Observing transiting exoplanets in colors with ASTEP+

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SCAR - 10 September 2021

Where is Astronomy heading?

The Science of the next Decade

Dome C

LIGO
Gravitational wave detections

V. Rubin Observatory
Fast and Deep Survey of the visible sky.

From “Niche” to “Node”

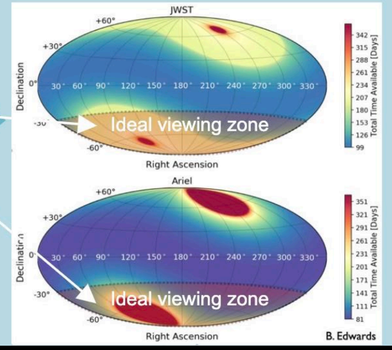
“Multi Messenger”
“Transient astronomy”
“Alert Networks”

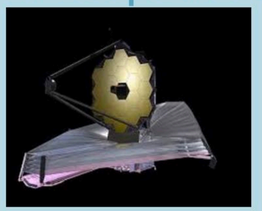
TESS (+ other surveys)
Exoplanet candidates

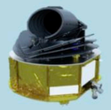
Dome C

Validation, follow-up, ephemerides

JWST + ARIEL
Characterization of exoplanets



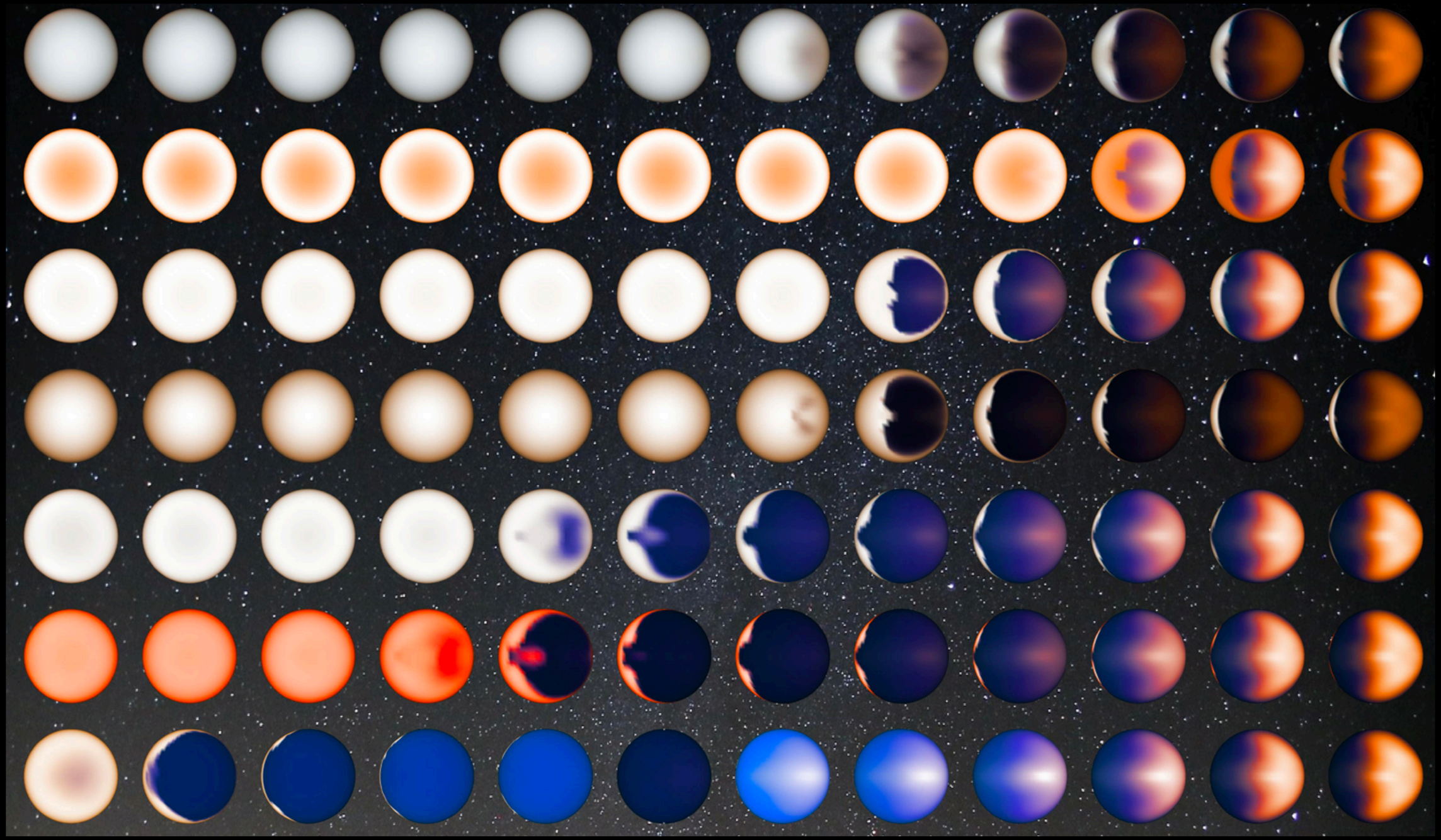




JWST
NASA/ESA
6m telescope
launch 2021

ARIEL
ESA
1m telescope
launch 2029

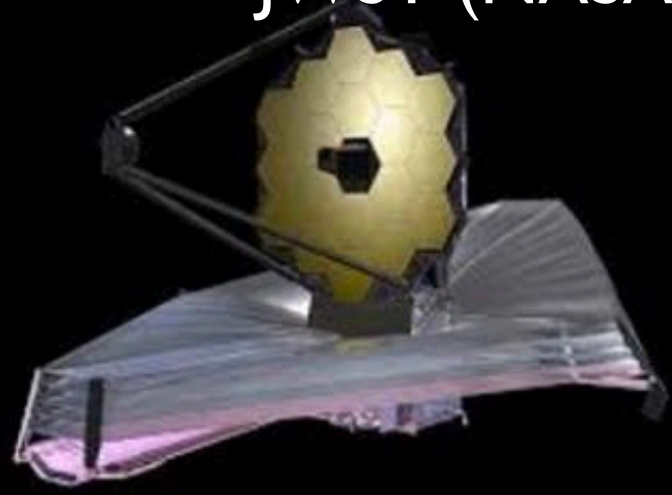
Courtesy: T. Travouillon, Concordia Perspectives Webinar, 16/11/2020

