Recent highlights from JPL use of the 200-inch telescope at Palomar Observatory

Michael Werner

6 July 2021

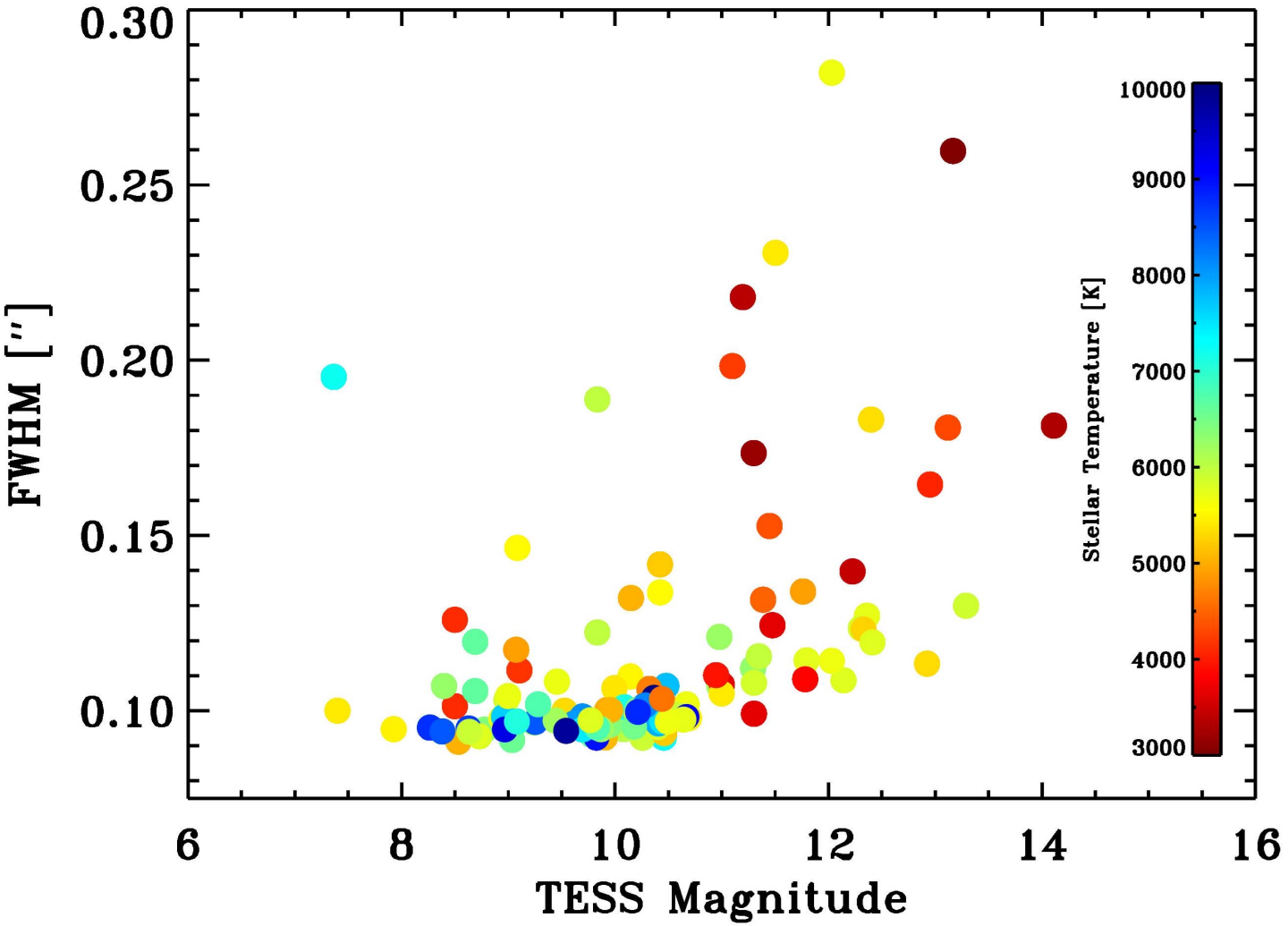
OVERVIEW

- JPL purchases 25% of the nights on the 5m Palomar Telescope for JPL/IPAC Scientists – an additional investment supports instrument development

- We have our own proposal process and access to full suite of observatory instruments.

