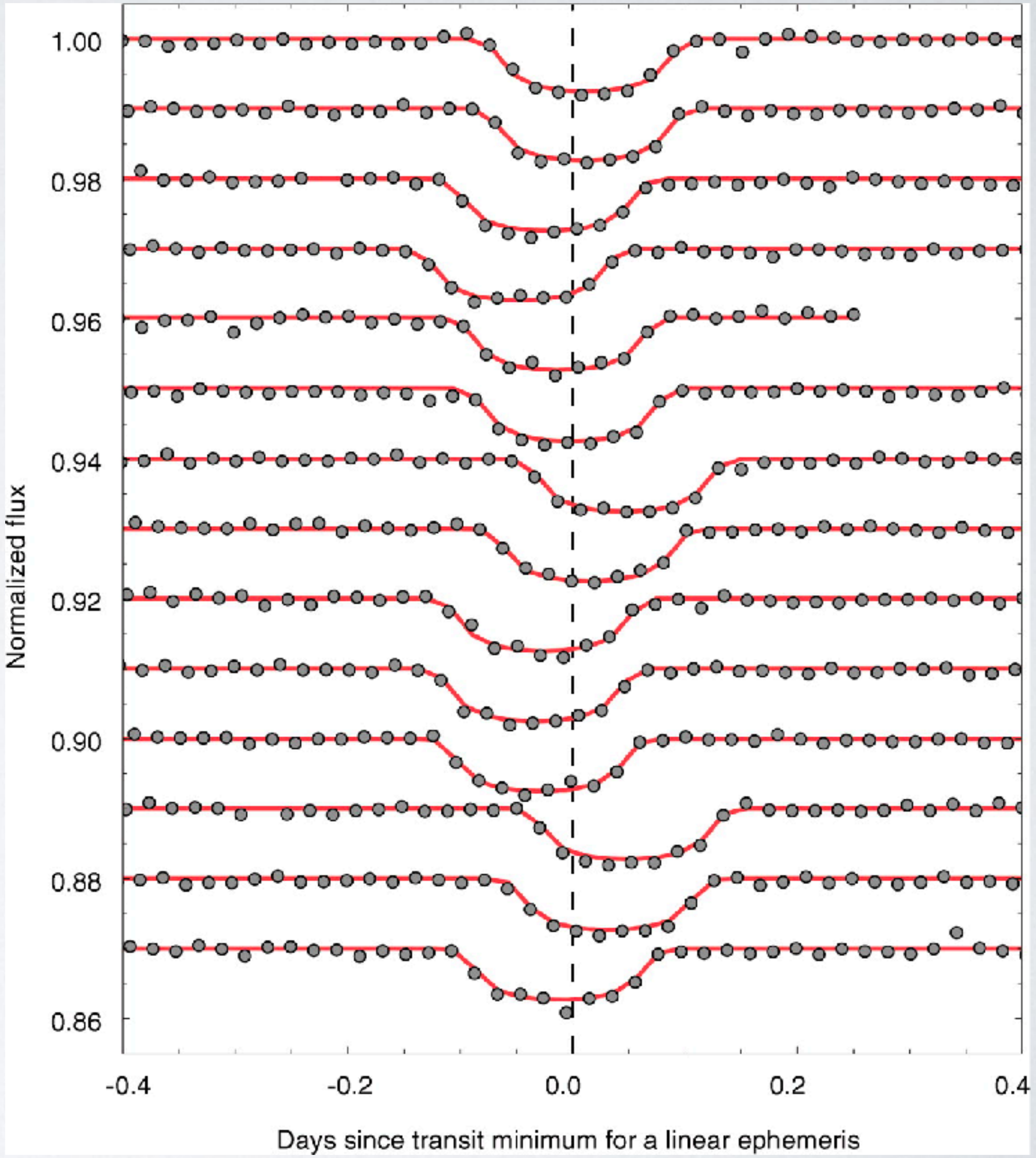

Nesvorny+ 2013

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- Planet-star spin-orbit (mis)al
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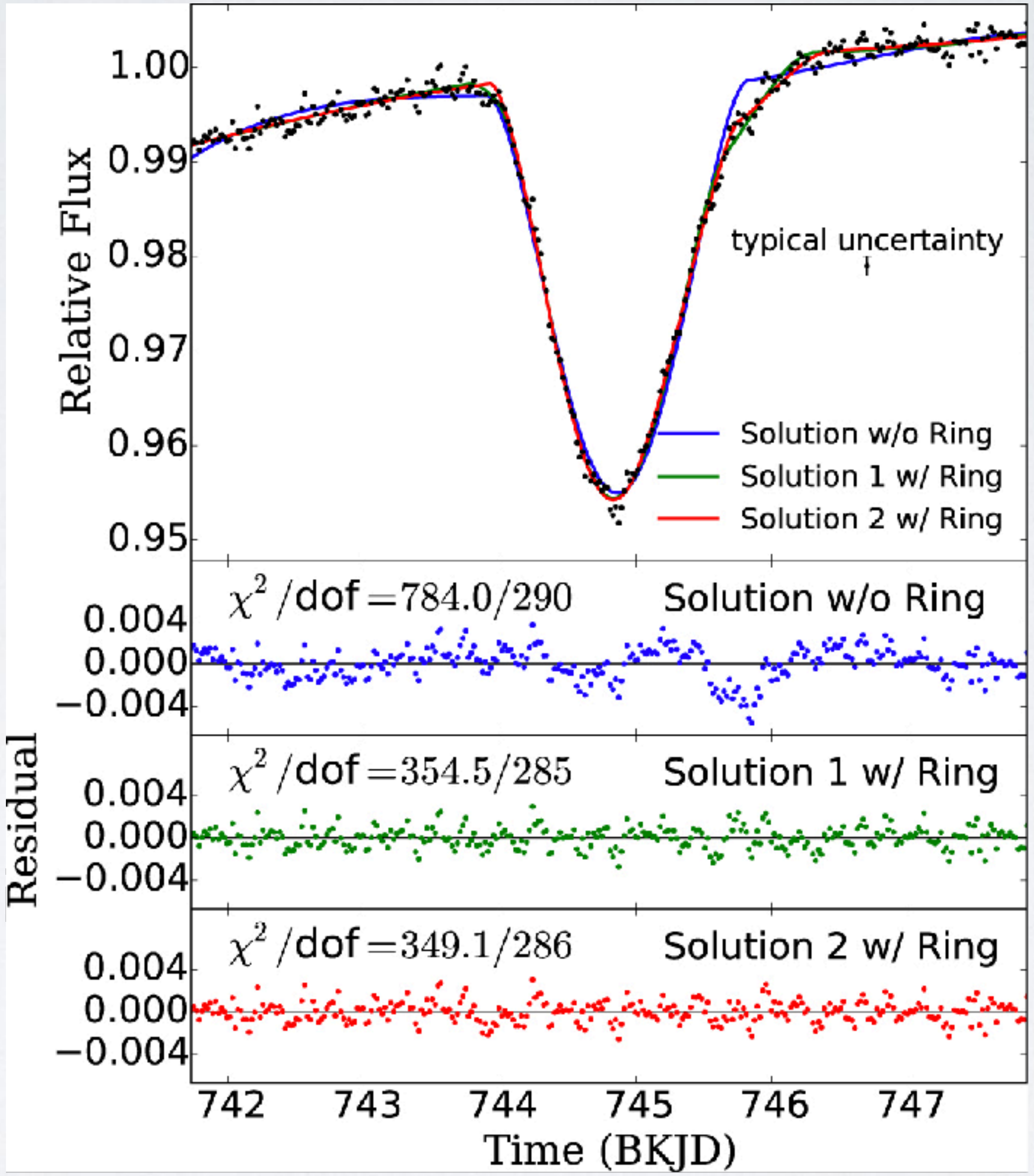