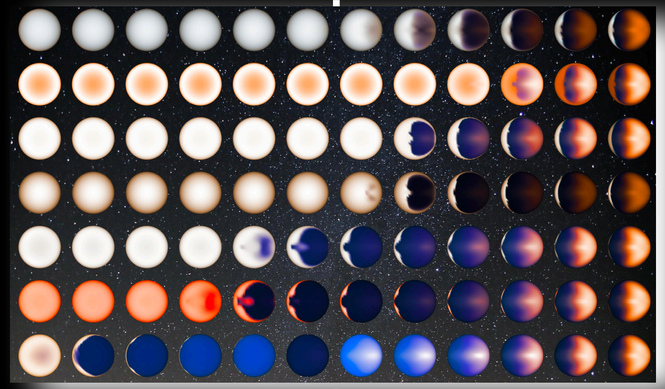


Parmentier et al. (2016)

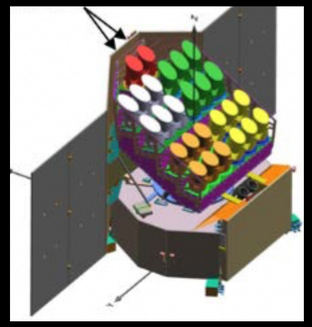
TESS (NASA)

JWST (NASA/ESA)

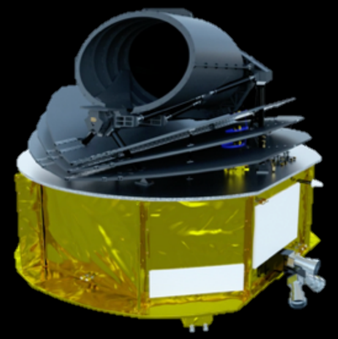




PLATO (ESA)



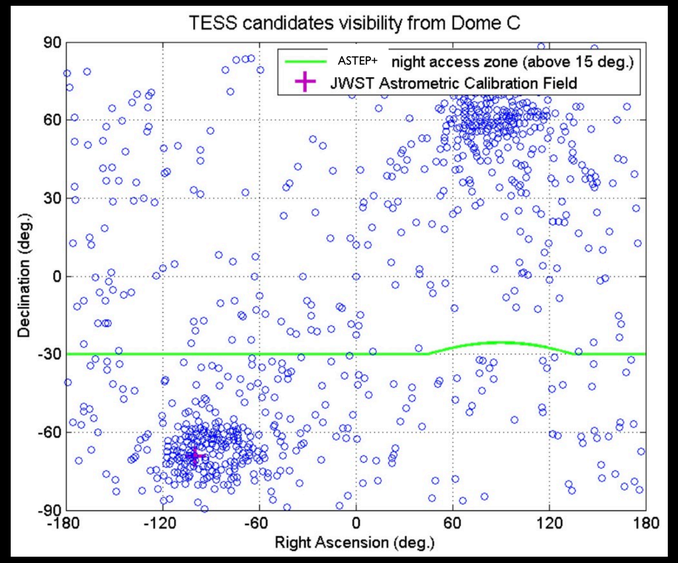
ARIEL (ESA)



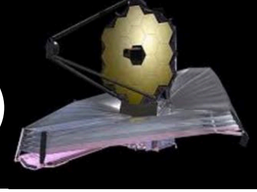
discover

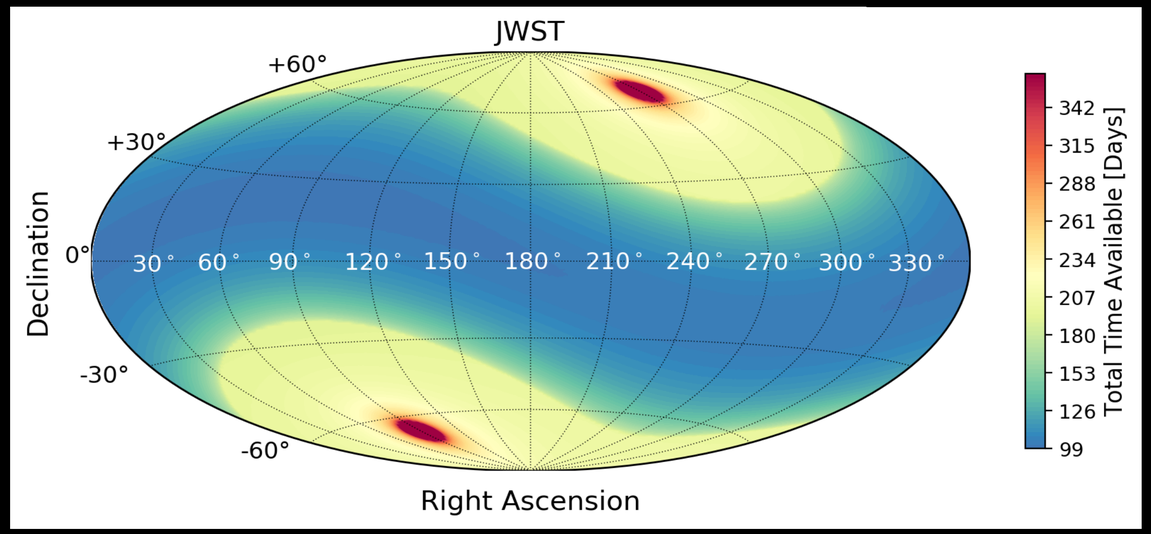
characterize

TESS (NASA)