- JPL scientists use telescope for:
  - Curiosity driven research
  - Mission follow up and preparation
  - Instrument development

- Telescope was very well-managed and operated during peak of pandemic and is now returning to normal ops, perhaps with more remote observing than in the past



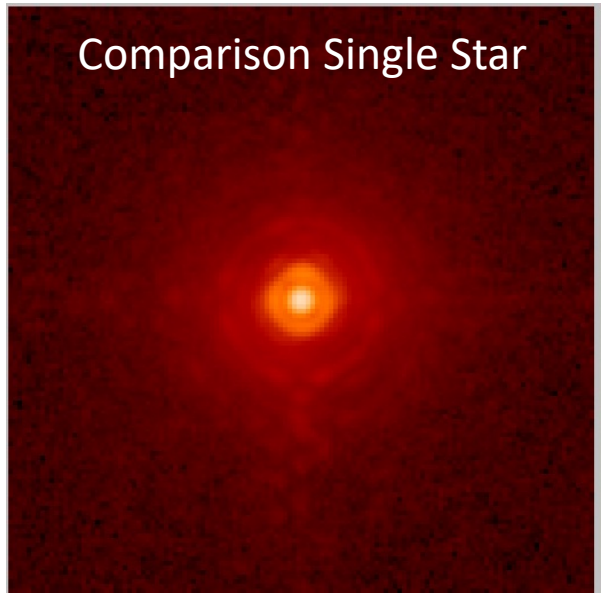
The P3K high performance Adaptive Optics System at Palomar has undergone a series of upgrades in recent years.

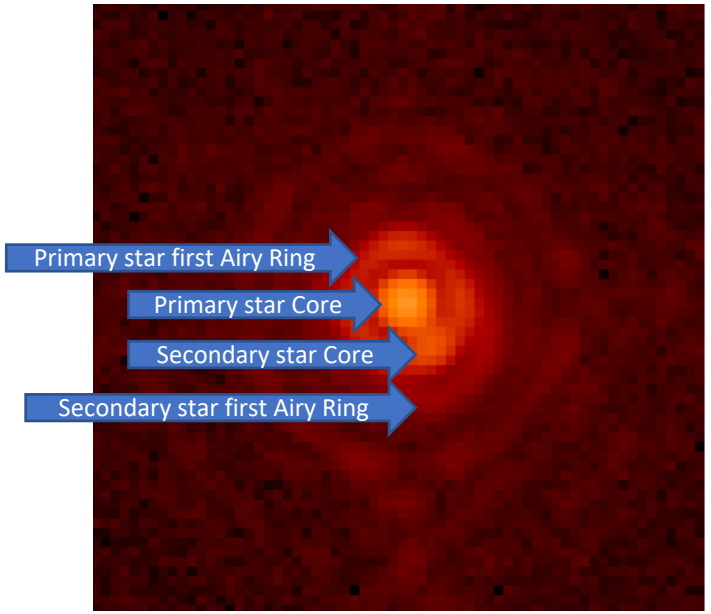
Dave Ciardi at IPAC continues to use the system very effectively for screening candidate exoplanet host stars [Kepler, now TESS]

