2013 bright spots on Neptune

M. Delcroix[1], F. Colas[2,3], P. Gorczynski (EPSC2014-58 AM1,P172)

(1) Commission des observations planétaires, Société Astronomique de France (delcroix.marc@free.fr) (2) S2P,France (3) IMCCE, France

Abstract

After Uranus spot observed in 2011 from Pic du Midi one meter telescope (T1M) by an amateur (see [1]),for the first time in 2013 amateurs have been able to capture a bright white spot in the southern hemisphere of Neptune. From these observations a wind speed could be calculated and compared to the known wind profile for the planet.

Amateur data

Amateurs use mostly reflectors with an aperture from 25 to 40 cm. They observed 4 months around Neptune's opposition but not often as it was not considered that details could be imaged with small apertures telescopes. The data comes from different sources (French Astronomical Society, ALPO Japan, IOPW, …).

Observations by a few amateurs from US and Europe from July to October 2013 have been studied, included some from the T1M at Pic du Midi, yielding 18 individual measurements of white spots, in near infrared long-pass filters, usually with a 685nm long-pass filter. This allowed to track in particular spots in the Southern hemisphere.

WinJUPOS software, used by amateur astronomer associations on Jupiter and Saturn, was used to measure the position of features, and derive one drift rate in longitude.

Persistent white spot in the southern hemisphere

Peter Gorczynski (an amateur astronomer from Connecticut, USA) discovered a very bright spot on Aug. 21th 2013 (see figure 1).

It led to other amateur detections, as well as some images using the one meter telescope at Pic du Midi, France (see [2]). Between July 1st and Oct. 7th 2013, 13 candidate white spots could be observed between -38° and -53° planetographic latitude. Out of these 13 observations, 9 showed clearly a bright spot, visible in figure 2.

Figure 1: Discovery of the first bright spot on Neptune on Aug. 21st 2013 by an amateur astronomer

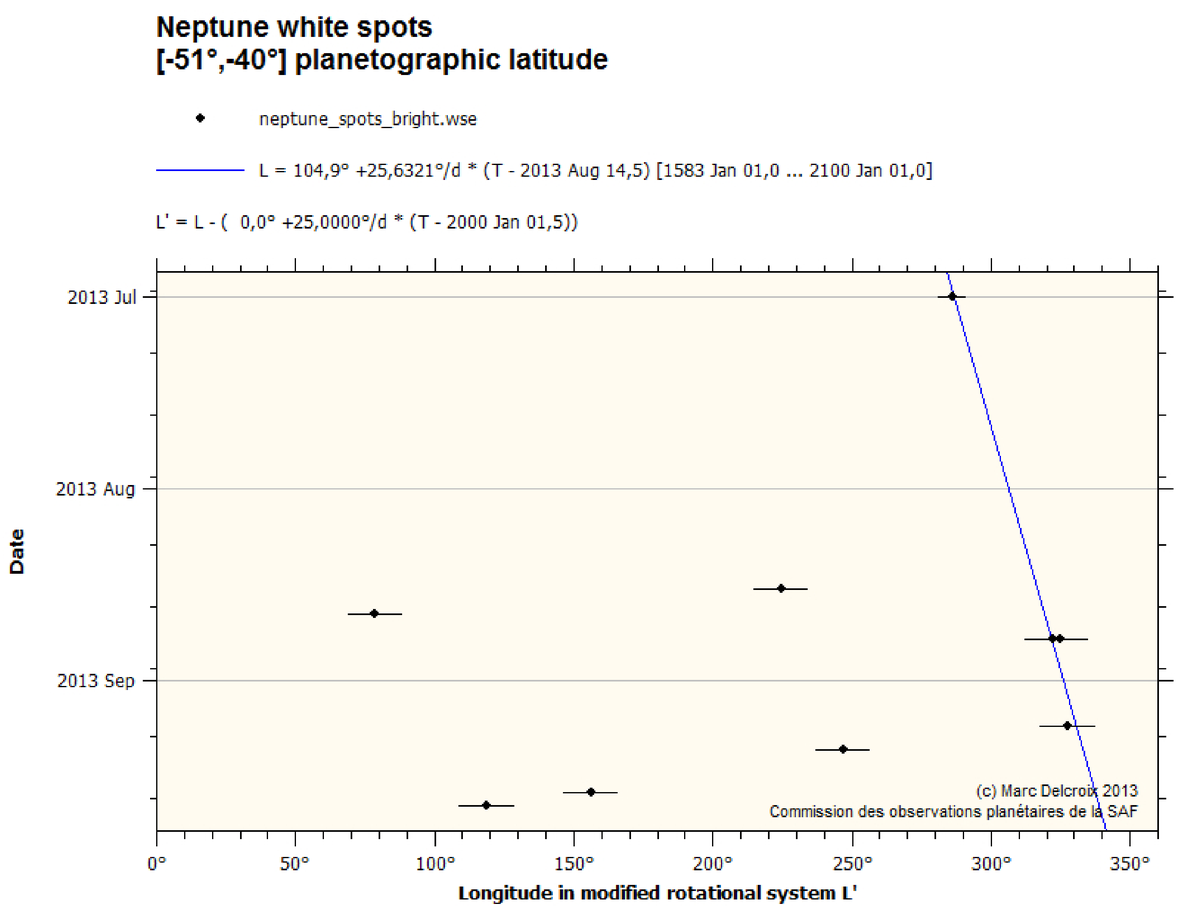

Figure 2: 9 bright white spot observations in the [-51°,-40°] latitude range. A few white spots have been observed including a possible persistent one following a constant drift rate line (in blue).

