



# MINERVA-Australis: A Southern TESS Follow-Up Machine

Rob Wittenmyer

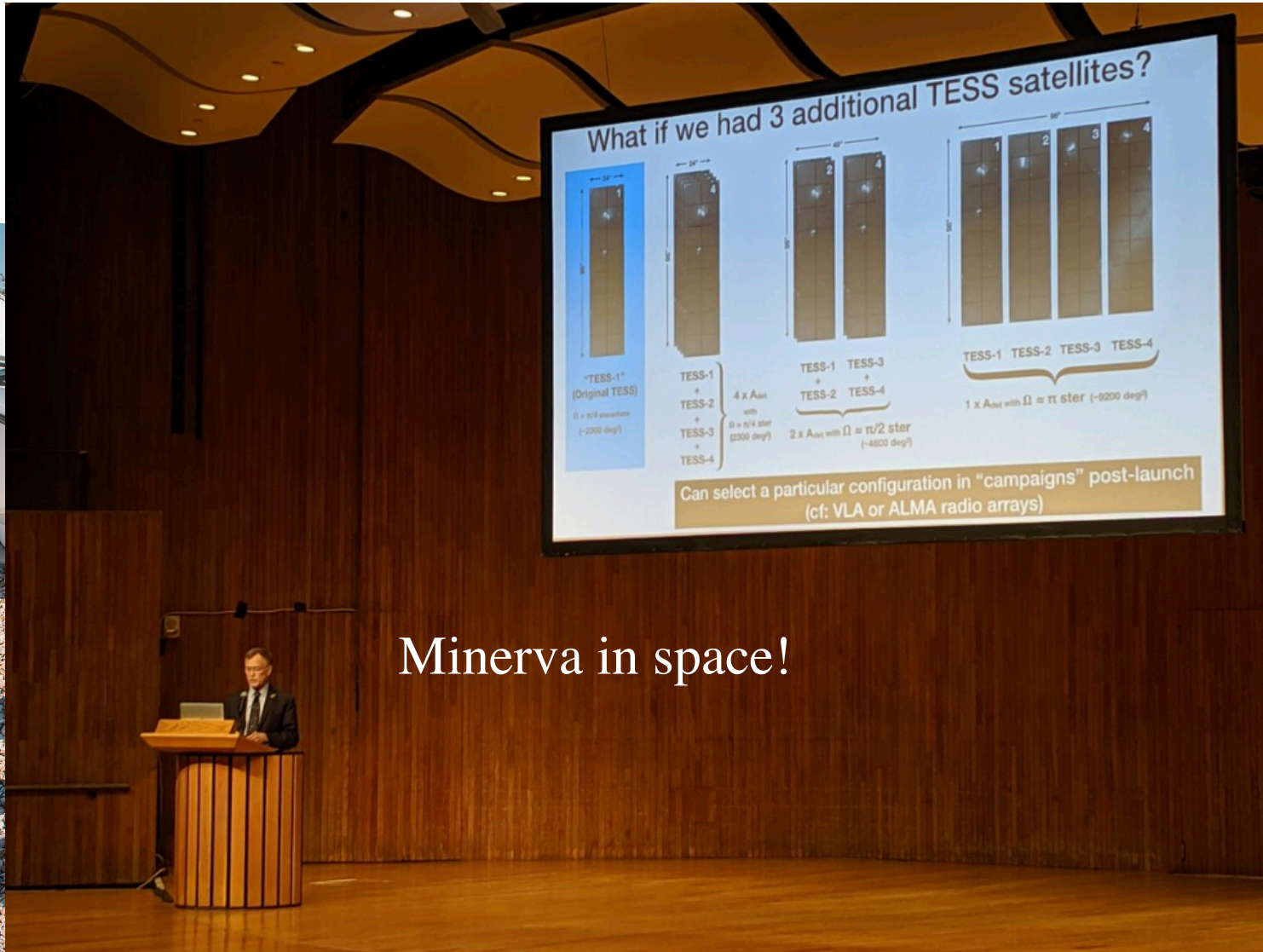
University of Southern Queensland

MINERVA-Australis Lead Investigator

2019 August 1

# MINERVA-Australis: Concept

## Multiple telescopes, one spectrograph



Minerva in space!