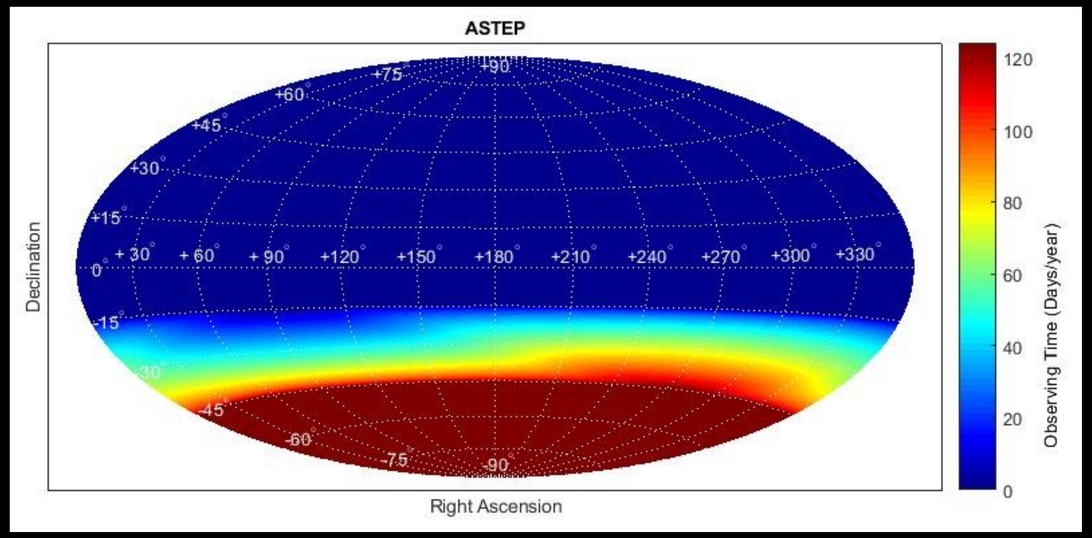


JWST (NASA/ESA)