The Neptune disk on amateur images, taken with amateur telescopes (350mm maximum diameter), is very small : around 14 pixels diameter at acquisition scale. Hence the quality of the latitude/longitude measure is low (measurement error estimated to +/-7° latitude, +/- 10° longitude system I).

Finding which of these spots could be the same over time is tricky with only a few observations over two months. We first have to know an estimation of the wind speed at these latitude. For the medium latitude at -46° planetographic, a wind profile derived from Voyager 2 and HST observations (see [3]) is -61 m/s (and between -150m/s and 16m/s on the overall [-51°, -40°] planetographic latitude range). Then studying the longitude distribution of these 9 observations over time, and trying to derive from a part of them a coherent drift rate leads to a nice match of 4 of these observations (see figure 3) along a drift rate line of 25,63°/JD (Julian Day) (+/- 0,06°/JD) or -90m/s, at an average -46,0° planetographic latitude (+/- 5°), visible in figure 2.

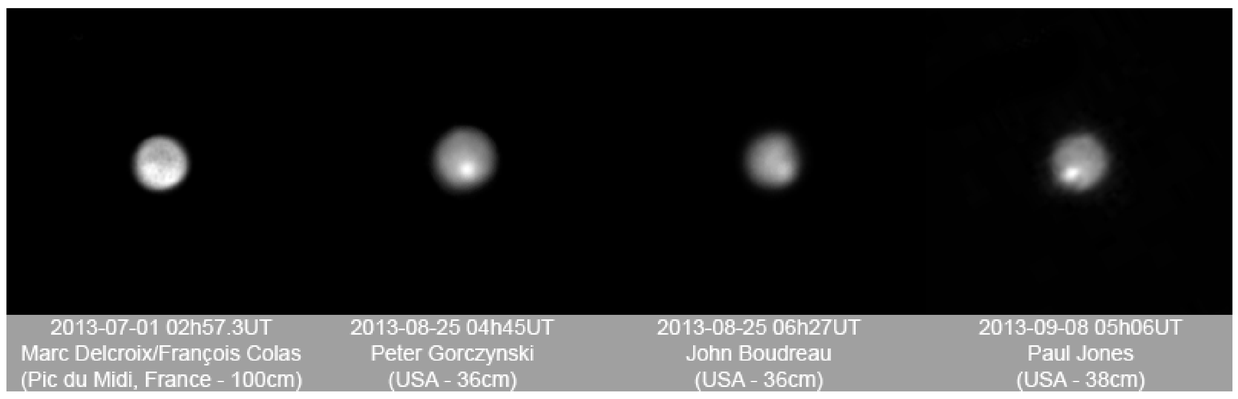

Figure 3: Observations (rescaled at the same size)of the bright spot on Neptune in 2013, from July 1st to September 8th. All images were done with a 685nm long-pass infrared filter.
Last three images are from American amateurs a few days around opposition, while the first one was done 2 months before opposition, with the professional one meter telescope at Pic du Midi.
Please note the second and third images performed less than 2 hours apart by two different amateurs, hence confirming the visibility of the spot with small diameter telescopes.

Other potential spots

A few single observations of candidate spots were done at other latitudes (+2°, -12°, -24°, -33°, -73° planetographic). These are non confirmed observations, because they are of lower quality than the ones studied around -46° latitude.

Conclusion

In 2013, amateurs proved successfully their ability of observing a very bright spot at ~46°S latitude on Neptune in infrared wavelength, despite the very small apparent diameter of the planet and its' faint luminosity.
Their observations allowed to estimate the wind speed at spot latitude of -90m/s, coherent with known wind profile. This proves the interest of having this difficult planet as a target for regular amateur observations.

In August 2014 it has been also the case for Uranus, with an apparent diameter twice as big, and magnitudes brighter: a very bright spot could be observed by amateur astronomers as well. Such regular observations would be useful for targeting professional studies as these planets are not observed very often with professional telescopes.

Acknowledgments

To all other dedicated amateurs who provided their images:
- Paul Jones (North Carolina, USA)
- John Boudreau (Massachusetts, USA)
- Paul Maxson (Arizona, USA)
- Mike Philipps (North Carolina, USA)
- Steve Fugardi (Connecticut, USA)

References

[1] Sromovsky L. et al.: Episodic bright and dark spots on Uranus, Icarus vol.220 issue 1 pp 6-22, 2012

[2] Delcroix M. et al.: Amateur observations with one meter professional telescope at Pic du Midi, EPSC2°14-14, Cascais, Portugal, September 2014

[3] Kaspi Y. et al.: Atmospheric confinement of jet streams on Uranus and Neptune, Nature 497, 344-347 May 16th, 2013