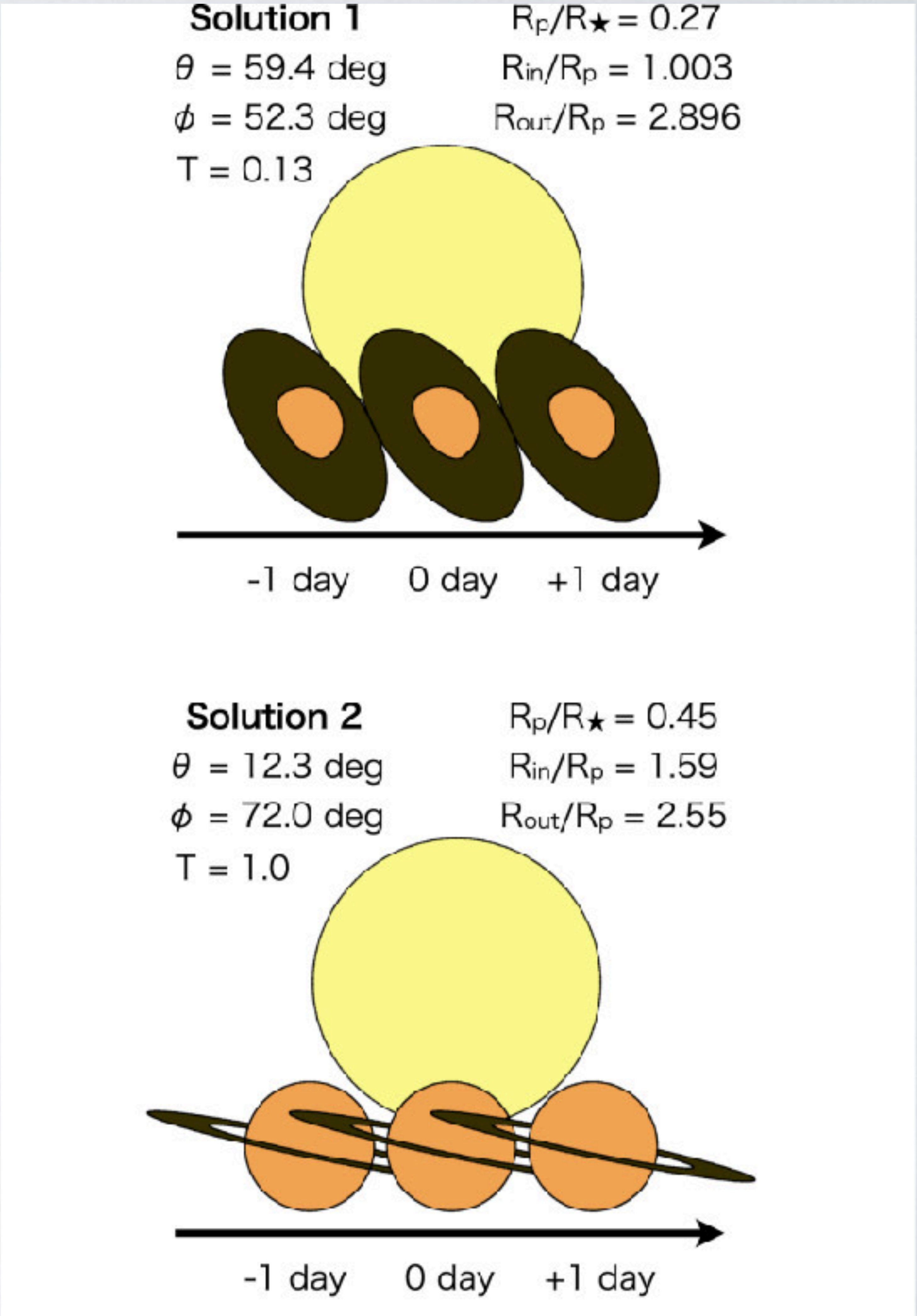

Aizawa+ 2017

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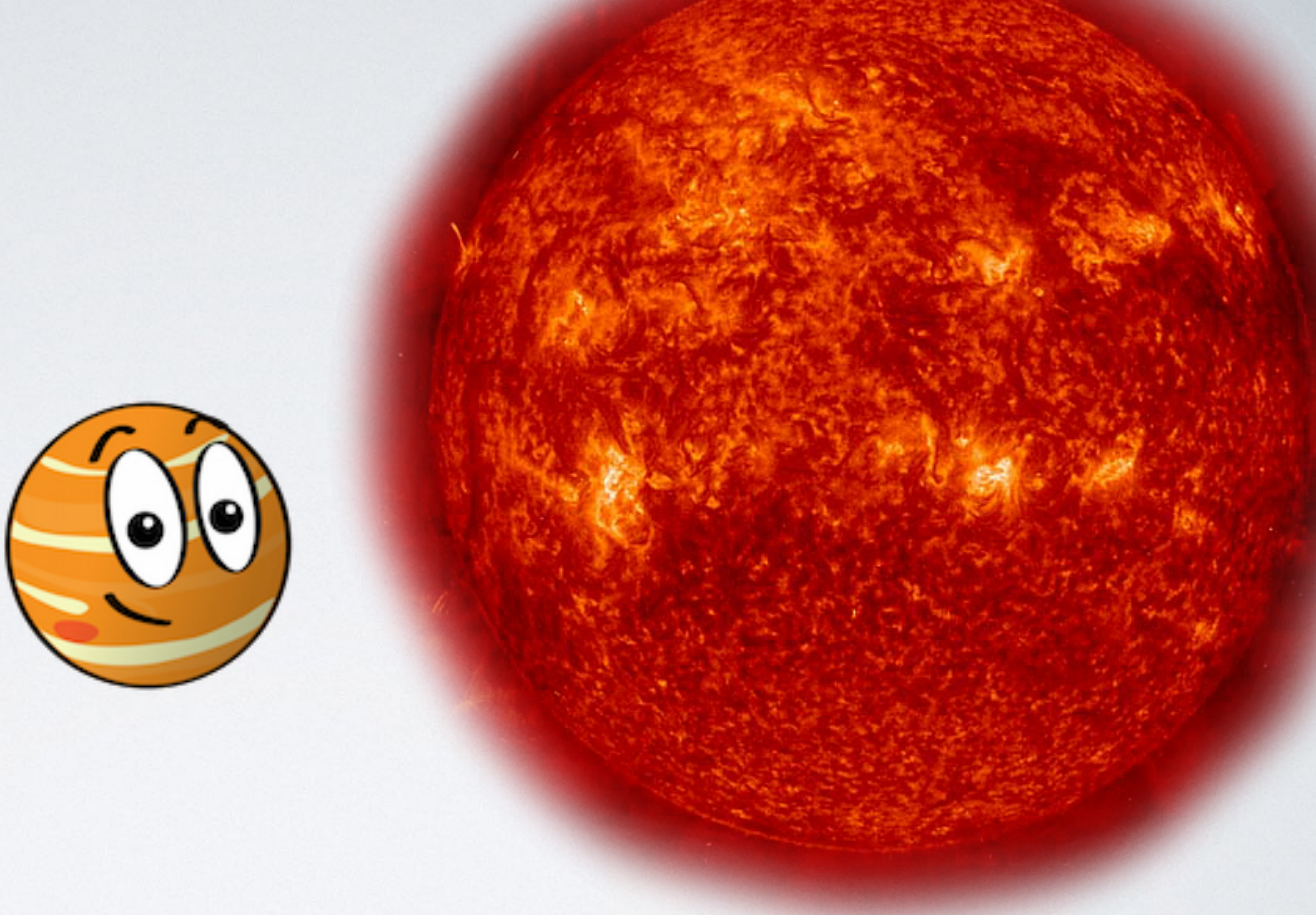

Image credit NASA (really)

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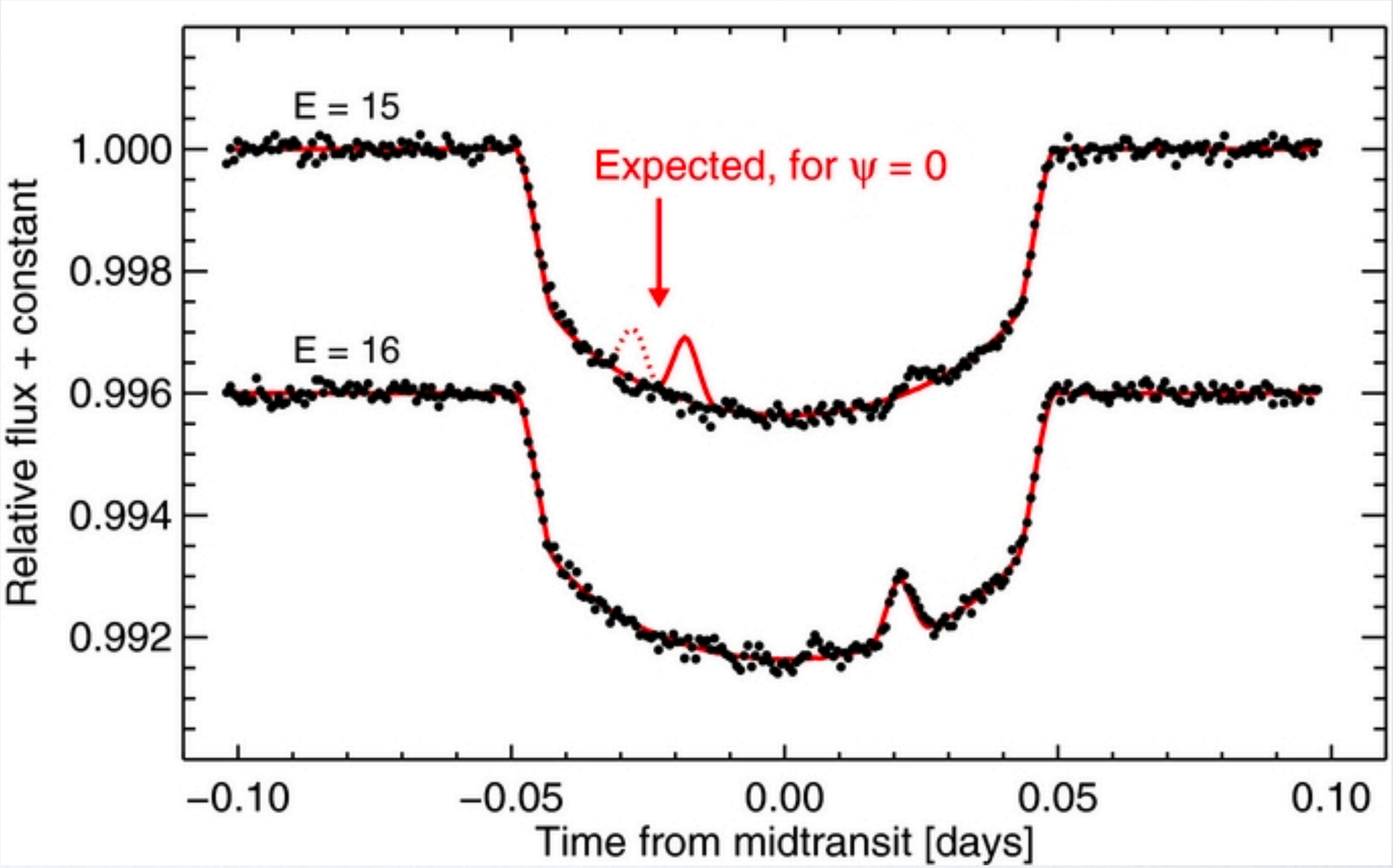

Sanchis-Ojeda and Winn (2011)