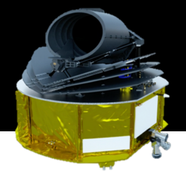


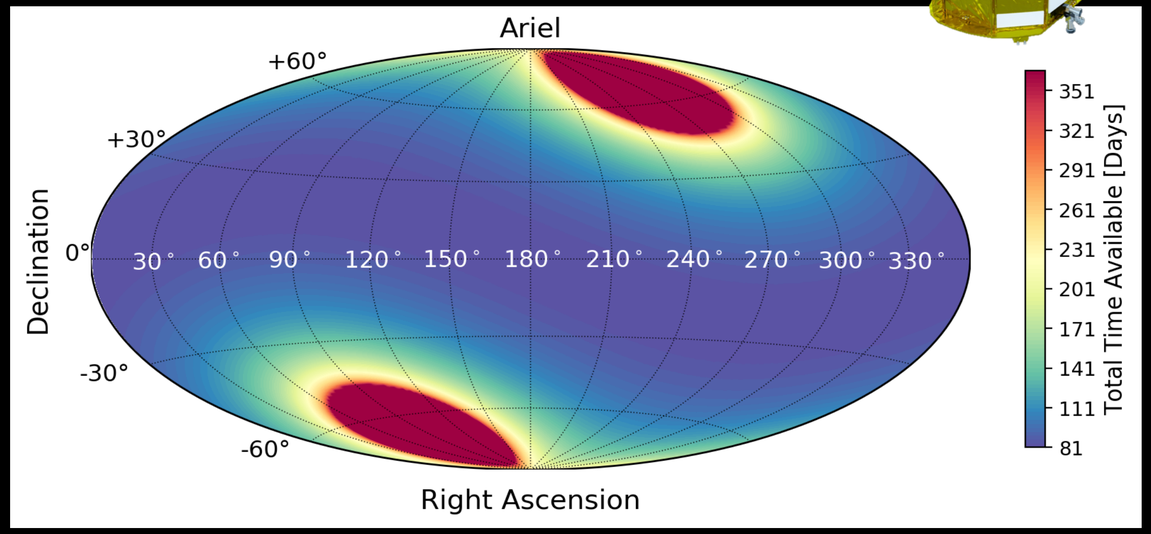


ASTEP

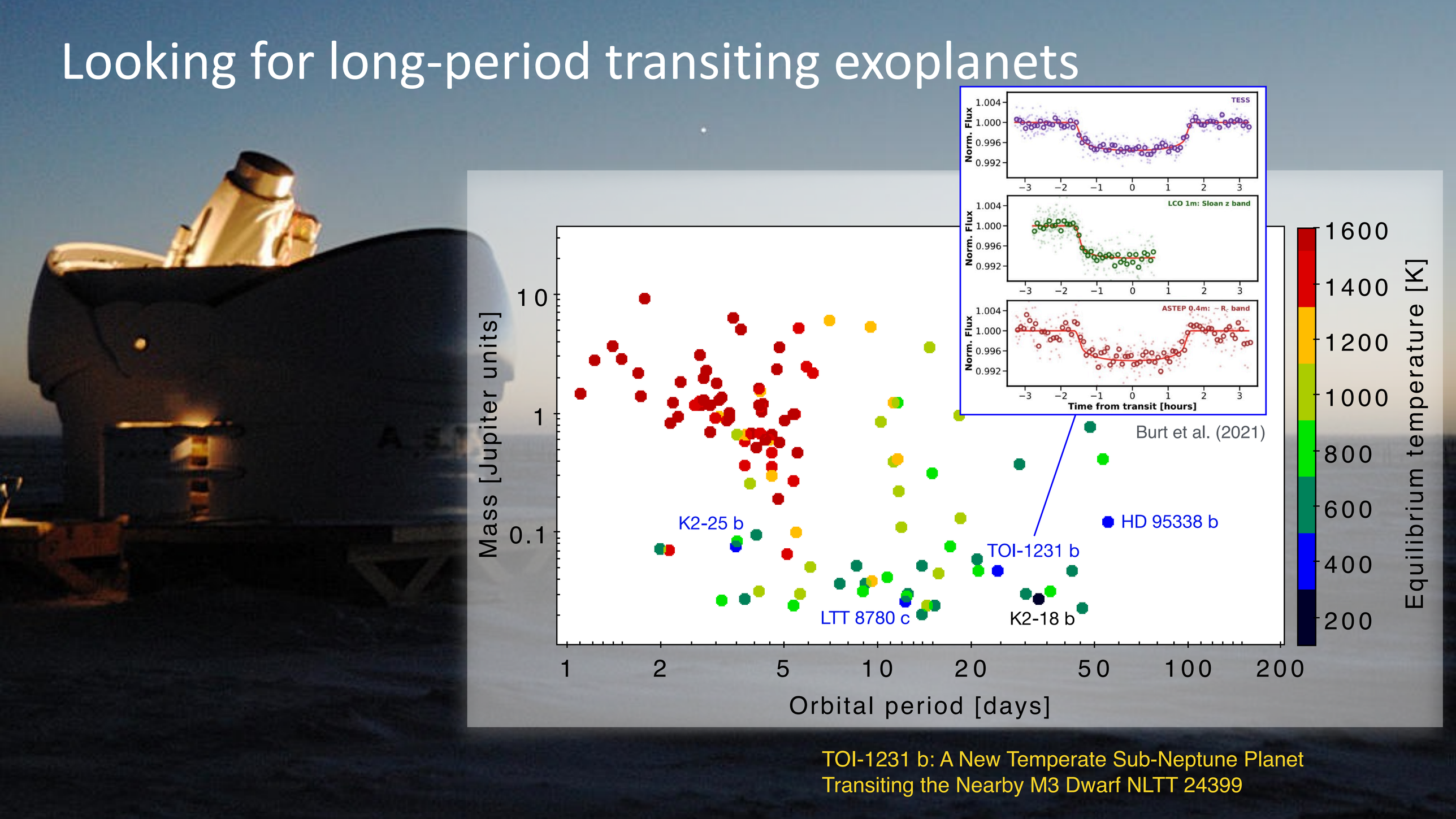


ARIEL (ESA)