# MINERVA-Australis: Partners

“From many, we are one”



# MINERVA-Australis: Science



- TESS mini-M
- Precise highly and n
- Prime planet additi



MAKE GIFS AT GIFSOUP.COM

- MINERVA-Australis at USQ is the world's only fully dedicated TESS Southern follow-up facility.

-earths and  
re limited and  
any planets  
r TESS  
monitoring for

## WHAT PLANETS WILL WE FIND?

# MINERVA-Australis: Site



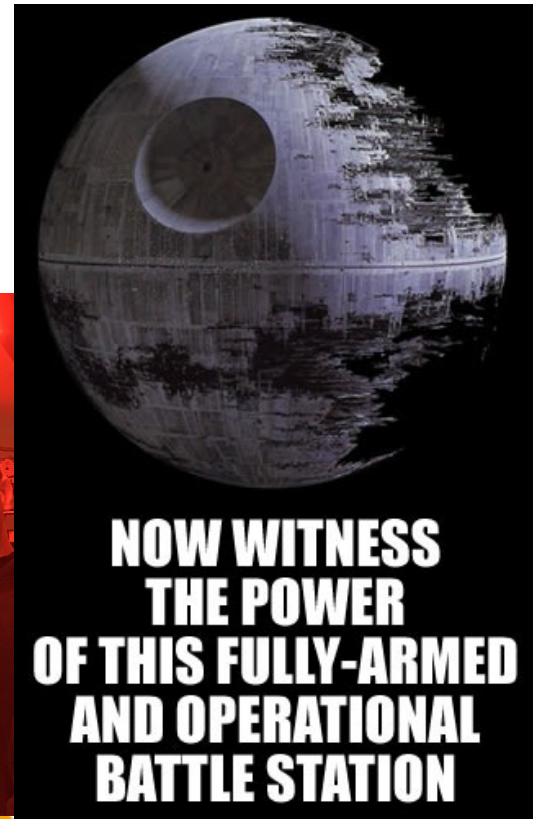
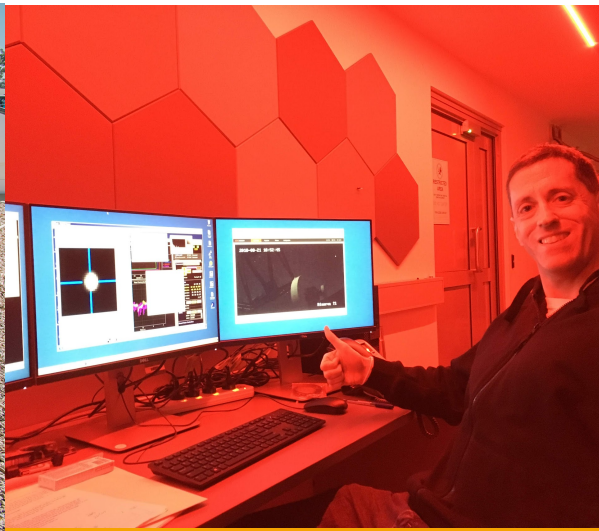
- 28° South: Northern targets observable to +40 dec
- Average 1.6" seeing, ~65% spectroscopic nights
- 30 minutes from Toowoomba campus: easily accessible for maintenance
- Semi-robotic operations: "cyborg observing" mode



# MINERVA-Australis: Status



- Telescopes 1-3-4 fully operational in RV mode
- T2 in full photometry mode
- T5 coming online next week when we get back
- “Poster sparklers” highlighting my team members who are doing the real work



# MINERVA-Australis: Team



LIVE [Truegif.com](http://Truegif.com)