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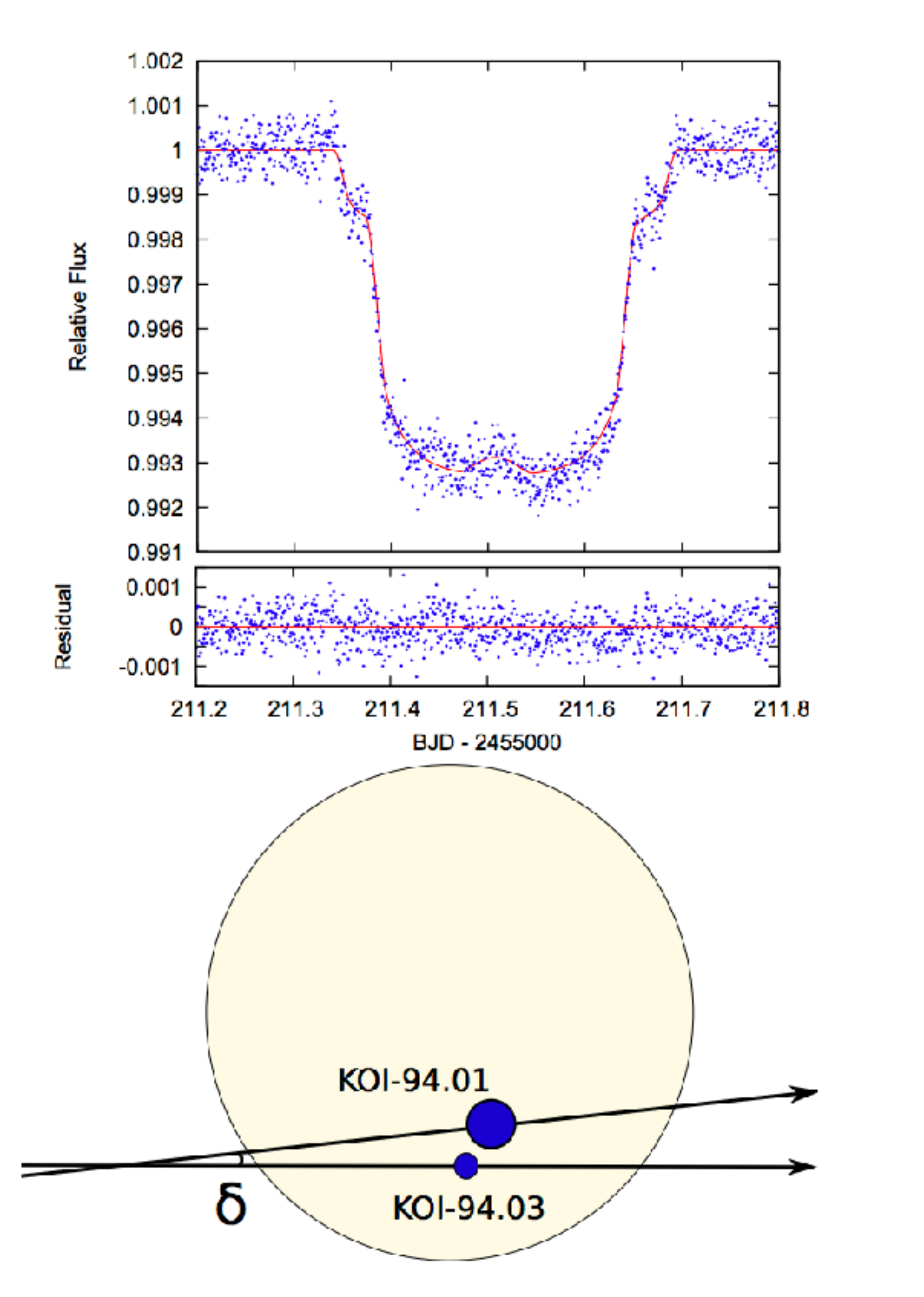
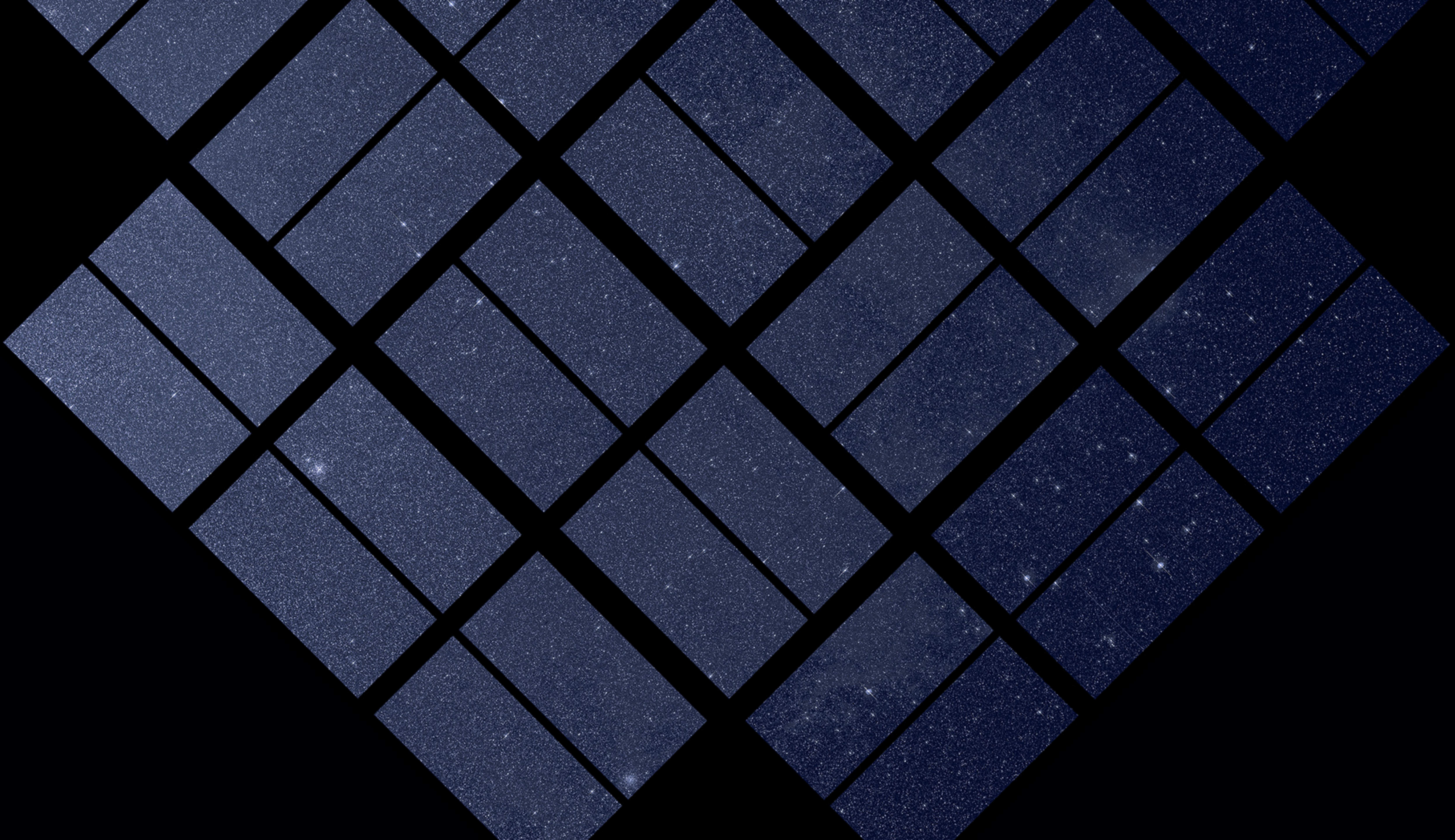


