New Horizons: A Search for Temporal Changes on Pluto and Charon

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Overview

- Background Information (Pluto, *New Horizons*)
- Motivation and scope of project
- Method
- Results
- Discussion
- Future Research
- Acknowledgements

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An Overview of Pluto

- Discovered February 18th ,1930
- Visited by *New Horizons* July 14th, 2015
- Kuiper Belt Object
- Dwarf Planet classification by IAU
- Surface Area: 1.77×10^7 km
- Mass: $(1.303 \pm 0.003) \times 10^{22}$ kg
- Surface composed mainly of Ices of Water, Nitrogen, CO, and Methane.

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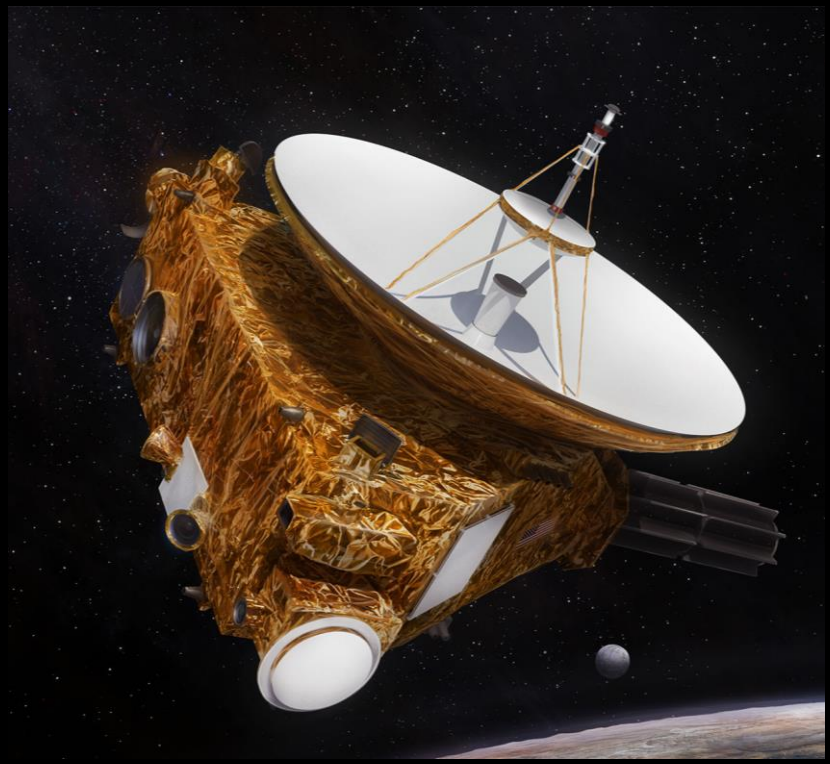
New Horizons Spacecraft Overview

- Built by JHUAPL/SWRI
- Launched on January 19th, 2006
- Visited Jupiter prior to Pluto System
- Made closest approach to Pluto July 14th, 2015 at 12,500 km from the surface of Pluto
- Suite of seven instruments to explore the Pluto system
- Currently in extended mission cruise to another KBO (2014 Mu69)



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Motivation and Scope

- *New Horizons* represented first spacecraft visit (flythrough) to the Pluto System
- Searching for either geologic or atmospheric activity at the time of the flyby was possible by comparing images taken at different points in time
- Capturing the behavior of such activity *in the moment* carries a tremendous amount of scientific potential
- Comparing to Triton as a KBO (Voyager 2)
- Spacecraft data and images were rendered and processed using USGS ISIS 3

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Method

- Images were gathered from the approach to the flythrough of the Pluto System
- Images are at varied phases and points in time.
- Highest spatial resolution is desirable (flyby constrained)
- Use of both visible imaging cameras optimized variability of surveyed terrain
- Images are ‘blinked’ and compared pixel by pixel with manipulating contrast to show differences in comparative brightness values