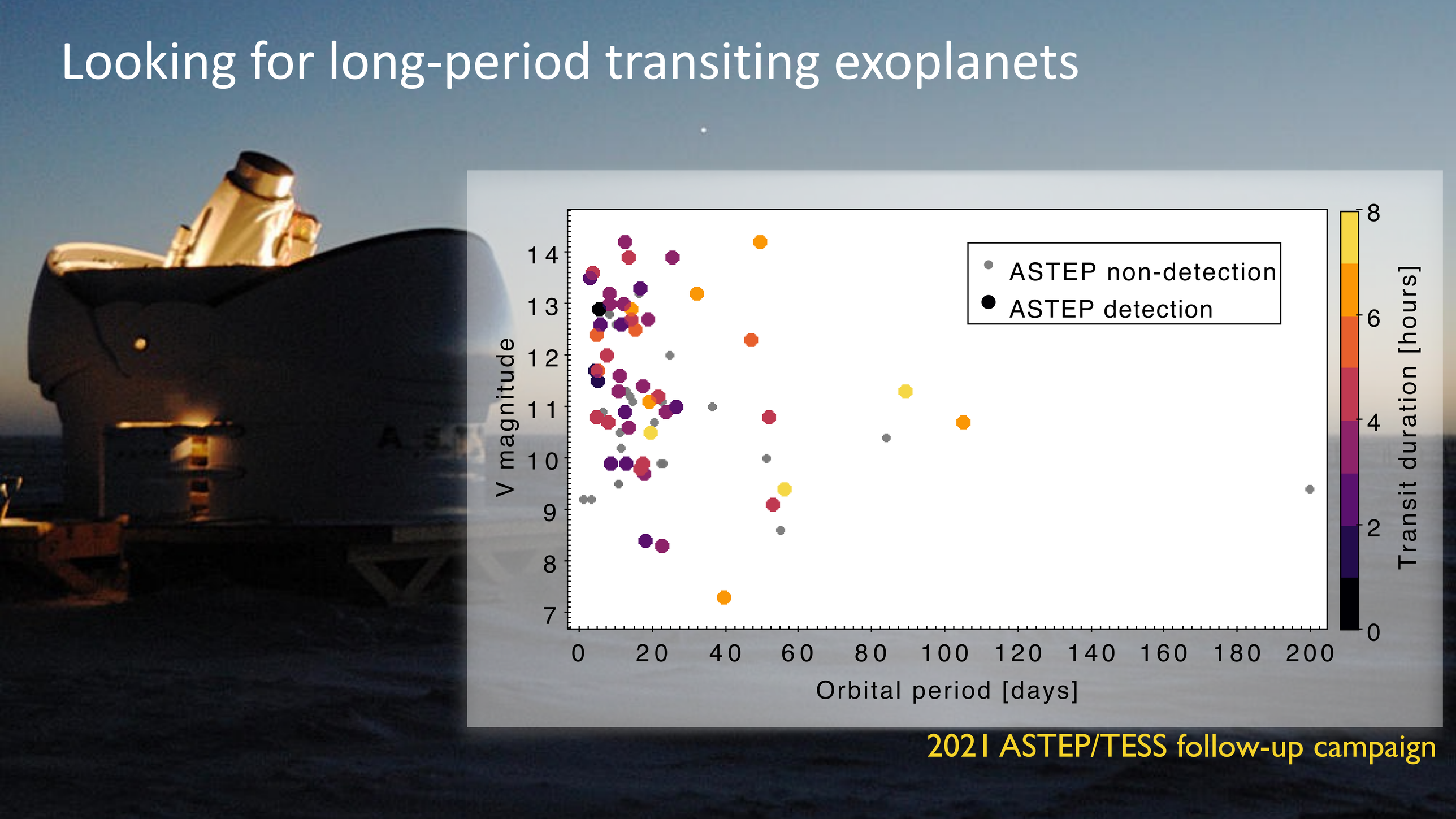


Looking for long-period transiting exoplanets



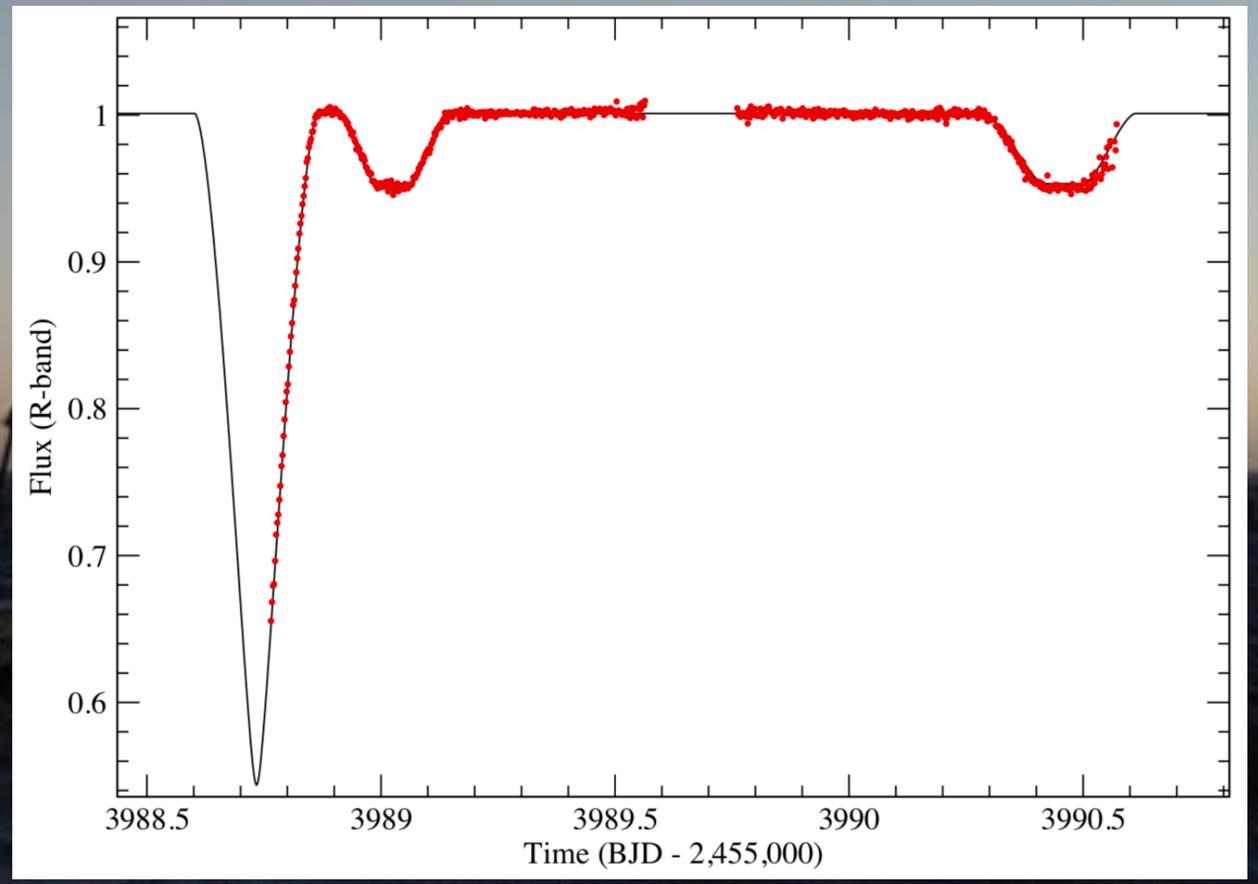
TOI-1231 b: A New Temperate Sub-Neptune Planet Transiting the Nearby M3 Dwarf NLTT 24399