Hirano+ 2012

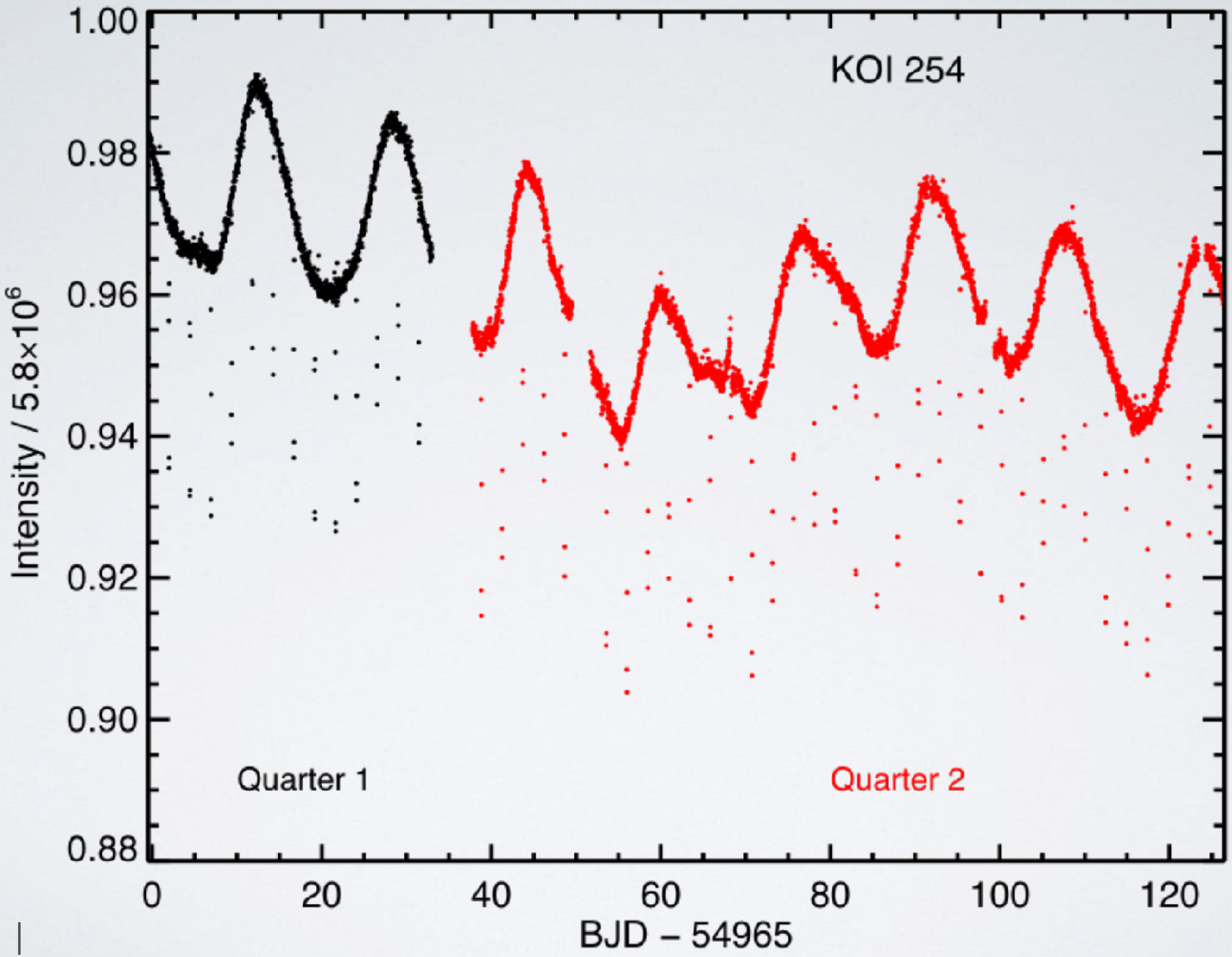
TRANSITS ARE

RARE



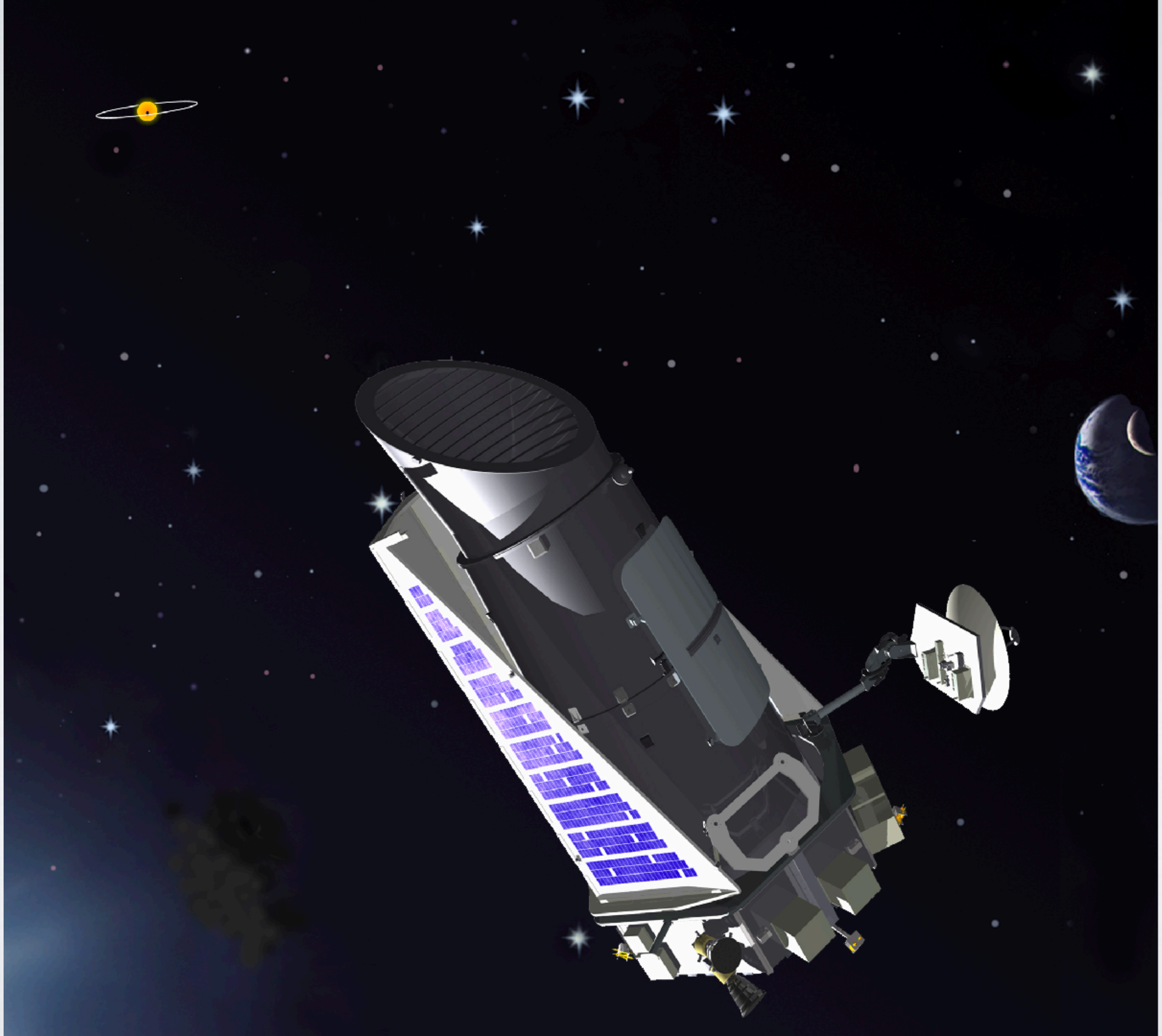
TRANSITS ARE

UNCOMMON



Johnson+ 2011

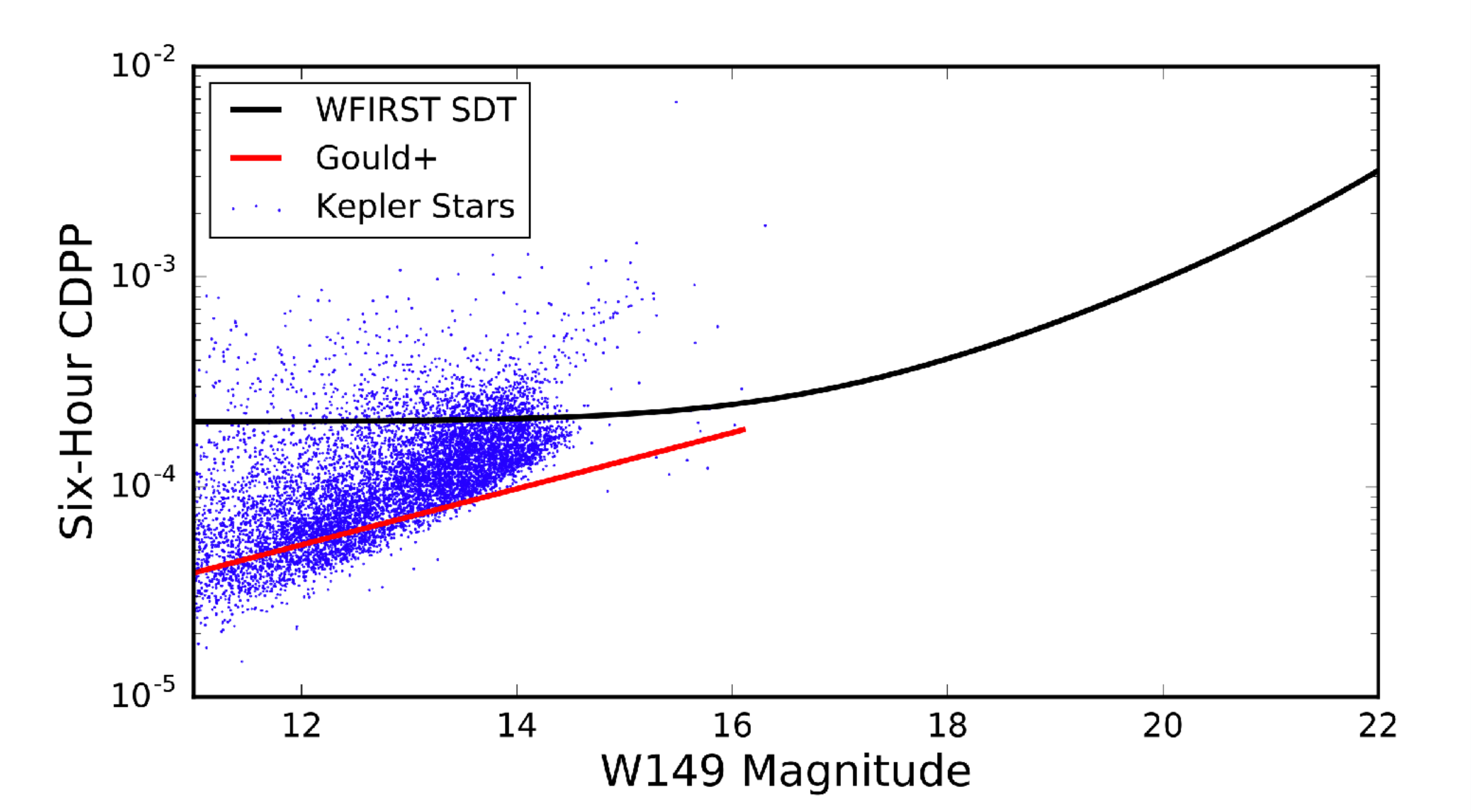
TRANSITS ARE **SMALL**



KEPLER VS *WFIRST*

	KEPLER	WFIRST
Photometric Precision		
Observing Baseline		
Number of Stars		

KEPLER VS WFIRST



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Nu

KEPLER VS WFIRST

	KEPLER	WFIRST
Photometric Precision	✓	
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CAN *WFIRST* FIND TRANSITS?

