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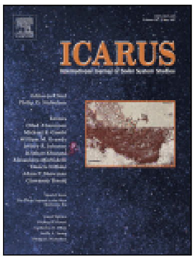

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Icarus
Volume 287, Pages 1-334 (1 May 2017)
Special Issue\: The Pluto System
Edited by Richard P. Binzel, Catherine B. Olkin, Leslie A. Young and Philip D. Nicholson

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Highlights

- Pluto and Charon are rock rich while the small satellites are mostly water ice.
- Charon is about 10% icier than Pluto.
- A giant impact origin involving partially differentiated precursors supported.
- Formation of entire PC system in a collapsing, rotating pebble cloud not supported.
- Slow, late accretion of impact precursors indicated.

Highlights

- We determined the radii of Pluto and Charon from New Horizons images.
- The radii are 1188.3±1.6 km and 606.0±1.0 km.
- Pluto is 9% denser than Charon.
- No flattening is detected for either Pluto (<0.6%) and Charon (<0.5%)
-

The absence of flattening is consistent with the presence of a subsurface ocean.

Climate zones on Pluto and Charon Original Research Article
Pages 30-36
Richard P. Binzel, Alissa M. Earle, Marc W. Buie, Leslie A. Young, S. Alan Stern, Cathy B. Olkin, Kimberly Ennico, Jeffrey M. Moore, Will Grundy, Harold A. Weaver, Carey M. Lisse, Tod R. Lauer, the New Horizons Geology and Geophysics Imaging Team
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Highlights

- Pluto's large axis tilt creates “seasons” that are very different from Earth's.
- Most of Pluto's surface is actually “tropical” in experiencing direct sunlight.
- Much of Pluto's surface experiences both tropical AND arctic seasons.
- The unusual seasons experienced by Pluto may shape what we see.

Long-term surface temperature modeling of Pluto Original Research Article
Pages 37-46
Alissa M. Earle, Richard P. Binzel, Leslie A. Young, S.A. Stern, K. Ennico, W. Grundy, C.B. Olkin, H.A. Weaver, the New Horizons Geology and Geophysics Imaging Team
Abstract | Close research highlights | Purchase PDF - $35.95

Highlights

- Presents local and global thermal models of Pluto.
- Consider the current epoch as well as past epochs during which Pluto experienced “extreme seasons” due to variations in its orbit over millionyear timescales.
- Local thermal model explores possible surface temperatures as a function of latitude and albedo.
- Pluto’s equatorial region supports stark albedo contrasts over million-year timescales because bright areas will stay cold, attracting fresh volatile deposits, while dark regions will stay warm and be unlikely locations for long-term volatile deposits.

Past epochs of significantly higher pressure atmospheres on Pluto Original Research Article
Pages 47-53
S.A. Stern, R.P. Binzel, A.M. Earle, K.N. Singer, L.A. Young, H.A. Weaver, C.B. Olkin, K. Ennico, J.M. Moore, W.B. McKinnon, J.R. Spencer, New Horizons Geology and Geophysics and Atmospheres Teams
Abstract | Close research highlights | Purchase PDF - $35.95

Highlights

- Pluto has undergone thousands of cycles of obliquity change and polar precession.
- Such changes could produce dramatic increases in surface pressure.
- Such changes may also explain geomorphologic features suggesting paleo-liquids.
- This paper motivates future climate modeling/geologic interpretation in this area.

A post-new horizons global climate model of Pluto including the N_2, CH_4 and CO cycles Original Research Article
Pages 54-71
F. Forget, T. Bertrand, M. Vangvichith, J. Leconte, E. Millour, E. Lellouch
Abstract | Close research highlights | Purchase PDF - $35.95

Highlights

- A new 3D Global Climate Model (GCM) to simulate Pluto’s atmosphere is described.
- The model simulates temperatures, winds and the N_2, CH_4 and CO cycles.
- Surface winds are induced by the topography and N_2 condensation and sublimation.
- A cold atmospheric layer is obtained in Sputnik Planum, as observed by New Horizons.
- The GCM predicts abundance of CO and CH_4 gas in agreement with observations.

3D modeling of organic haze in Pluto’s atmosphere Original Research Article

Highlights

- We obtained a maximal photolysis rate of CH_4 of 1.3 × 1021 g cm-3 s -1 in 2015, at 250 km altitude, and a haze extending up to 500 km altitude with a density scale height of 40 km.
- Due to the weak meridional circulation, the haze precursors are not easily transported in the lower atmospheric layers and remain at high altitudes and in larger amount at high northern latitudes, leading to a more extensive haze in the northern hemisphere.
- If we assume a condensation flow of N_2 from the northern towards the southern hemisphere, then the haze precursors can be transported faster at lower altitude above the south pole, leading to a latitudinally more homogeneous haze density.
- The column mass of haze computed by our model primarily depends on the sedimentation velocity and thus on the pressure and the considered monomer radius. Between 1990 and 2015, the column mass of haze obtained follows the trend in surface pressure: an increase by a factor of 3.
- We computed the UV and VIS opacities of the haze as a diagnostic of our simulation results and in all simulation cases, the column visible opacities have similar values around 0.001–0.01 (slightly higher for large fractal particles).

