Jupiter in 2022/23: Report no.4

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Soon after Report no.3 was posted, it became evident that there was more to show and tell about the topics therein, as presented here. As always, we are very grateful to all the observers who provided images.

Global maps:

Report no.3 included a labelled map from Sep.29 (at PJ45), and here we add a map at the thermal infrared wavelength of 5.1 microns on the same date (Figure 1, from imaging by Dr Glenn Orton). Also shown are maps in the 0.89 micron methane absorption band, on Oct.2 by Andy Casely (Figure 2), and on Oct.23-26 by Manos Kardasis (Figure 3). New RGB maps compiled by Rob Bullen are shown for Oct.20-21 (Figure 4) and Nov.20-22 (Figure 5). (A map on Nov.5-7 was included in our PJ46 report.)

Some hi-res images:

Damian Peach and Ian Sharp had an observing trip to Barbados in Sep.-Oct.; some of their images are shown in Figure 6, along with several of comparable quality from other observers. Later hi-res images (including the GRS) are included in Figures 7 & 8, and more recent ones in Figure 9.

Satellite phenomena:

Some nice double transits of Europa and Ganymede and their shadows have been observed. Here we show multiple images of one event on Oct.26 (Figure 7) and one on Nov.2-3 (Figure 8). (Here we are glad to include images by some observers from a Facebook group, whose work we do not regularly receive.) Because of the coupled motions of the satellites, while Europa and Ganymede are beginning their transits, Io is going into occultation on the opposite side. In Figure 7, some well resolved images of Ganymede are enlarged, with a WinJupos simulation for comparison. They show not only the large dark regions and the ray-crater Osiris, but in some cases the largest grooved bands and the white North Polar Cap.

NEB:

The activity in the NEB(S) continues, and the disturbance from it continues to push north-wards into the mid-NEB. Indeed, much of the NEB is now of a fairly normal width and there has been some rifting extending north to the faded barges (Figures 4 & 5). But it is still not normal, as the barges are still very pale. Indeed the one remaining dark barge also faded during October – more so at the end of the month as it was affected by small-scale passing rifts, then by a tiny dark spot that retrograded up to its N edge according to the JUPOS chart.

GRS:

Hi-res images of the GRS are included in Figures 6-9. The Hook and Collar around the GRS largely faded away in November (compare Figures 4 & 5), but a relatively bluish-grey streak remained S of it, and the STB(N) has started to stream past it, so its environs are still changing. Although the GRS had shrunk to a record small size in the summer, its length has recovered somewhat since Sep. (Figure 10; & measurements by the JUPOS team, not shown).

STB:

A change took place during October in the sector of the STB preceding STB Segment G, where a cascade of numerous STBn jet spots had been emerging: a more 'solid', wedge-shaped dark grey sector began pushing in the preceding direction. By November it extended all the way to DS8, which was approaching the GRS, so there were almost no distinct STBn jet spots left. However, there are still plenty of indistinct ones inside the new dark sector. This sector was closely imaged by JunoCam at PJ46 (Nov.6), confirming that it contains a jumble of jet spots like the previous ones, embedded in a dusky streaky band. DS8 was confirmed to be a well-defined cyclonic brown oval in the PJ46 close-ups.

The evolving p. end of this sector, with DS8, is well shown in Figures 5-9, as it approaches the GRS; note the recent thinning out of STBn jet spots but the general darkening of the STB(N). This sector is still changing as it starts to pass the GRS, as noted above.

Another feature of interest is a small but bright white spot preceding DS8, now passing the GRS; it and DS8 are both methane-dark (visible in Figures 5-9). This white spot must be a small cyclone, just like those which produced the convective outbreaks of Clyde's Spot in 2020 and Spot 8 in 2021 just after they had passed the GRS. It may be unlikely that this one will do the same, but it needs to be monitored.