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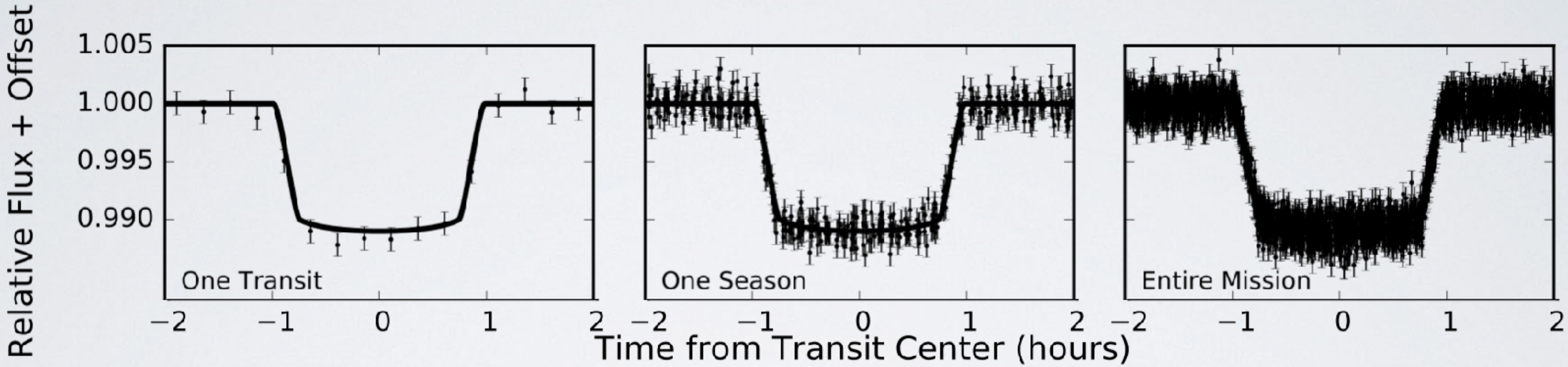

Montet, Yee, and Penny (2017)

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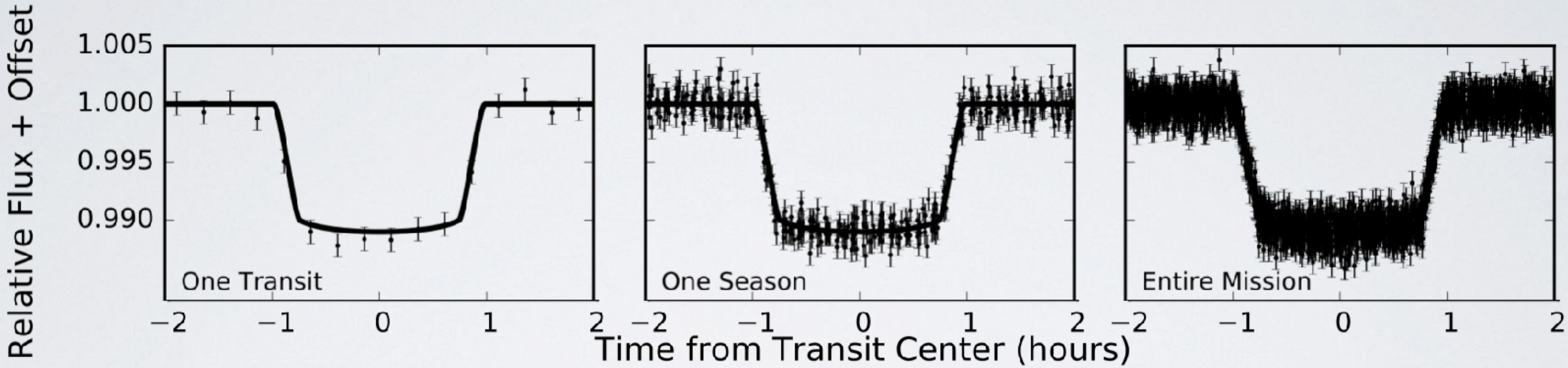
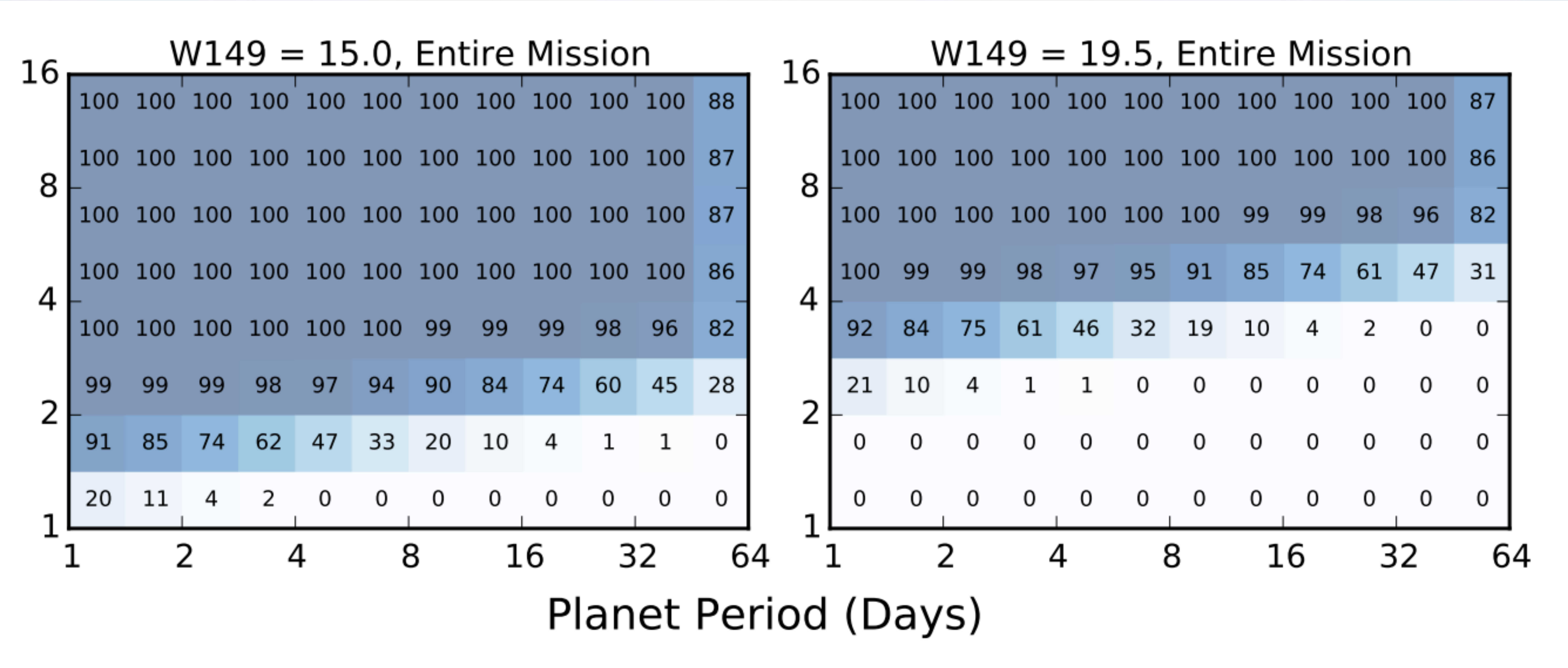


YES!

Montet, Yee, and Penny (2017)

WFIRST CAN FIND TRANSITS!



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KEPLER VS WFIRST

	KEPLER	WFIRST
Photometric Precision	✓	
Observing Baseline		
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KEPLER VS WFIRST

	KEPLER	WFIRST
Photometric Precision	✓	
Observing Baseline	✓	✓
Number of Stars		

KEPLER VS WFIRST

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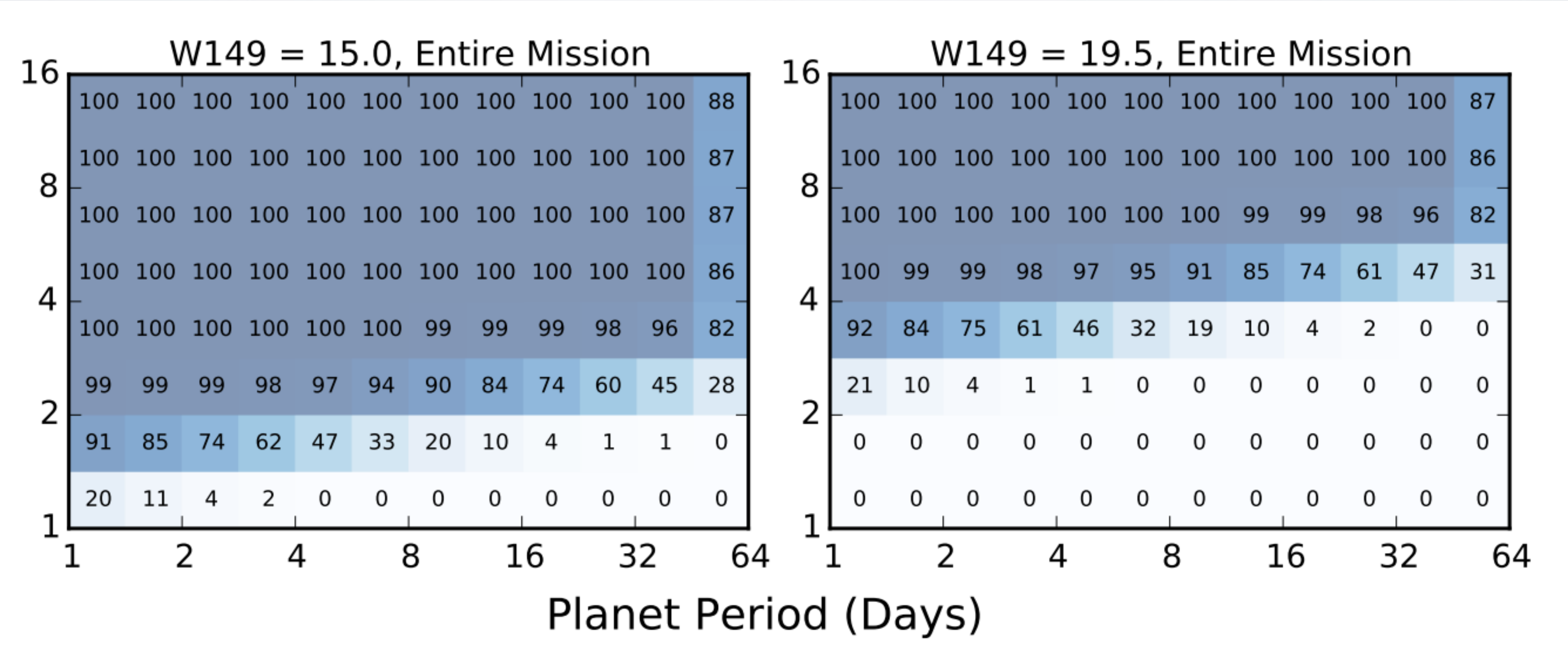
Photometric Precision	✓	
Observing Baseline	✓	✓
Number of Stars		


Hubble
WFIRST

KEPLER VS WFIRST

	KEPLER	WFIRST
Photometric Precision	✓	
Observing Baseline	✓	✓
Number of Stars		✓✓✓

WFIRST CAN FIND TRANSITS!