**You Da Real MVP**

# MINERVA-Australis: Technical

## Duncan Wright



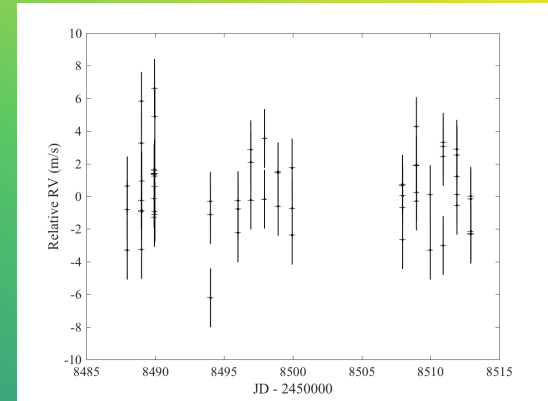
## MINERVA Australis

5 telescopes

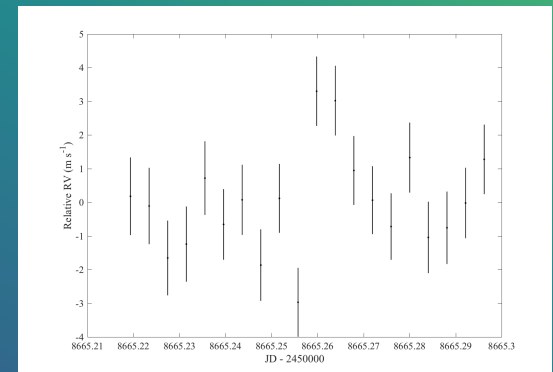
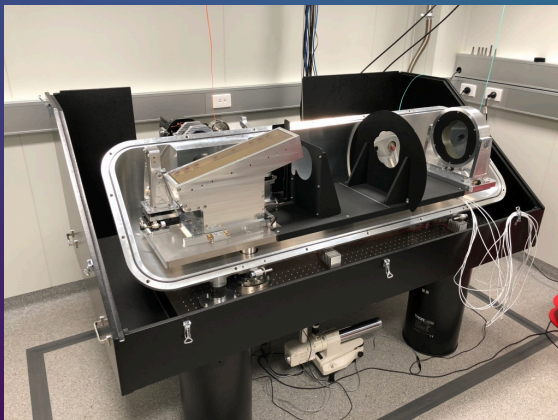
One spectrograph

$1.5\text{ms}^{-1}$  precision

$V < 11$



1 telescope  $2.3\text{ms}^{-1}$   
tau Ceti  
3 telescopes  $1.5\text{ms}^{-1}$



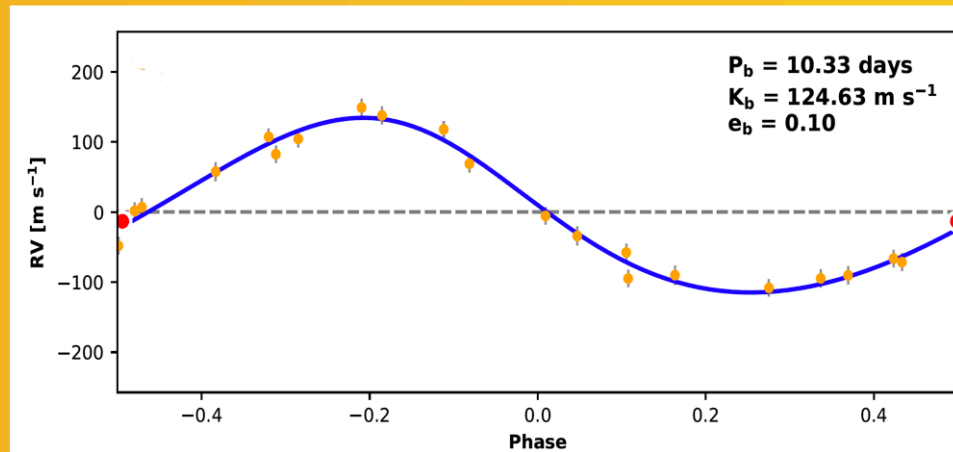
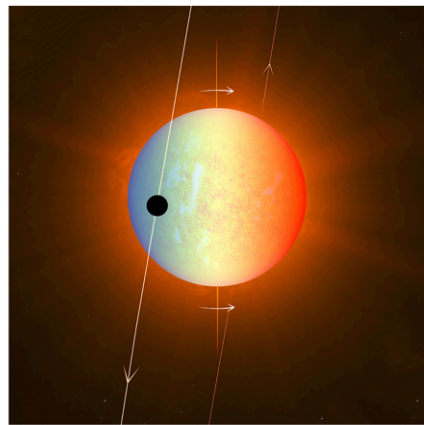
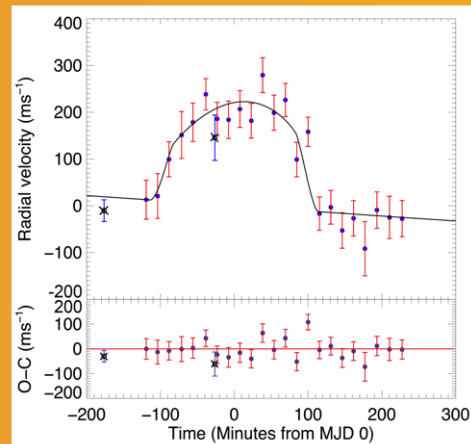