Looking for long-period transiting exoplanets



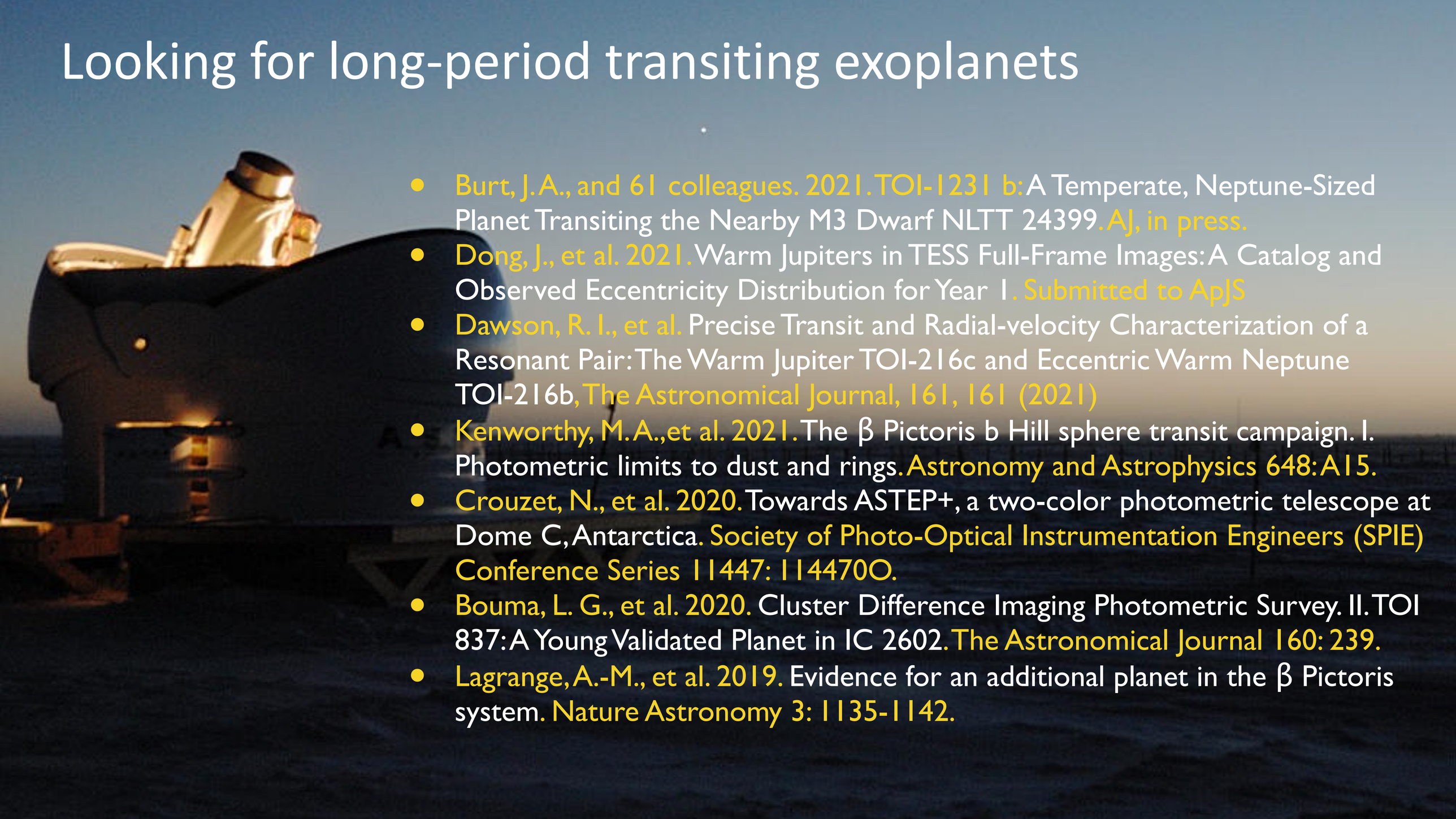
2021 ASTEP/TESS follow-up campaign

Looking for long-period transiting exoplanets



Rare eclipsing triple system: outer period 236 days!

Looking for long-period transiting exoplanets



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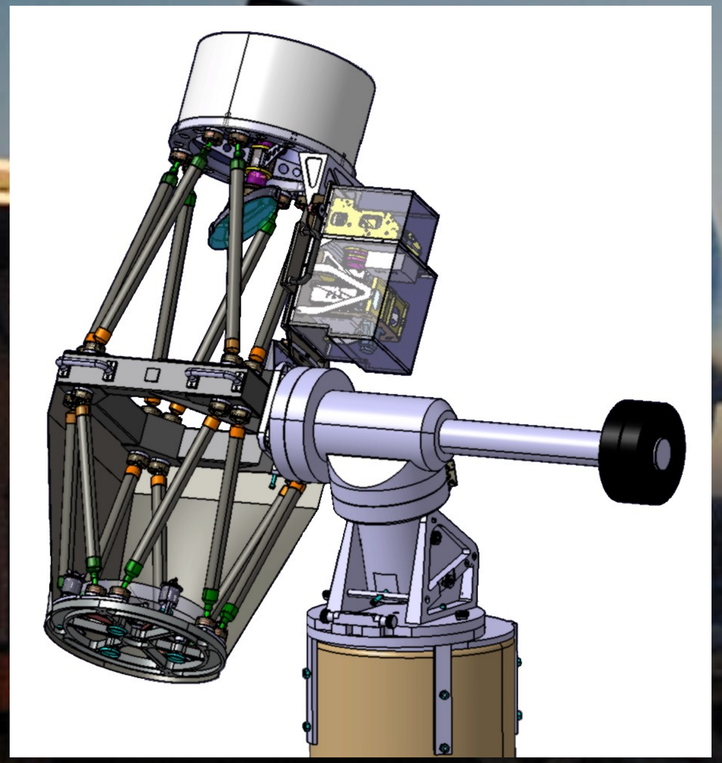
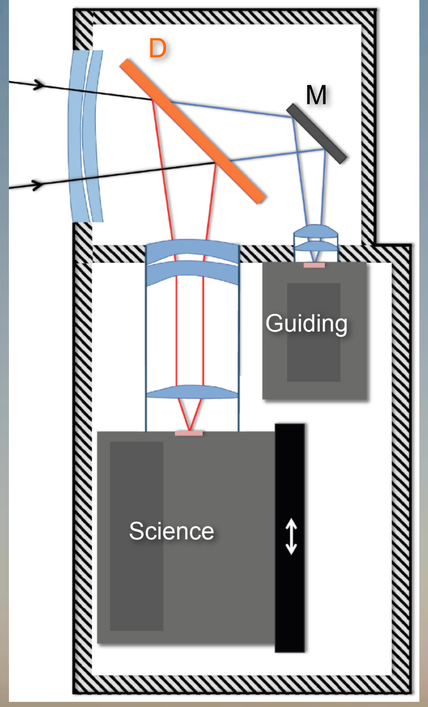
ASTEP Characteristics





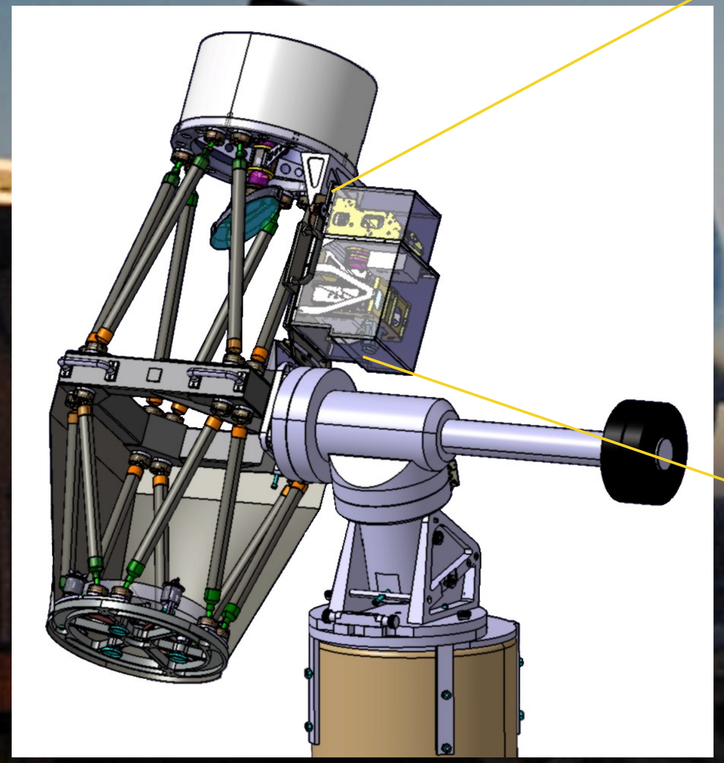
Telescope weight = 83 Kg, including 23 Kg for the focal box