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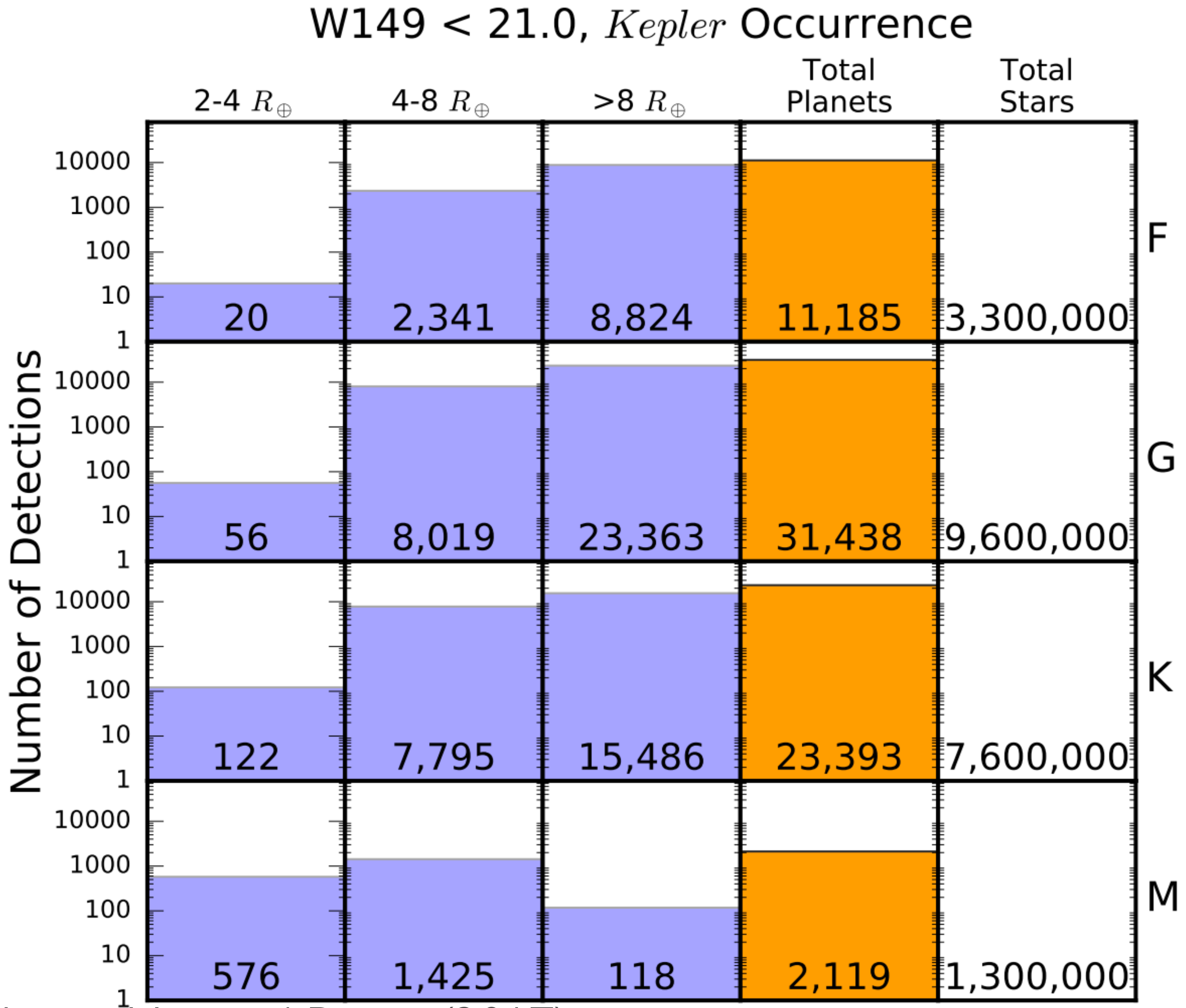

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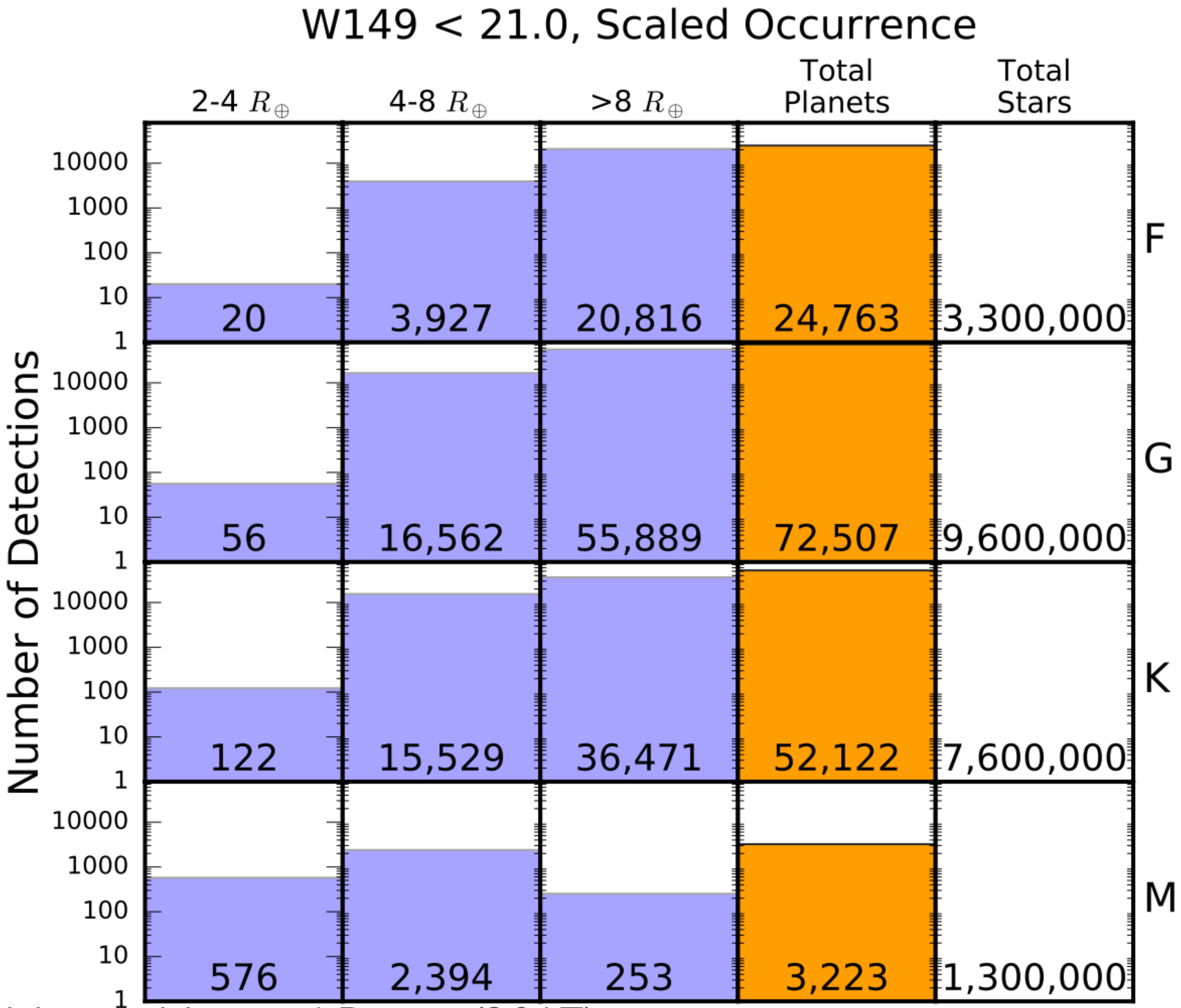
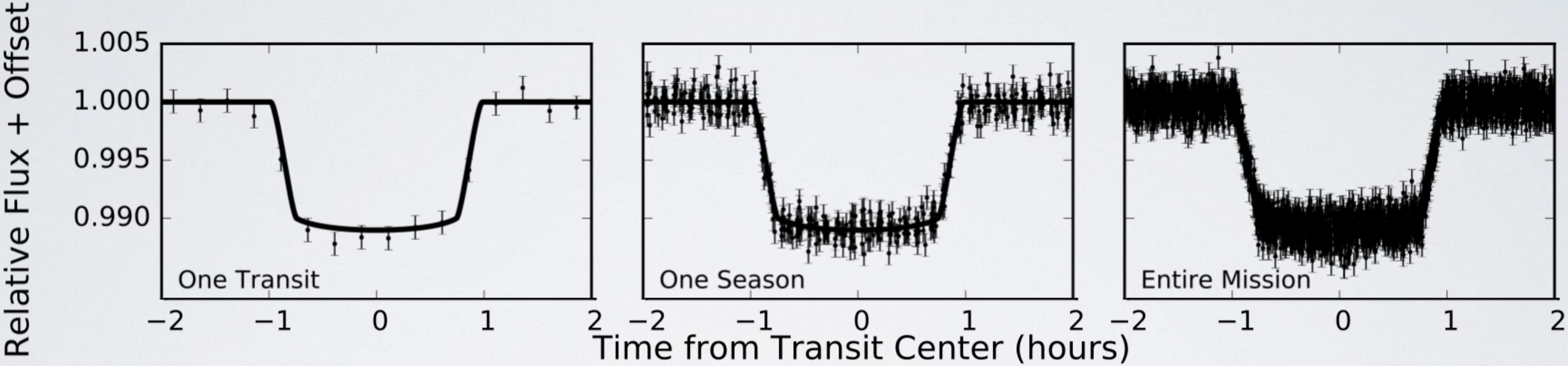