# MINERVA-Australis: Science

Brett Addison



Do you want to probe the migration history of exoplanets?  
Do you want the masses & bulk densities of TESS planets?



Come see the cool science that team **MINERVA-Australis** is doing!



Poster →

**18**

# MINERVA-Australis: Science

Jake Clark



WOULD YOU LIKE REVISED RADII AND  
MASS MEASUREMENTS FOR CTL STARS?

WOULD YOU ALSO LIKE 29 CHEMICAL  
ABUNDANCES WITH SAID STARS?

We've got you fam!

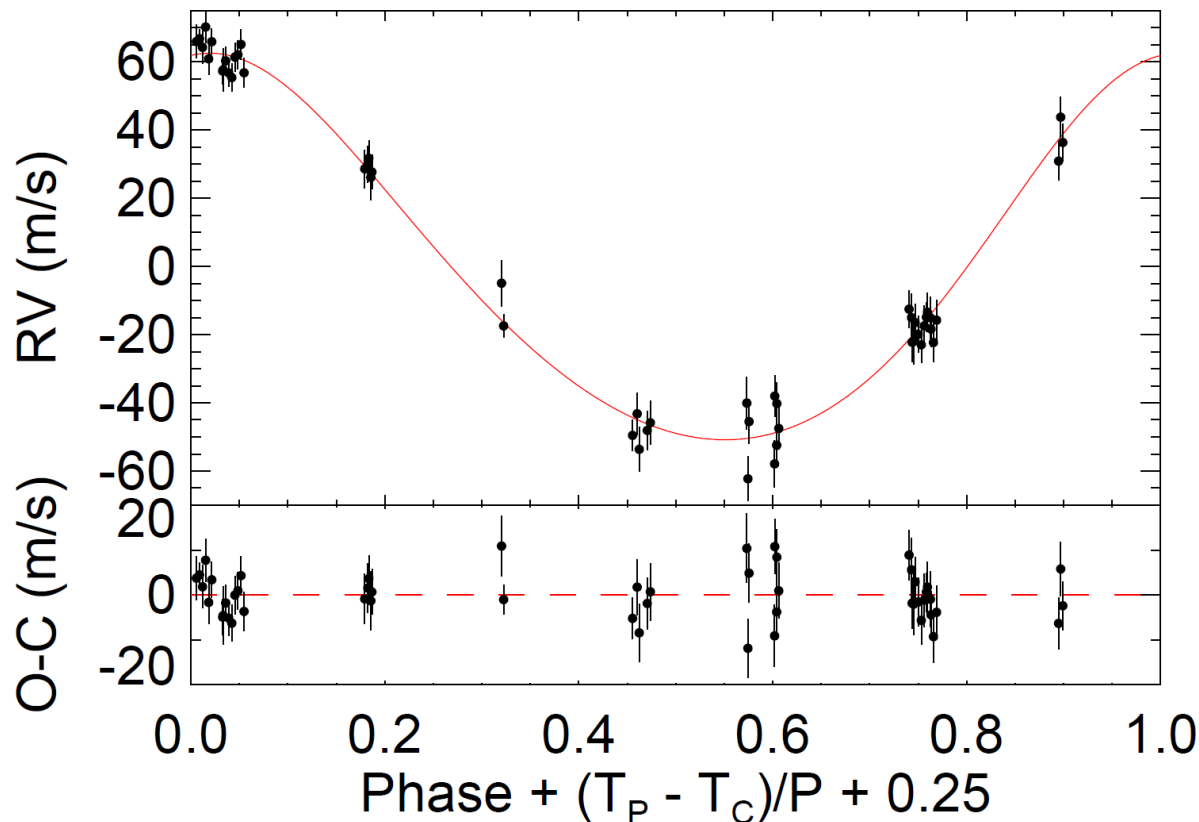
81

# MINERVA-Australis:

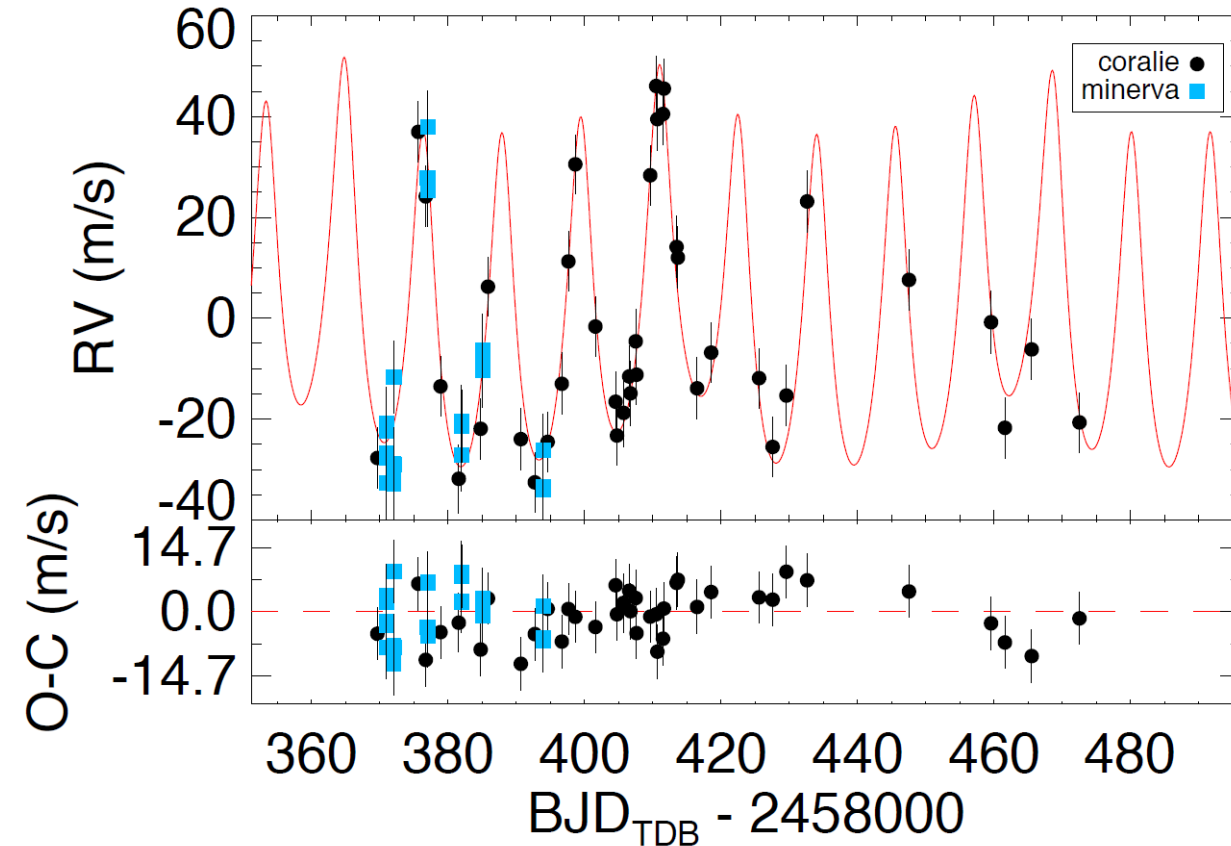
## Does the bloody thing work?



- HD 75289, known Hot Jupiter  $P=3.486$  d
- V mag: 6.36 26 days of data
- Fit RMS = 5.3 m/s



# MINERVA-Australis: Results



Our first discovery!