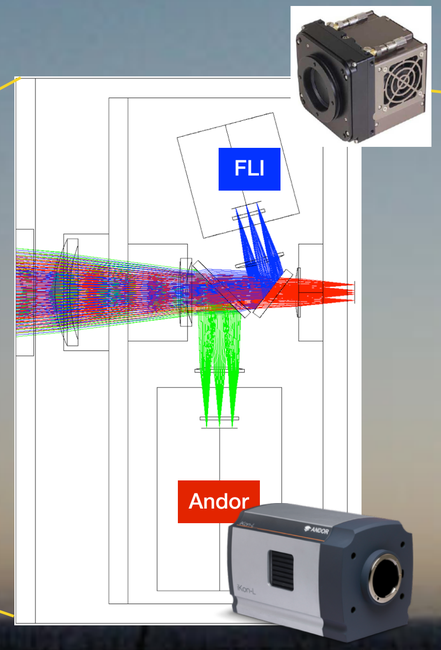
✓ Optical & Mechanical
- 400mm Newton optical design, f/D=4.6
- FoV 1° × 1° [Wynne corrector]
- Commercial AP3600 Equatorial Mount

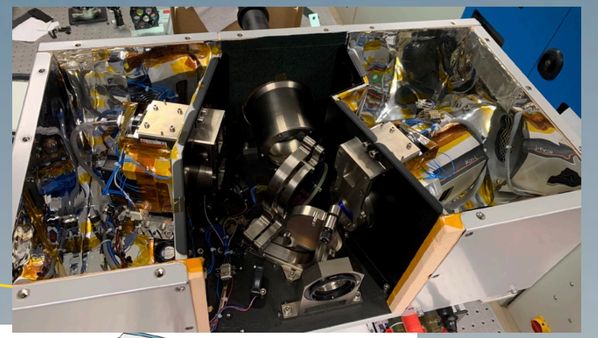
✓ Cameras
- Cooled Science CCD [FLI 4k × 4k, ~0.9''/pix]
- Cooled Guiding CCD [SBIG]

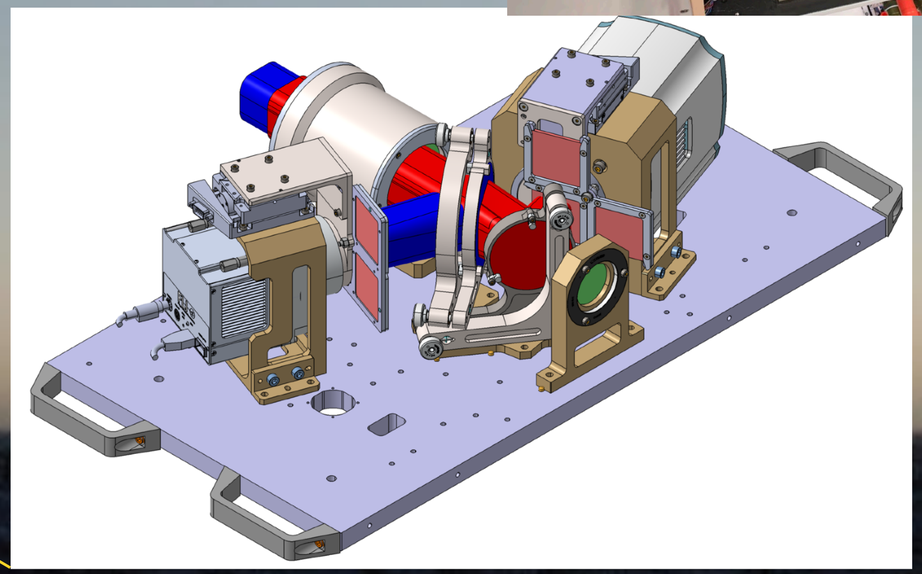
✓ Operation
- Automatic mode [scheduler & remote control]

