

# Planetary Science Nuggets

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Presentation at VEXAG



The background of the slide features a dark blue space-themed image with several planets and their rings, including Saturn and Jupiter, set against a starry background. The title "Scientific Nuggets" is overlaid in white text on the top left of this image.

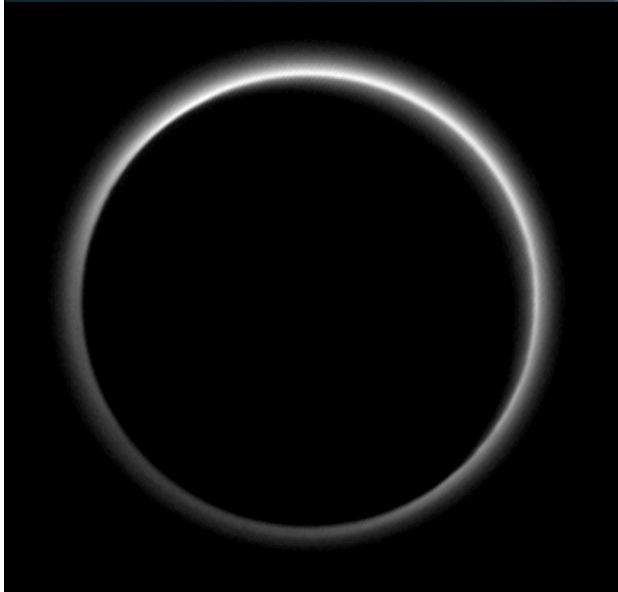
# Scientific Nuggets

- Each week Planetary Science Division provides one science discovery/story for distribution through upper management and the Administration – called Weekly Nuggets
- SMD science nuggets have even attracted the attention of the President
- Nuggets also help PSD create our annual reports
  - Government Performance and Results Modernization Act (GPRA-MA) required by Congress
  - Strategic Objective Annual Review (SOAR) – required by the Administration
- What does it take to be a good nugget and how do you get them submitted to SMD
  - Nugget coordinator at JPL is Lindsay Hays
  - Missions communicate nuggets through their Program Scientists

# Nuggets - Content

- Current event-based activities, results, or science papers
- Specific format – Images and text in a PowerPoint
- Include:
  - Compelling result for a “general” audience
  - Image or simple graphic (artist concept) is required
  - Text should give background information and explain the impact of the results or activity to the field – at about an Grade 8 level
  - Reference to paper, refereed or non-refereed journals are important
- Nuggets submitted are found at:
  - <http://www.lpi.usra.edu/nuggets/>