“Pre-commissioning”  
data from 2018 Sep



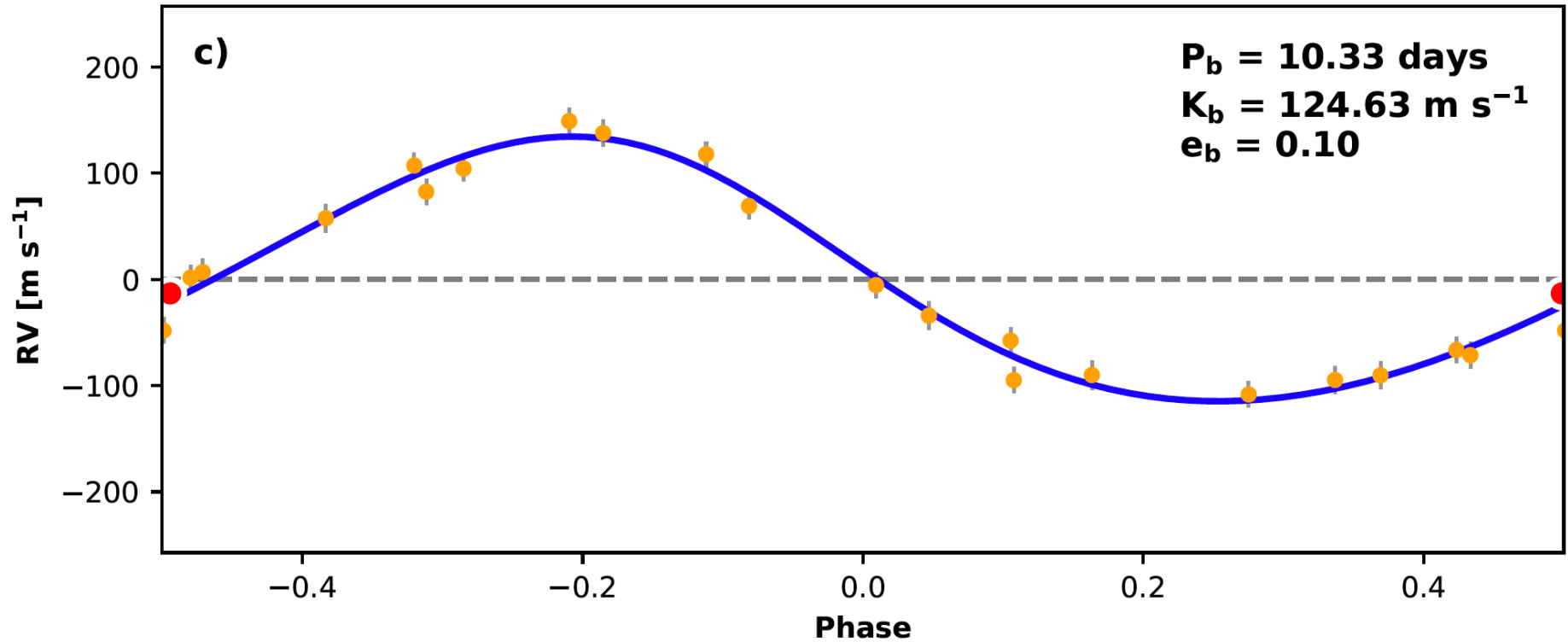
Minerva data (blue) for HD 1397 = TOI-120

Consistent with CORALIE data (black)