Montet, Yee, and Penny (2017)

CONFIRMING *WFIRST* PLANETS



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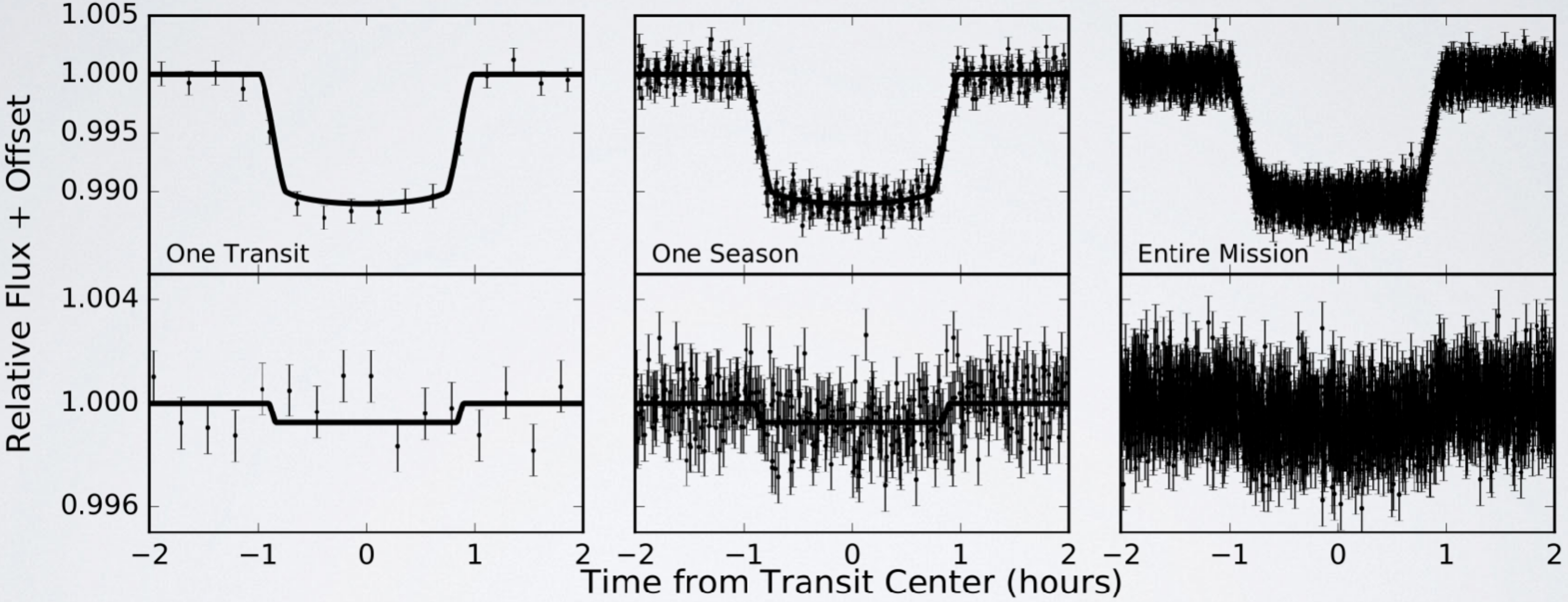
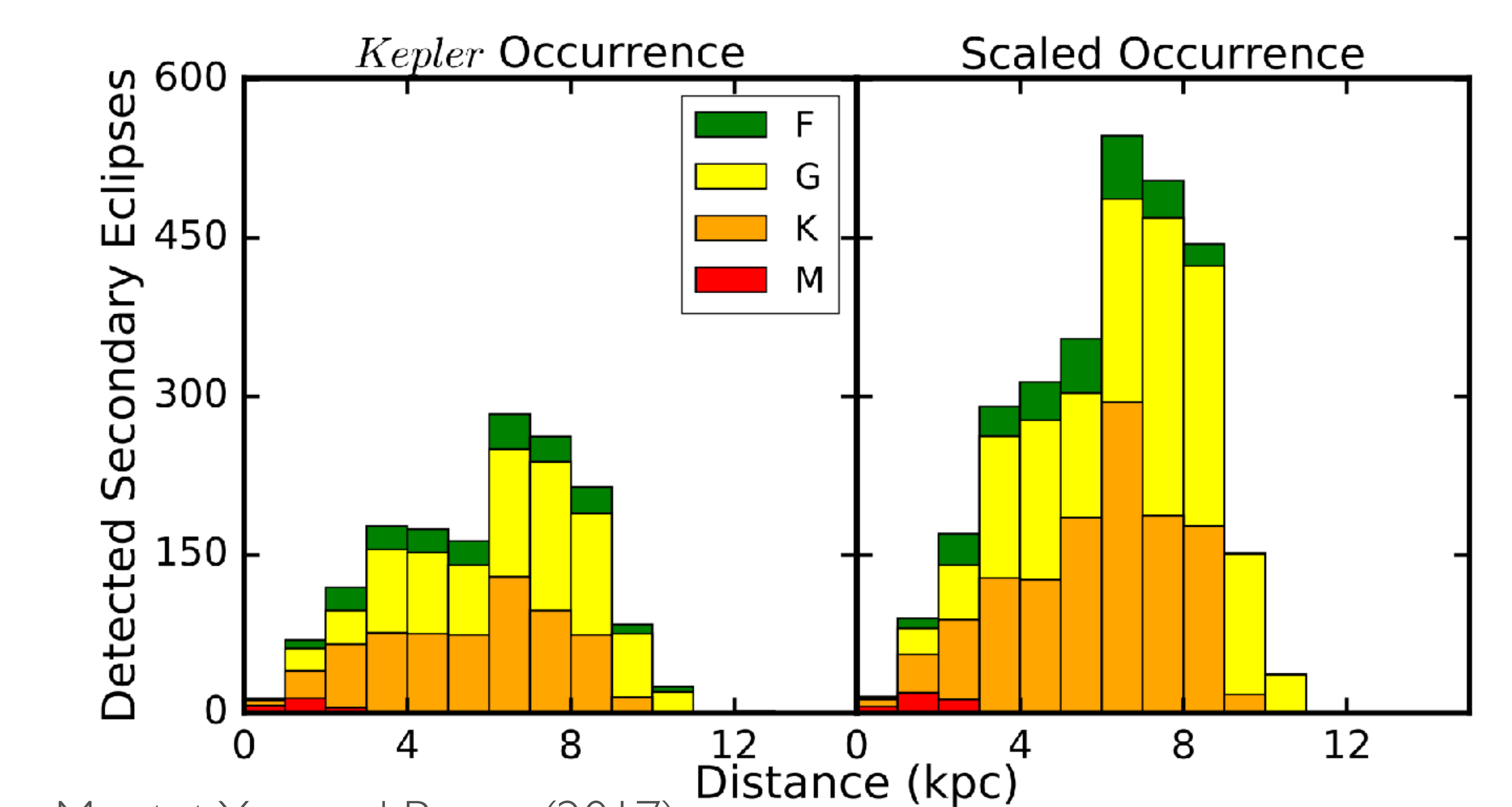


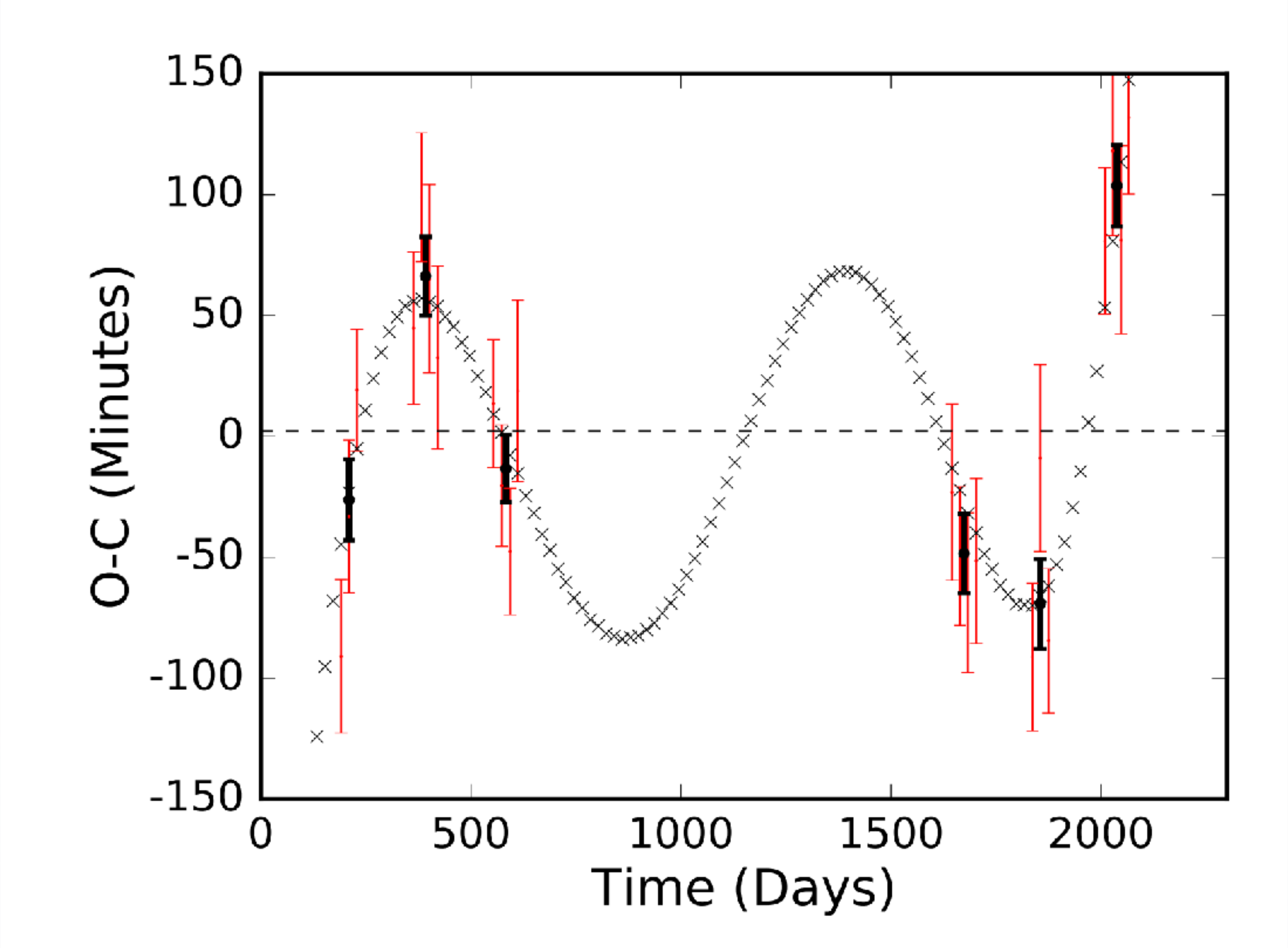
Montet, Yee, and Penny (2017)