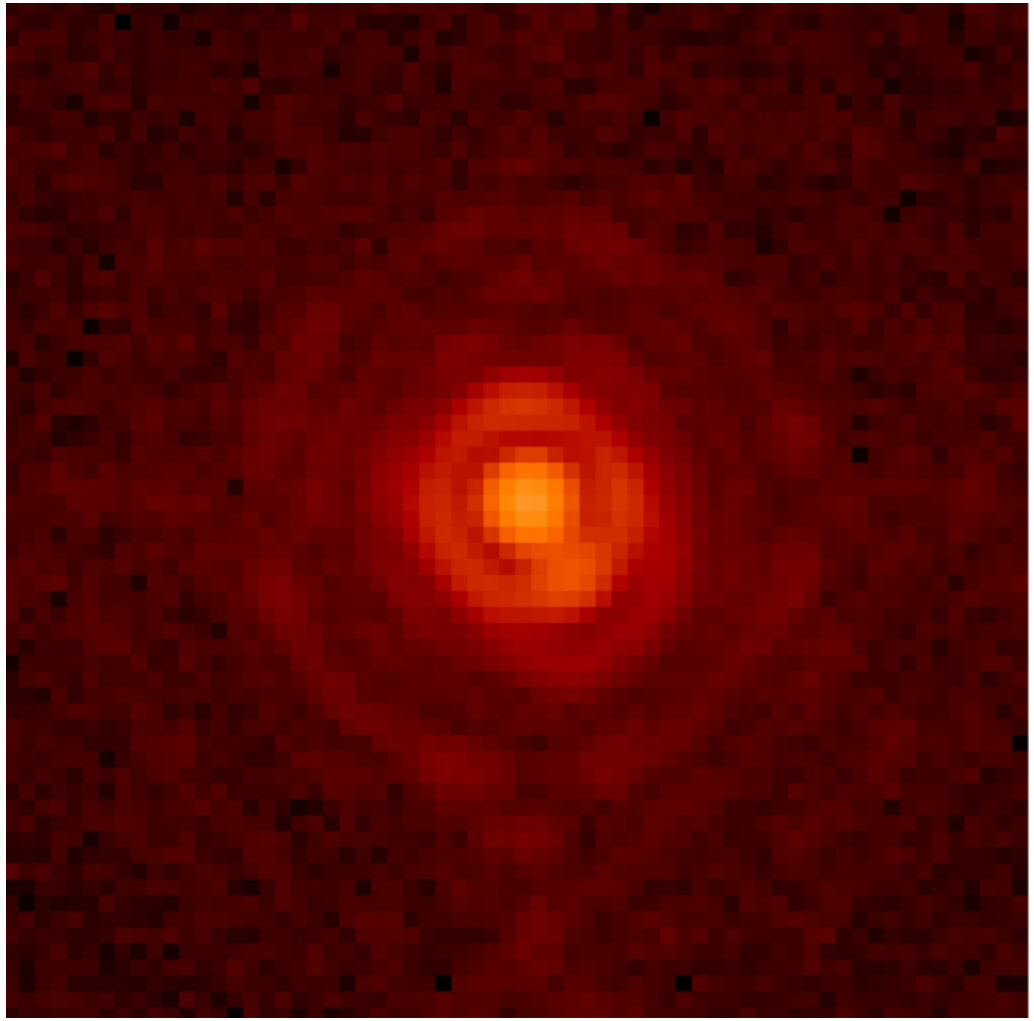
This recent compilation shows both the number of stars he has been observing and the performance of the system at 2.1um, which is spectacuar

HIGHLIGHT #1. Palomar AO Continues to Find Close-In Binaries to TESS Planet Host Stars