L.D. Nielsen et al., 2019 A&A 623, 100

# MINERVA-Australis: Results

## Our first TOIs



Planet mass:  $1.55 \pm 0.19$  Jupiter masses

$a = 0.100 \pm 0.004$  AU



# MINERVA-Australis: Results

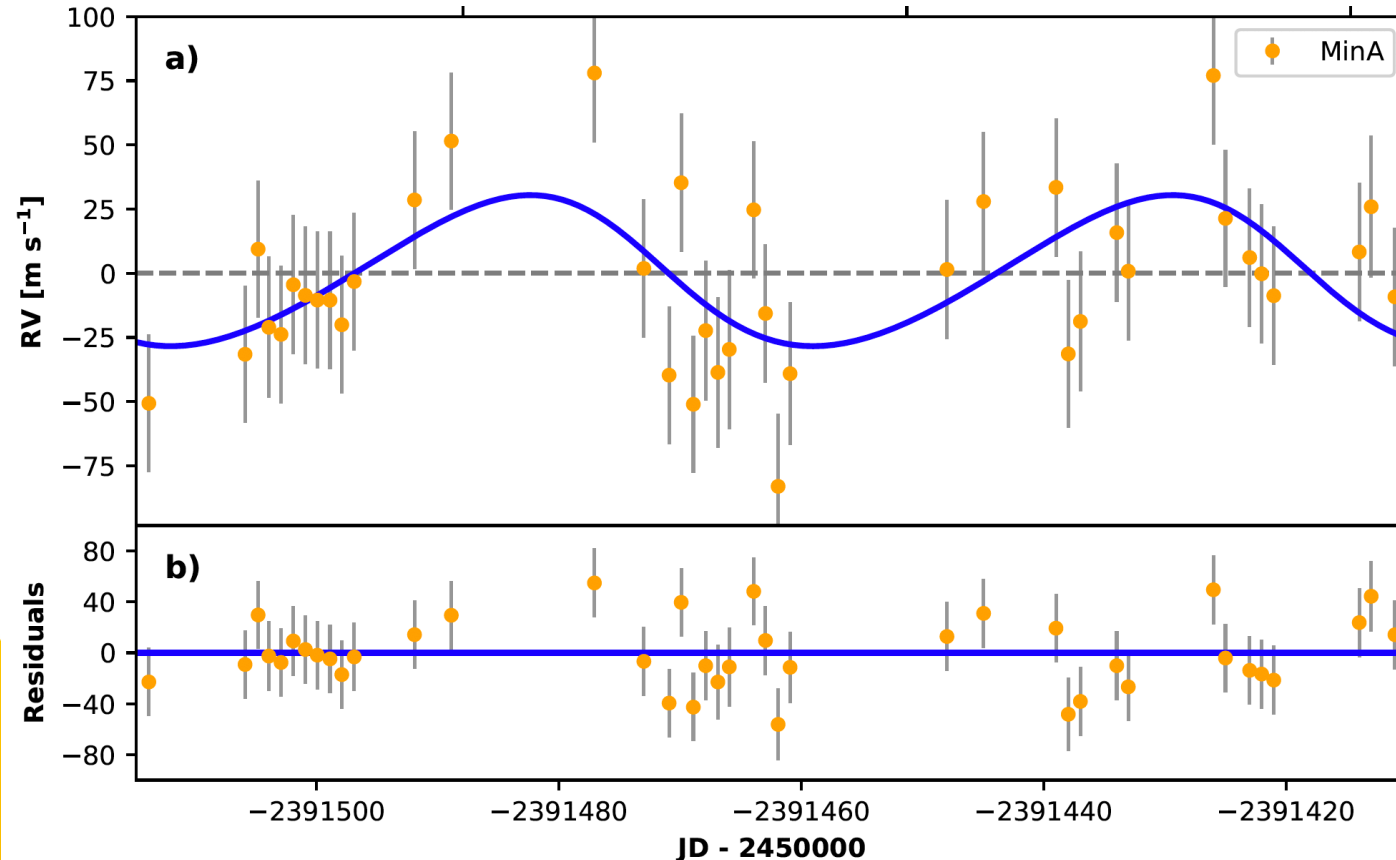
## Our First TOIs



$P=52.98$  days

About 2 Saturn masses

Longest period (coldest) TESS planet yet!



# MINERVA-Australis: Results

## Our First TOIs



40 c)

$P_b = 0.52783 \pm 0.00054$  days  
 $K_b = 20.5 \pm 6.1 \text{ m s}^{-1}$

- $P_1 = 0.5$  days  
-/- 8 Earth mass



= 12.7 days  
- getting more



# Summary: Dream not of today

- Two years ago, this was dirt. Now we are a full 4-telescope RV machine.
- Fully dedicated to PRV ops means we can pursue science beyond “flag planting.”
- Single transits. Overall system architectures. R-M. Doppler Tomography...



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