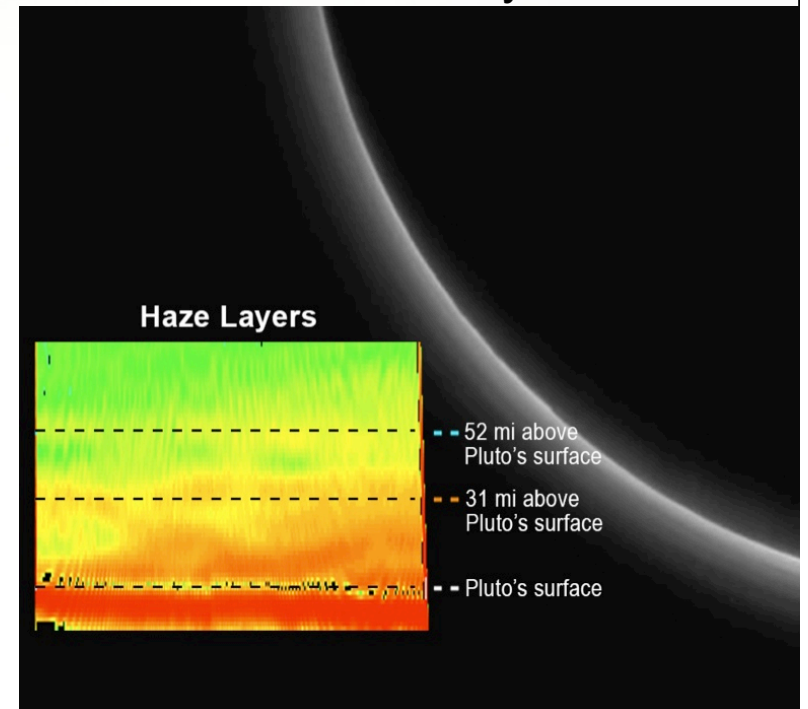
# Backlit Pluto Shows Atmospheric Haze



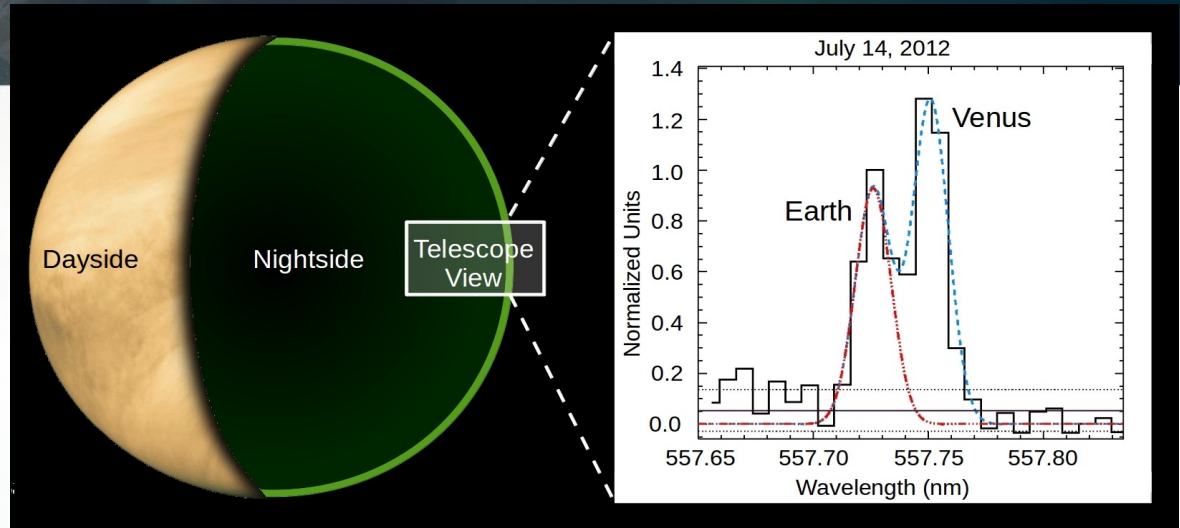
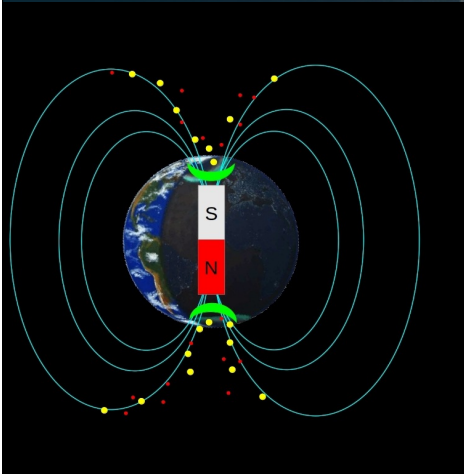
**Just seven hours after its closest approach, New Horizons took a picture showing Pluto backlit by the sun and showing layers of haze in its atmosphere.**

- Taken by Long Range Reconnaissance Imager (LORRI), the images show hazes much higher above the surface than previously predicted and in two distinct layers, at 50mi (80km) and 30mi (50km).
- The hazes are key to the formation of the hydrocarbon ices that give Pluto its reddish hue.

- They are thought to form when ultraviolet (UV) light breaks down methane, which allows it to reform into more complex hydrocarbons. These compounds condense as ice particles, which form the haze, or are altered further by UV light to form tholins, which color Pluto's surface.
- The presence of these hydrocarbon hazes come as a surprise, as previous models had indicated that it would be too warm for them to form above 20mi (30km) above Pluto's surface.

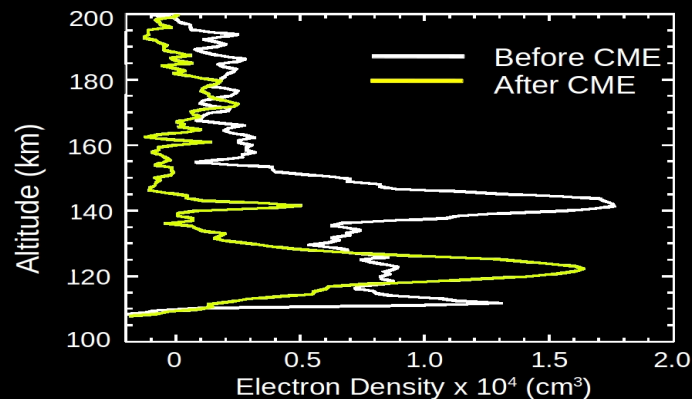


# Venus's Mysterious "Aurora"



- The Earth possesses a magnetic field which funnels solar charged particles to the poles, generating aurora.
- The brightest aurora on Earth is the oxygen green line at 5577 Å.

