

# Pluto at opposition: The Palomar Adaptive Optics Campaign

Bonnie Buratti (1), Emily Kramer (1), Michael Hicks (1), James Bauer (2)

(1) Jet Propulsion Laboratory, California Institute of Technology, Pasadena CA 91109 USA, (bonnie.buratti@jpl.nasa.gov)

(2) University of Maryland, Department of Astronomy, College Park, MD 20742 USA

## Abstract

The Pluto-Charon system reached a solar phase angle of less than  $0.01^\circ$  in 2018. This opportunity will not be repeated for another 161 years. This time-critical period presents an unprecedented chance to explore the photometric properties of Pluto, and to capture data that are ideal for testing various models of the opposition surge. Quantitative modeling of the surge provides insights into the nature of planetary surfaces, such as the particle sizes of grains comprising the regolith, and the compaction state of the optically active portion of the regolith. These data are especially important because small solar phase angles were not obtained by the *New Horizons* spacecraft.

## 1. Introduction

The *New Horizons* mission provided the first close-up views of the Pluto system, a complex world of multiple moons and active geology [1]. However, key viewing geometries, such as small solar phase angles, were not captured, as well as long-term contextual observations. The adaptive optics (AO) system on the Palomar Hale 200-inch telescope, capable of separating Charon and Pluto (Figure), can fill in these gaps and provide continuing observations of the system.

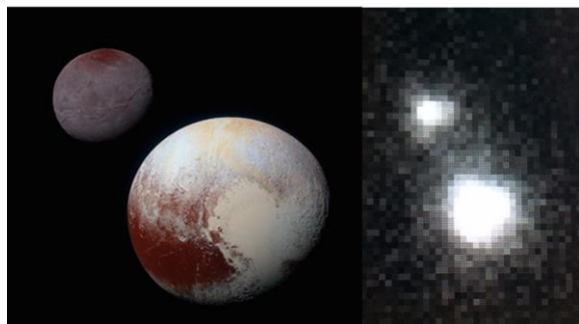


Figure. Pluto-Charon through the eyes of *New Horizons* (left) and the Palomar AO system (right). NASA/APL/SWRI/Palomar Observatory

## 2. Observations in 2018-2019

Data were successfully acquired during the opposition of 2018 [2]. Huge surges were discovered on both Pluto and Charon. For the opposition in 2019, which covers Sputnik Planitia (the “heart” of Pluto) six additional nights on the Hale telescope were assigned (see Table).

Table: Nights assigned to this team in 2019

Month	Dates	Solar phase
May	15	$1.5^\circ$
June	11,13,22	$0.6-0.9^\circ$
July	12,13	$0.01-0.05^\circ$

## 3. Summary and Conclusions

The first year of successful observations in 2018 has already revealed a huge opposition surge on both Pluto and Charon. This year’s additional observations will enable the filling-in of a phase curve sufficient for robust modelling of physical and photometric parameters, as well as a comparison of properties on different hemispheres of Pluto and Charon.

## Acknowledgements

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## References

- [1] Stern, S. A. et al. (2015). *Science* **350**, 292. [2] Buratti, B. J. et al. (2019) LPSC #50 LPI Contribution No. 2132, id.1723.