

Triton Fun Company

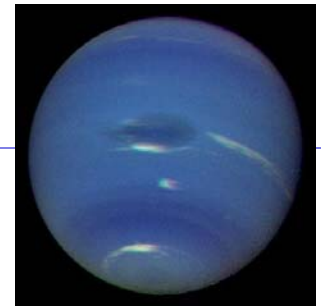
Science Newsletter August 2009

# Science Newsletter

## August 2009

### Voyager Neptune — It was 20 years ago

H. McDougall



#### Neptune

The beautiful blue planet imaged by Voyager 2 showing many atmospheric features. Neptune has *weather*.

#### Special points of interest:

Blue Neptune..

Triton Fun stuff

Superfluous questions

One of the most extraordinary missions of exploration, and certainly the most distant exploration by mankind occurred 20 years ago this month as the Voyager spacecraft flew by the planet Neptune. This was the first and only reconnaissance of the farthest gas giant outer planet. It was possible because of the rare alignment of the outer planets in the years around 1980-1989; this lineup of planets made this voyage possible in a reasonable amount of time in the lifetime of humans. The four outer planets, whose orbits of the Sun (i.e., their year) are very long (it takes 165 years for Neptune to orbit the Sun once) were all going to be roughly in the same direction (on one side of the Sun) with respect to Earth. It was realized by Michael Minovitch, a graduate student working at the NASA Jet Propulsion Laboratory in the summer of 1961, that this alignment was to occur in the 1980's. A spacecraft sent to Jupiter could slingshot its way to the next outer planet, Saturn, and then Uranus and Neptune by the method of "gravity assist". Once this idea was recognized, NASA and JPL planned a "Grand Tour" mission with two spacecraft to visit these outer planets at that future time. The original grand tour idea was scaled down for the mission, but the Voyager 1 and 2 spacecraft visited all four outer planets and made history.

It was Voyager 2 that visited all four outer planets. Voyager 1 visited Jupiter and Saturn. The reason it did not go on to Uranus and Neptune was because NASA and the planetary science community thought that study of Saturn's moon Titan was so interesting (because it was known to have a thick atmosphere and exotic chemistry in its smog and hazes) that Voyager 1 did a fly-by of Titan at close range which threw it out of the plane of the ecliptic and thus eliminated its ability to go on to Uranus and Neptune. This close flyby of Titan revealed a wealth of detail about Titan's physics and chemistry, particularly of the atmosphere.

Voyager 2 went on to explore all four planets: Jupiter in 1979, Saturn in 1980, Uranus in 1986 and Neptune in 1989. The close encounter with Neptune occurred on August 25, 1989 at 0356 GMT at ~ 4478 km above the cloudtops. The many staff members that for years participated in putting together the sequence of commands to be uploaded to the spacecraft and watched the data come in at encounter time were elated and exhausted. It was an incredible voyage of discovery.

Since Neptune orbits the Sun at 3 billion miles, the roundtrip light-time for the Voyager signal was 8.2 hrs at the speed of light.

That's how far away Neptune is..even at the speed of light, the telemetry finally limps in to Earth's antennas after 4 hours travel time. This is why, before the encounter, knowledge of the Neptune system was limited.

The new knowledge that poured in during encounter was transforming. As Voyager approached, Neptune appeared to have *ring arcs*; not rings, but partial rings that were mainly on one side of the planet. Dynamicists struggled to explain the physics of how one could sustain a partial ring that would not equilibrate all around the planet. When Voyager finally arrived, the ring was found to be completely encircling Neptune. The "ring arcs" were an illusion caused by the fact that the rings were *clumpy*, thicker on one side than the other.

continued, pg 2 —>

We are always looking for **contributors** to the Science Newsletter. If you would like to write an article about a science subject you are excited about, or contribute a superfluous question, or if you would like to be on our **mailing list** for future newsletters, please e-mail us at:

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Voyager Neptune: *continued*

Photos/Info: NASA/JPL

Details about Neptune's largest moon, Triton, were also unknown. Methane had been detected on its surface, and in 1983, the presence of nitrogen, probably in liquid form as a sea or lake, was detected. Suddenly Triton became an ocean world with methane dissolved in liquid nitrogen; with energetic particles and photons raining down on its surface unprotected by an atmosphere, a wealth of related organics were expected to also be swirling around, dissolved in the Triton seas.

The reason that Triton's nitrogen was thought to be liquid is that the object is very bright and its radius was thought to be fairly large. When the corresponding temperature was calculated, it appears to be near 62 Kelvin, the melting point of solid nitrogen into liquid. However, when Voyager arrived, the radius was accurately measured and was smaller than had been previously thought. The actual temperature was found to be near 37 Kelvin, much colder, and any nitrogen present would be frozen out as huge ice blocks or crystals. The methane would then be dissolved in the nitrogen as a solid solution.