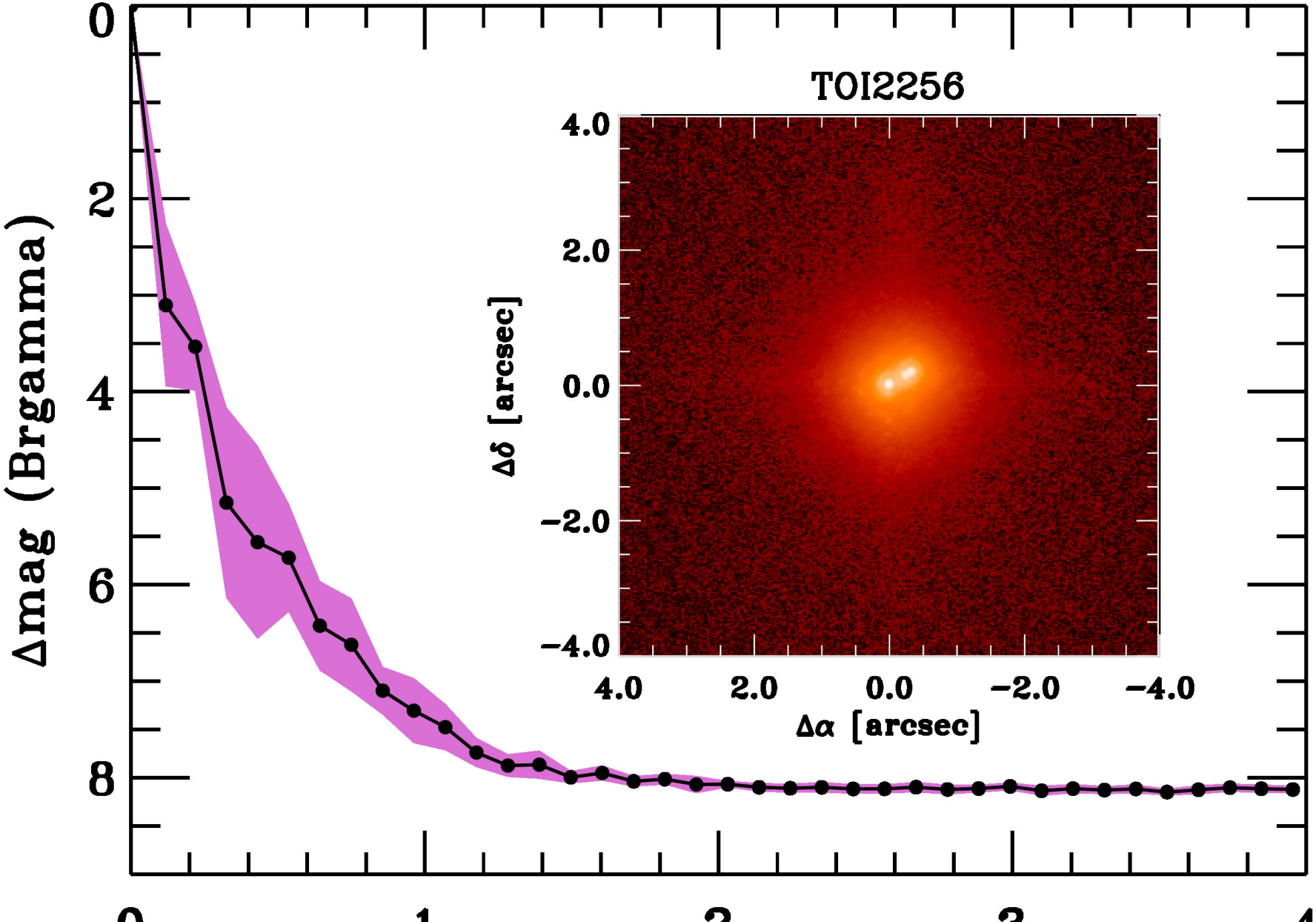
- TESS Object of Interest 1131 (TESS mag = 9.3 mag)
- 0.1” Binary
- Δmag≈1.5 mag (2μm)
- David Ciardi at IPAC heads this important program which screens candidates transiting exoplanets
- JPL-developed AO expertise has other applications, at Palomar and elsewhere







THIS ONE IS A TRIPLE STAR!