- Venus has no magnetic field and is not expected to possess aurora, but the green line is detected sporadically in the Venusian atmosphere.
- The greatest emission is observed after large injections of solar charged particles from coronal mass ejections (CMEs).
- Data from Venus Express Radio Science experiment show increased ionospheric electrons low in the ionosphere (120km) after CME impacts.
- During this increase, green oxygen emission is detected.
- We propose this is auroral-type emission occurring low in the ionosphere, the first of its kind to be detected on a nonmagnetic planet.

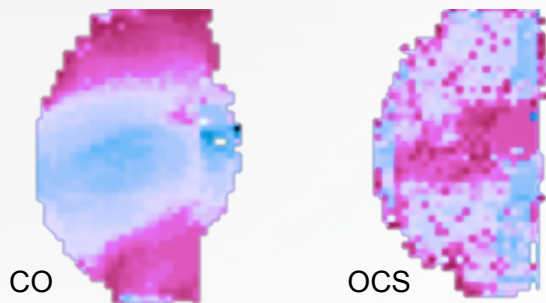


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01/09/2015

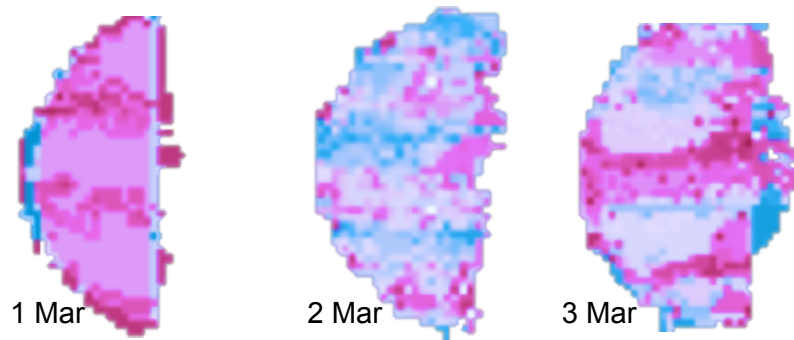


# Peeking at Venus' Dynamic Atmosphere Below the Clouds

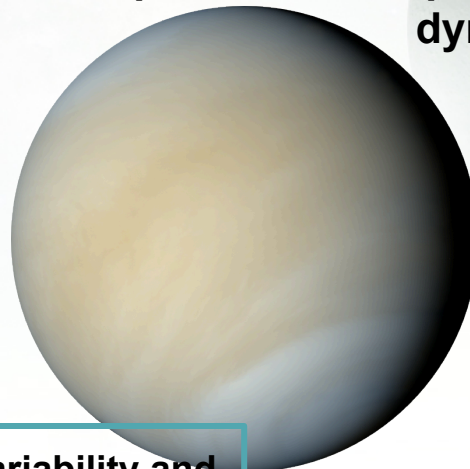
CO and OCS maps show strong anticorrelation (3 Mar 2009)



Water vapor displays surprising variability and banding patterns on short time scales (2009)



Maps of Venus's sub-cloud atmosphere made by the Apache Point Observatory reveal the interrelationship of multiple chemical species – and a lower atmosphere as dynamic as that above the clouds.



- The 3.5 m telescope TripleSpec spectrograph measured the Venusian atmosphere simultaneously over a 1-2.5  $\mu\text{m}$  wavelength range – the first ground-based observations of the planet.
- Many species display correlation or anticorrelation which indicate linked chemical and physical processes: e.g. carbon monoxide (CO) conversion to carbonyl sulfide (OCS) in the lower atmosphere.
- Strong banding patterns in water vapor that change on daily timescales are seen near the bottom of the cloud deck (~45 km) and may be indicative of cloud rainout.
- Inexplicably, CO, OCS, H<sub>2</sub>O, H<sub>2</sub>SO<sub>4</sub>, and SO<sub>2</sub> are more abundant in one hemisphere than the other, and some of these dichotomies shift hemispheres over the year.
- Understanding the atmosphere of our near-twin is important, as Venus is a likely end-state for terrestrial planet evolution, and hazy bodies like Venus may be common among exoplanets.

Qualitative color key (applies to all maps)

Less Average More