Highlights

- Pre- and post-encounter cases are simulated and well-resolved flowfields shown.
- A simulated escape rate of 7×10^{25} CH_4 s^{-1} for the NH encounter agrees with observation.
- Total flux to Charon is 2×10^{24} s^{-1} at ~98% CH_4, with peak values (~2x) on the upstream face.
- Charon gravitationally focuses incident flow into a wakeward high-density region.
- Charon may retain a thin atmosphere sourced from Pluto's escape, but below observable levels.

Highlights

- We have detected 7 net x-rays in 174 ksec from the Pluto system using Chandra.
- This 1st KBO x-ray detection was at > 99.95% significance & 0.60 > E > 0.31 keV.
- The power represented by this signal is significant, $200\ ^{+200/}{}_{-100}$ MW.
- Charge-exchange between SW CNO ions & escaping Pluto neutrals could produce this.
- Less likely is scattering of solar x-rays by haze particles in Pluto's atmosphere.

Highlights

- State-of-the-art photochemical model for Pluto's atmosphere.
- Constrained the surface mixing ratio of CH_4 and the eddy diffusion profile of Pluto's atmosphere.
- Constrained saturation vapor pressures and sticking coefficients for C_2 hydrocarbons and the sticking coefficient for HCN.
- Prediction for downward fluxes of hydrocarbon and nitrile species.
- Predictions for abundances of oxygen-bearing species in Pluto's atmosphere.

Highlights

- A model of Pluto's haze is developed and compared to New Horizons data.
- Extinction and scattering observations suggest that haze particles are aggregates.
- Condensation of hydrocarbons and nitriles likely affects haze distribution.
- Compositional differences between Pluto's and Titan's hazes require investigation.
- Pluto's atmosphere may be more amicable to particle charging than Titan's.

Highlights

- Charon is able to alter the Pluto-solar wind interaction significantly when upstream.
- If Charon possesses an ionosphere it alters the gross structure of interaction region.
- Evidence for Charon shielding Pluto against atmospheric loss is shown.

Highlights

- Outline of two semi-independent inflight calibrations of New Horizons/MVIC.
- The stellar calibration used to produce PDS radiometric keywords is detailed.
- Other technique compares MVIC and Hubble observations of Charon.
- Both techniques show good agreement (better than 7%).

Highlights

- Color light curves of Charon are produced from New Horizons/MVIC.

- Results show Charon is brighter on its Pluto-facing hemisphere.
- Blue and Red light curves show that Charon's surface is neutral in color.

Highlights

- Observations of extensional features on Charons surface are discussed.
- These features suggest an areal strain of 1%.
- This is consistent with an ancient global ocean that is now frozen.

Highlights

- This work was prompted by the New Horizons mission encounter with Pluto / Charon.
- We test whether Charon’s density is consistent with formation from a circumplutonian disk.
- We examine whether Charon should melt or differentiate if formed from a circumplutonian disk.
- We calculate the thermal history of Charon and determine when its subsurface liquid froze.
- We review evidence that Kubrick Mons and similar features are cryo- volcanic.

Highlights

- Present consensus impact crater catalog for Pluto, Charon, Nix, Hydra.
- Show pros and cons of different types of image processing to map craters.
- Show encounter hemisphere trends of craters on Pluto and Charon.

Highlights

- The reflectivity of Pluto's surface varies by over a factor of 10.
- The highest albedo regions of Pluto approach normal reflectances of unity.
- The albedo patterns on Pluto are well-correlated with its geology.
- The temperature variations on Pluto are at least 20 K.
- The dwarf planet Eris is likely to have ongoing activity on its surface.

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Highlights

- Pixel-by-pixel Hapke modeling of New Horizons Ralph/LEISA data.
- Maps of Pluto's volatiles and non-volatiles components.
- Latitudinal variations of CH4 and N2 ices consistent with differences in insolation.
- Possible sublimation transport of N2 ice within Sputnik Planitia.
- Sputnik Planitia is possibly a cold trap of volatiles.

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Highlights

- The analysis of the first couple of LEISA/New Horizons spectro-images is performed.
- Qualitative distribution maps are obtained for N2, CH4, CO, H2O and the red material.
- 3 different types of ices are found: N2-rich:CH4:CO, CH4-rich(:CO:N2?) and H2O ices.
- Sublimation sequence transforms N2-rich ice to CH4-rich ice through a binary mixture.

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Highlights

- The geology of Sputnik Planitia on Pluto is mapped at 1:2 M scale.
- All mapped units are presently being affected by the action of flowing N_2 ice.
- Sputnik Planitia is experiencing convection, glacial flow, and sublimation.
- Condensation of N_2 onto much of Sputnik Planitia creates a bright mantle.
- Blocky H_2O ice mountains and hills have been mobilized by flow of N_2 ice.

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Highlights

- Nitrogen glaciers are presently flowing on Pluto.
- A glacial cycle of N_2 sublimation, deposition and return flow is indicated.
- A variety of dissected landforms were probably carved by paleo-glaciers.

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Highlights

- A N_2 ice glacial flow model is developed.

- The model incorporates known thermophysical and rheological properties of N_2.
- Dark patterning seen near Sputnik Planitia's northern shoreline is examined.
- Our flow model suggests these may be imprints of near surface bottom topography.

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