SECONDARY ECLIPSES WITH *WFIRST*



Montet, Yee, and Penny (2017)

DYNAMICALLY INTERACTING PLANETS WITH *WFIRST*



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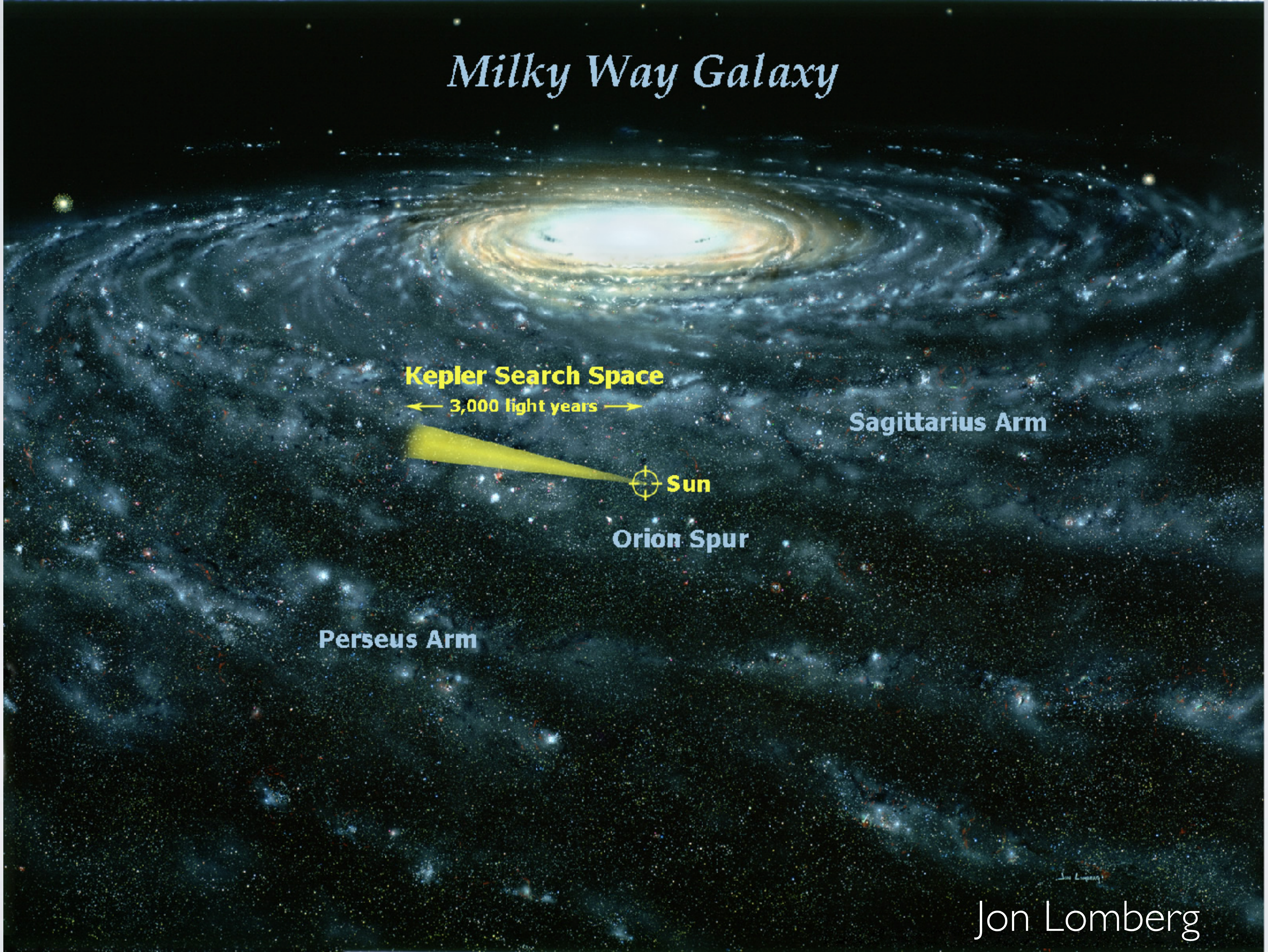
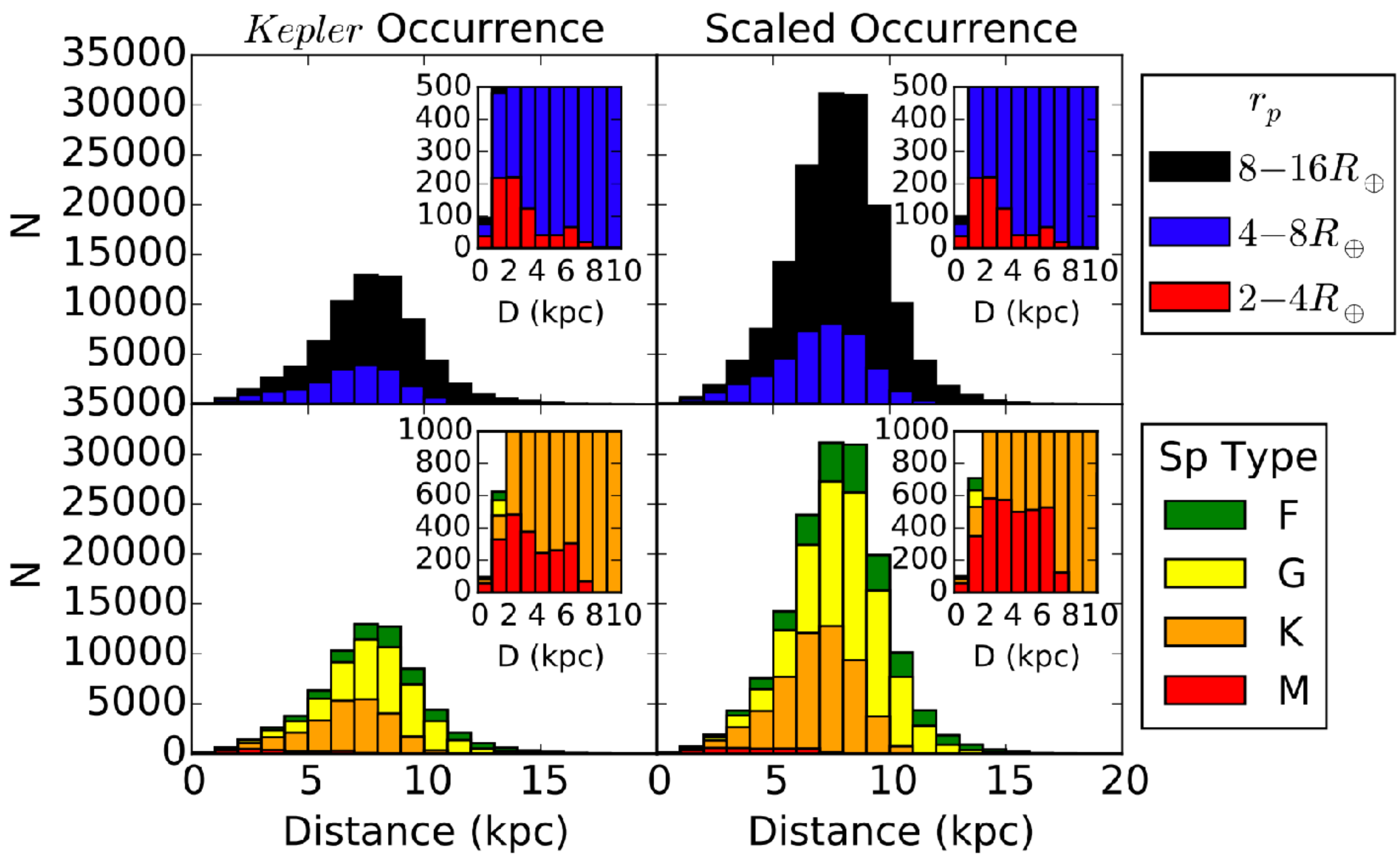

Milky Way Galaxy
Kepler Search Space
3,000 light years
Sun
Sagittarius Arm
Orion Spur
Perseus Arm
Jon Lomberg



Montet, Yee, and Penny (2017)

WFIRST IS PROBING A NEW GALACTIC ENVIRONMENT

How do giant planets form and evolve around the most metal-rich stars?

Do our expectations from the local part of the galaxy (RVs, *Kepler*)
hold true halfway across the galaxy?

Are planetary atmospheres different? What about orbital eccentricities?

Do hot Jupiters have friends? Are timing variations common?

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