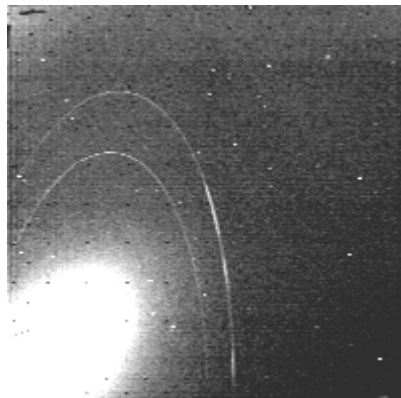
Triton turned out to be a fascinating world full of alien geology: weird landforms that came from unknown processes to produce strange crevasses, streaks, clover-shaped objects and icy cold-traps with freshly formed snow (but made of nitrogen, not water !) The sense of discovery of totally alien new worlds was awe-inspiring when looking at all of the new pictures and data from Triton and Neptune.

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**References**

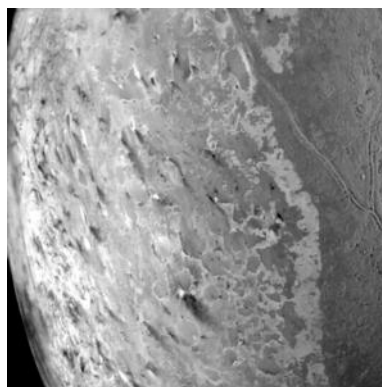
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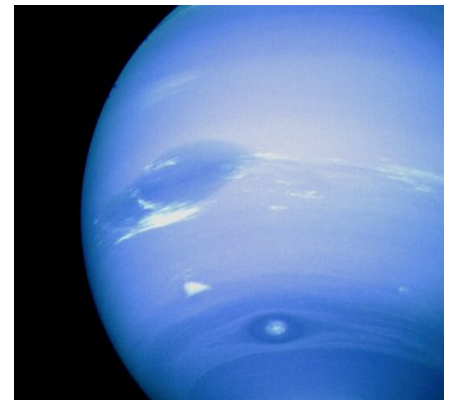
**Neptune's clumpy rings**

The unevenness of the rings is seen in these photos (above, below)



**The bizarre face of Triton**

Frost condensation at the cold traps on Triton creates the bright areas. The darker areas are warmer and the nitrogen frost has sublimated from there and gone to the cold regions. Also seen in this picture is the Y feature. As one of the Voyager scientists reported it: "This is the Y feature—spelled WHY."



**Clouds and storms on Neptune**

The variable activity and cloud features present on Neptune were a surprise, because Neptune was thought to be too far away from the sun to have much weather.



**Time for your close-up**

Image of the impressive storm system on Neptune called the *Great Dark Spot* (above) in analogy to Jupiter's *Great Red Spot*



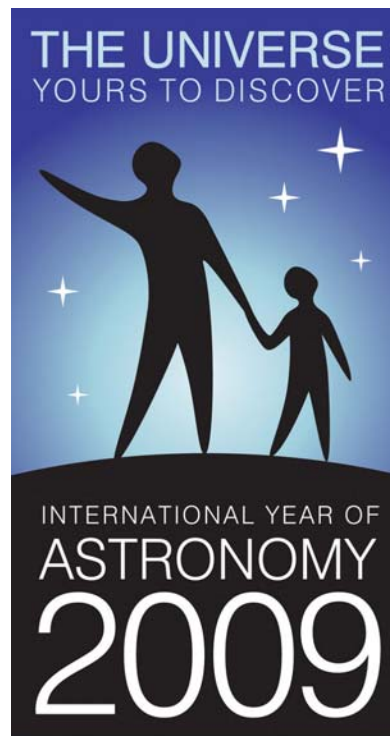
## TRITON FUN PRODUCTS

2009 has been declared the "International Year of Astronomy". Events and activities to further the excitement of astronomy are being planned by IYA committees in over 100 countries. The logo for the IYA2009 is shown below. For more info on upcoming IYA2009 events, go to: <http://www.astronomy2009.org>

Triton Fun is an authorized distributor of T-shirts, sweatshirts and long-sleeve tees sporting this new logo. Part of the proceeds from the sale of these shirts will go to support astronomy clubs and astronomy activities connected with IYA2009 in California.

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\*\* Send us your superfluous questions for a future issue ! They can be on any subject. The funnier, the better. M.D., our editor, appreciates the help and will send you a free Triton Fun coffee mug as compensation for your question. Or write an article for us and be read by professional and amateur astronomers and scientists in the U.S. and Canada ! \*\*

## Superfluous Questions:

- 1) Where is the *Mummers Museum*, featuring unique masks and costumes ?  
a) Boston    b) Providence    c) Philadelphia    d) Charlottesville
- 2) Who discovered Iapetus, the two-toned moon of Saturn ?  
a) Huygens    b) Barnard    c) Cassini    d) Galileo
- 3) William Szathmary is the real name of what famous TV actor/comedian ?  
a) Don Rickles    b) Bill Dana    c) Rich Little    d) John Byner
- 4) On the TV show *The Paper Chase*, law student James T. Hart grew up in *what* Midwestern state ?  
a) Indiana    b) Minnesota    c) Nebraska    d) Iowa

→ ANSWERS in next months issue of the Science Newsletter ! ←---

\*\* ANSWERS to July's Superfluous Questions: 1. d) zinc    2. b) tin    3. c) copper    4. d) chromium