ASTEP+: A new camera box

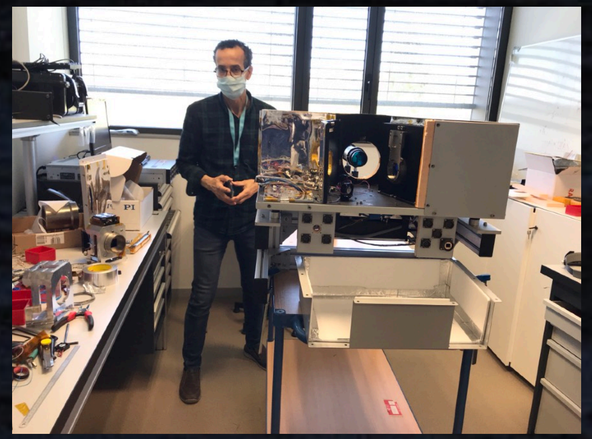


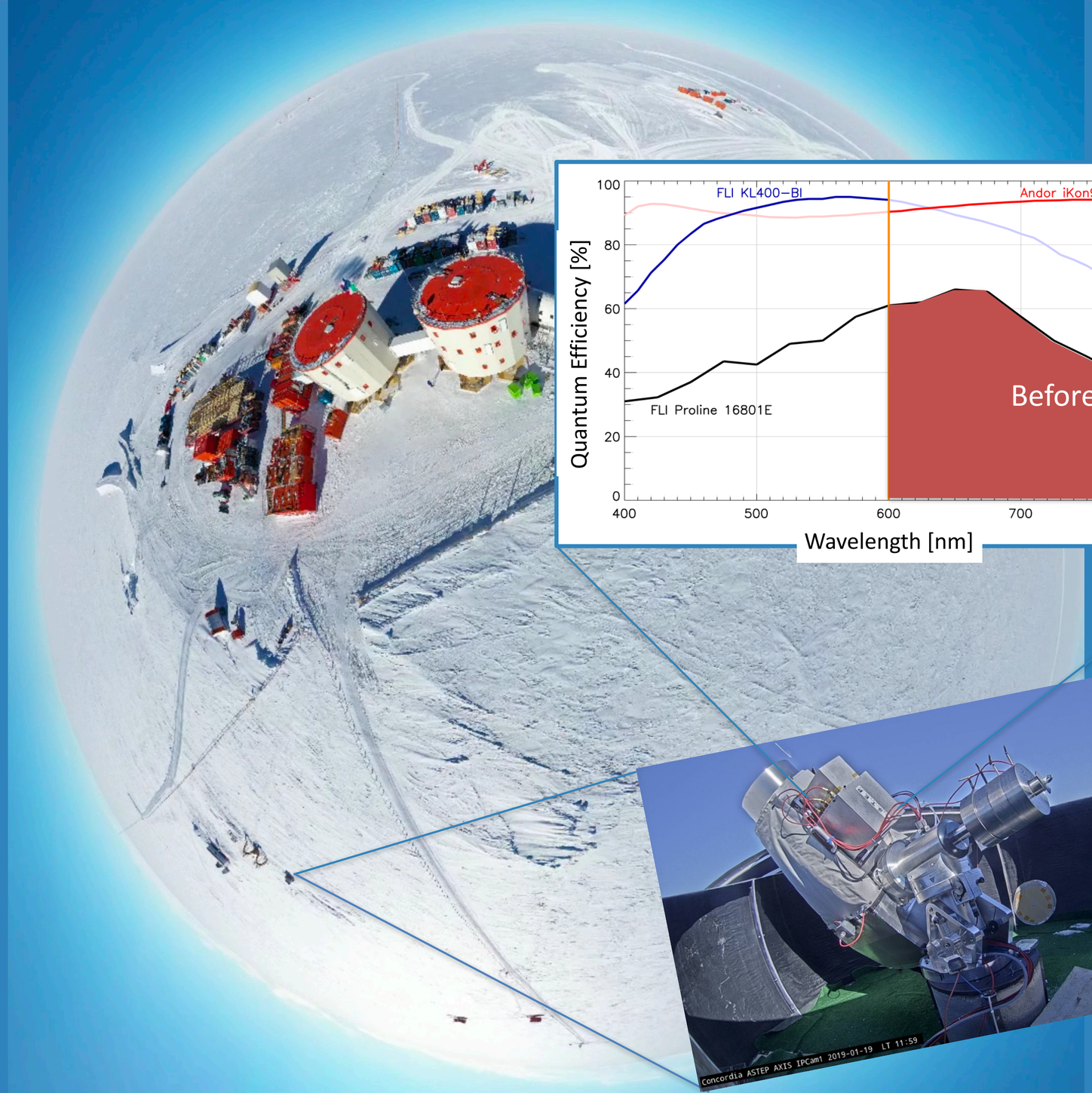






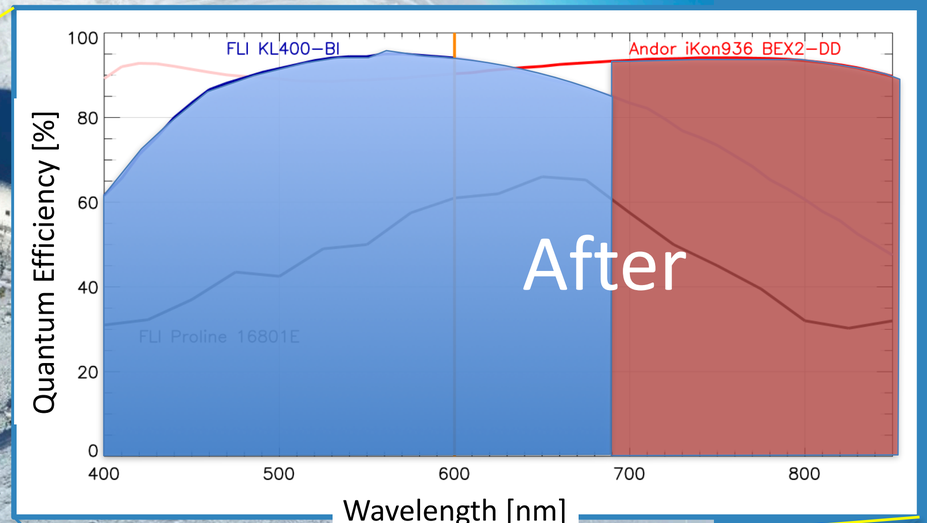
cold chamber tests @ -75°C





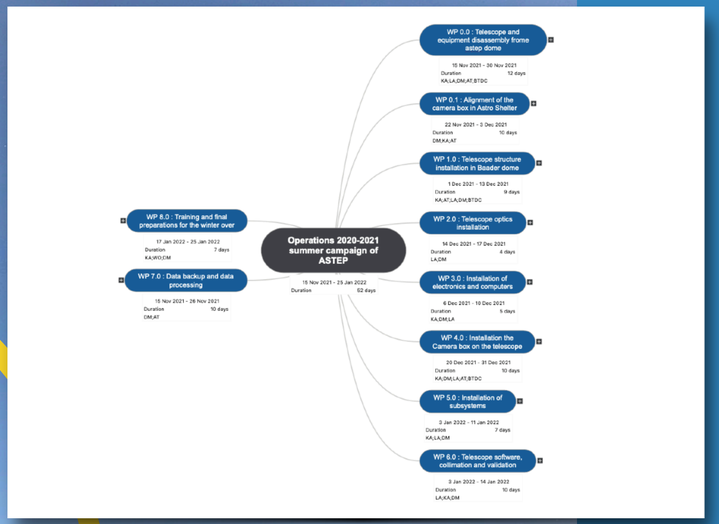
FLI KL400−BI
Andor iKon936 BEX2−DD
FLI Proline 16801E
Before
Quantum Efficiency [%]
Wavelength [nm]
100
80
60
40
20
0
400
500
600
700
800

Concordia ASTEP AXIS IPCam1 2019-01-19 LT 11:59



With a new camera box
To capture 3 times more photons
& discover transiting planets around M dwarfs

ASTEP+: Moving to the Baader dome



A busy 2021 summer campaign…

ASTEP+: Perspectives

- 3 times more photons for science
- 2 colors, simultaneously
- Automatized dome

- Toward transiting planets that:
  - are inaccessible from temperate sites
  - have long orbital periods
  - have precise ephemerides
  - can orbit binary stars

- Contribution to large projects:
  - TESS, JWST, ARIEL