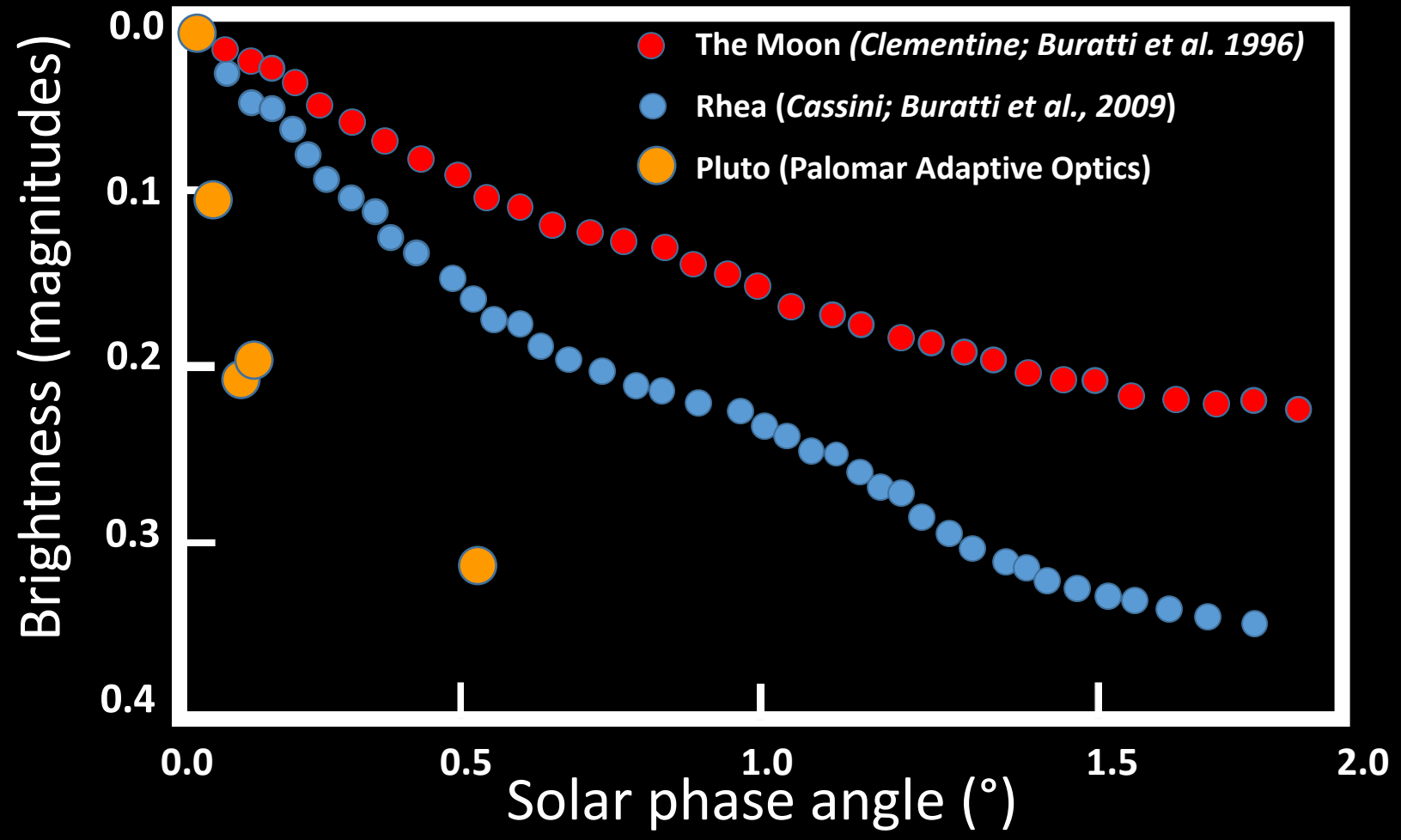


HIGHLIGHT #2 – Pluto Opposition Surge

- An opposition surge may be seen when the sun, the observer on the ground or in space, and a planetary target lie on the same line, or in opposition.
- Under these conditions “zero phase angle”, the reflected light brightness of the planet may increase, because of the microstructure of the planet’s surface.
- For the sun/Earth/Pluto system this occurs only once in about 160 years due to the tilt of Pluto’s orbit.
- Bonnie Buratti, JPL planetary astronomer, realized that this would occur in 2018/2019 and was awarded time on the 200-inch to study this phenomenon.
- Results complement observations from New Horizons

- Image shows Pluto separated from its moon, Charon, by about 1 arcsec, as viewed with the Palomar AO system

Bonnie found a huge and sharp opposition surge on Pluto, suggesting dynamic atmospheric and surface processes on this cold, lifeless body



Summary – Pluto is full of surprises!

- Historic observations of Pluto and Charon that will not be repeated for another 161 years were successfully obtained on both hemispheres of the two objects in 2018 and 2019.
- Pluto exhibits a huge increase in brightness when it is fully illuminated. As more observations are acquired and analyzed, the results will give us a handle on the sizes and “fluffiness” of surface particles, which in turn yield clues to the geophysical processes occurring on the surface (seasonal volatile transport, snow, volcanism, deposition of haze particles, etc.)