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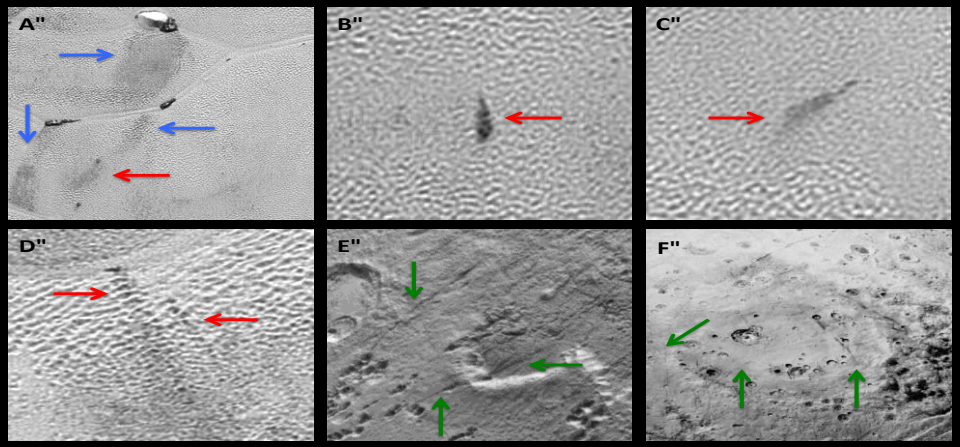
Results



- Of the thousands of images surveyed of both Pluto and Charon; no change surveyed represented one of definitive temporal activity.
- Most visual changes could be attributed to shifts in viewing geometry of the spacecraft to the spectacularly bright surfaces of Pluto and Charon

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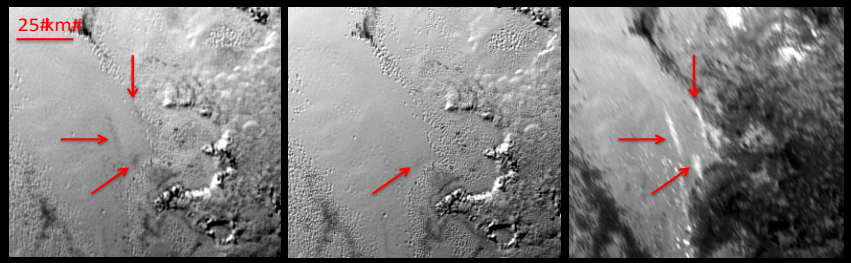
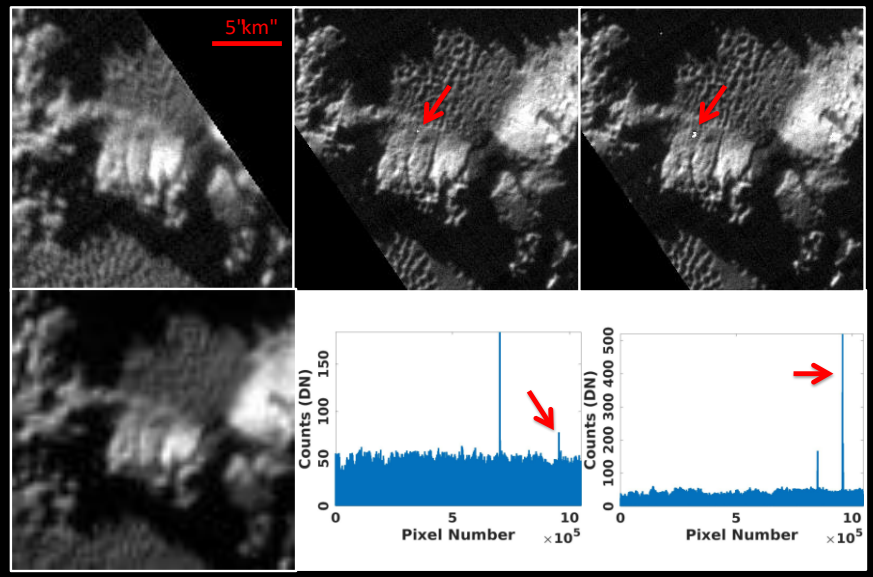
Results





- Contrast reversal features
- High phase bright features
- Spatially coincident cosmic rays

Discussion

- Lack of observed temporal changes could stem from limitations of flyby architecture of mission
- Activity on both bodies could be seasonally motivated
- Investigating observed streaks could help develop understanding of volatile transport
- Youthful Surfaces imply ongoing or recent processes

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Future Research

- Surface Roughness model
- Using Triton as a comparator
- Using previous ground based telescope data
- JWST Pluto imaging potential
- Future Orbiter Mission

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