Jupiter's closest oppositions:

In Report no.3 we noted that Jupiter was unusually close at the opposition on 2022 Sep.26. Its perihelion will occur on 2023 Jan.21. Obviously, close oppositions occur every 12 years because those (in Sep. or Oct.) are the ones when Jupiter is near its perihelion. But why was this year's opposition the closest for 59 years past and 107 years future? Dominic Ford has now calculated opposition and perihelion distances precisely, to investigate this question. His report is here:

https://britastro.org/forums/topic/jupiters-closest-opposition-since-1963

It turns out that this results from the combination of a 59-year cycle in perihelion distance (which is due to the 5:2 resonance between the orbital periods of Jupiter and Saturn), and an ~86-year cycle in the phase of Jupiter's apparition in which perihelion occurs. The smallest perihelion distance in the present 59-year cycle was actually in 2011, and the next will be in 2070, but these occurred on dates far from opposition. In 2022/23, perihelion distance is about average, but it occurs closer to opposition than average. In 2129, a close perihelion (Nov.3) will occur near to opposition (Oct.7), so the distance from Earth will be even less.

Figures *(small copies on following pages):*

Figure 1:

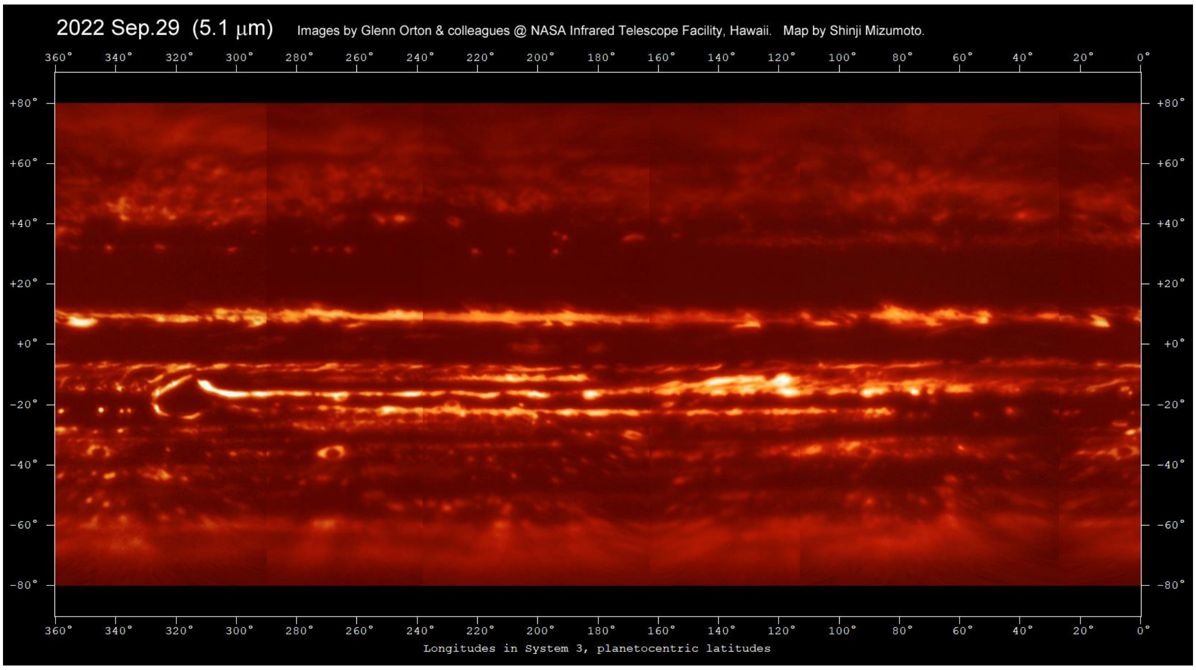

Figure 2:

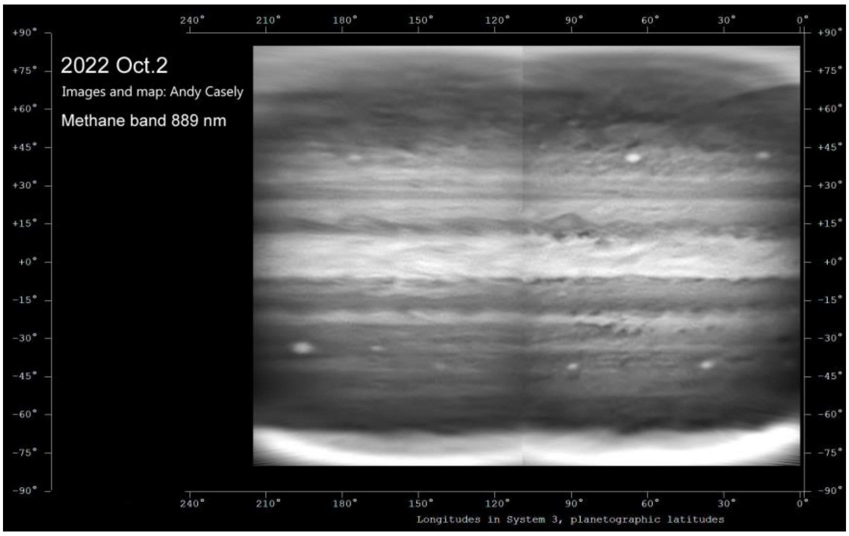

Figure 3:

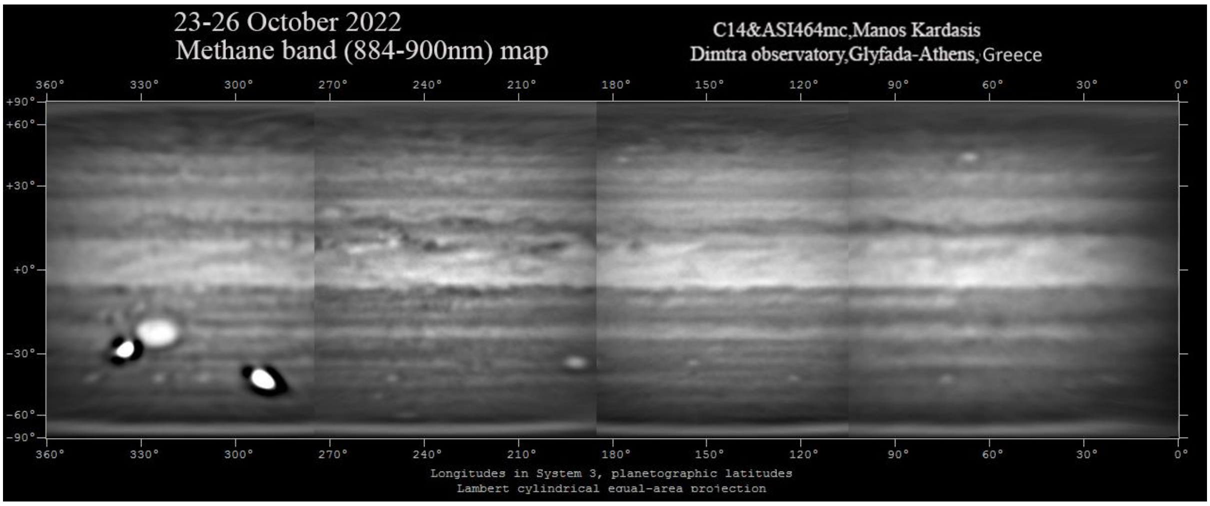

Figure 4:

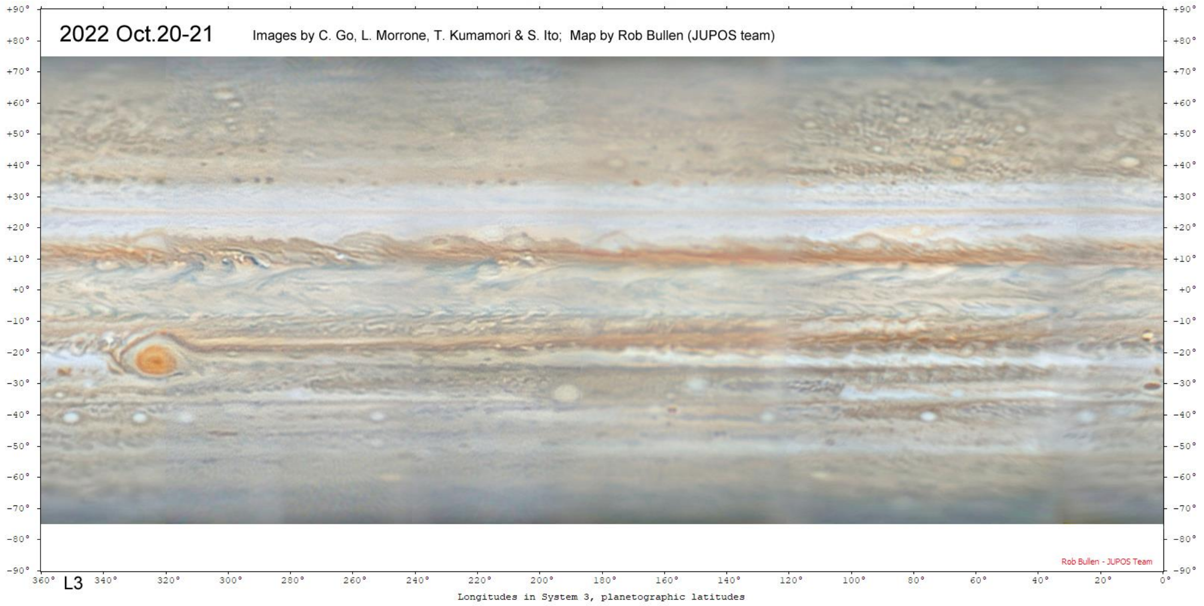

Figure 5:

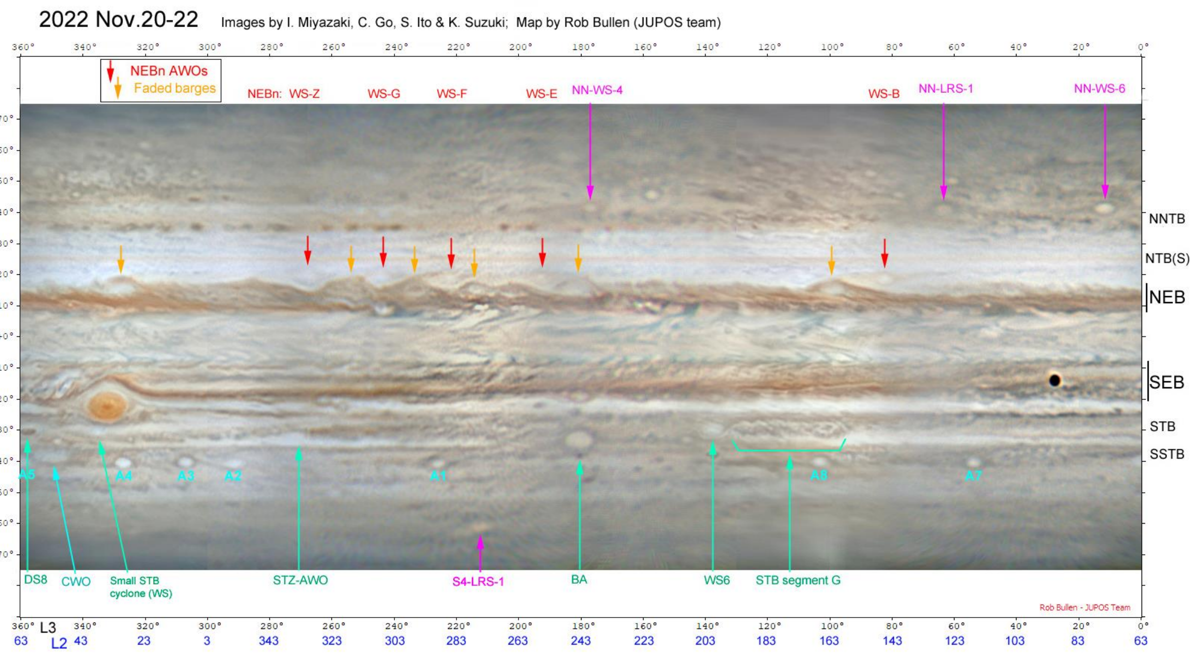

Figure 6:

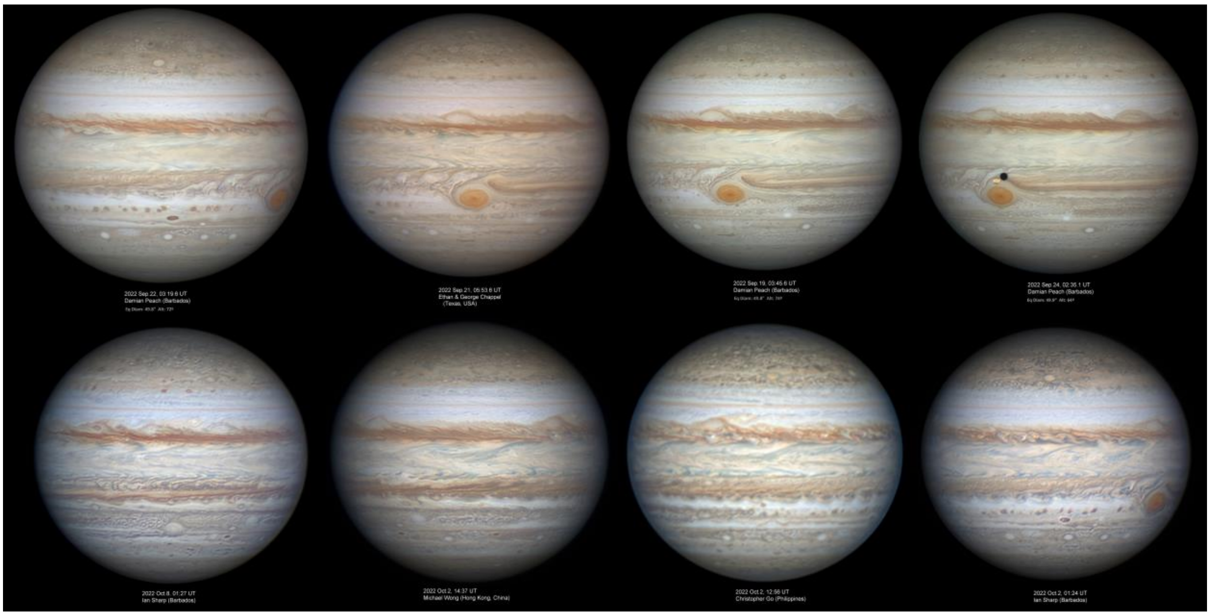

Figure 7:

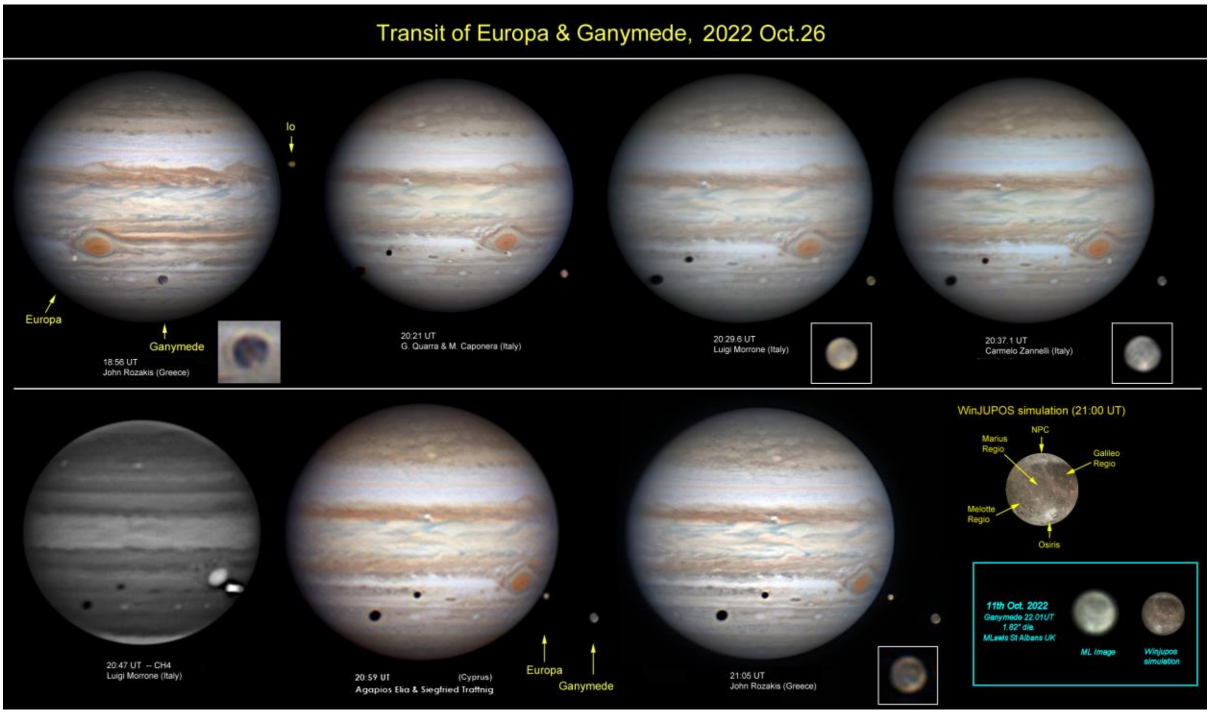

Figure 8:

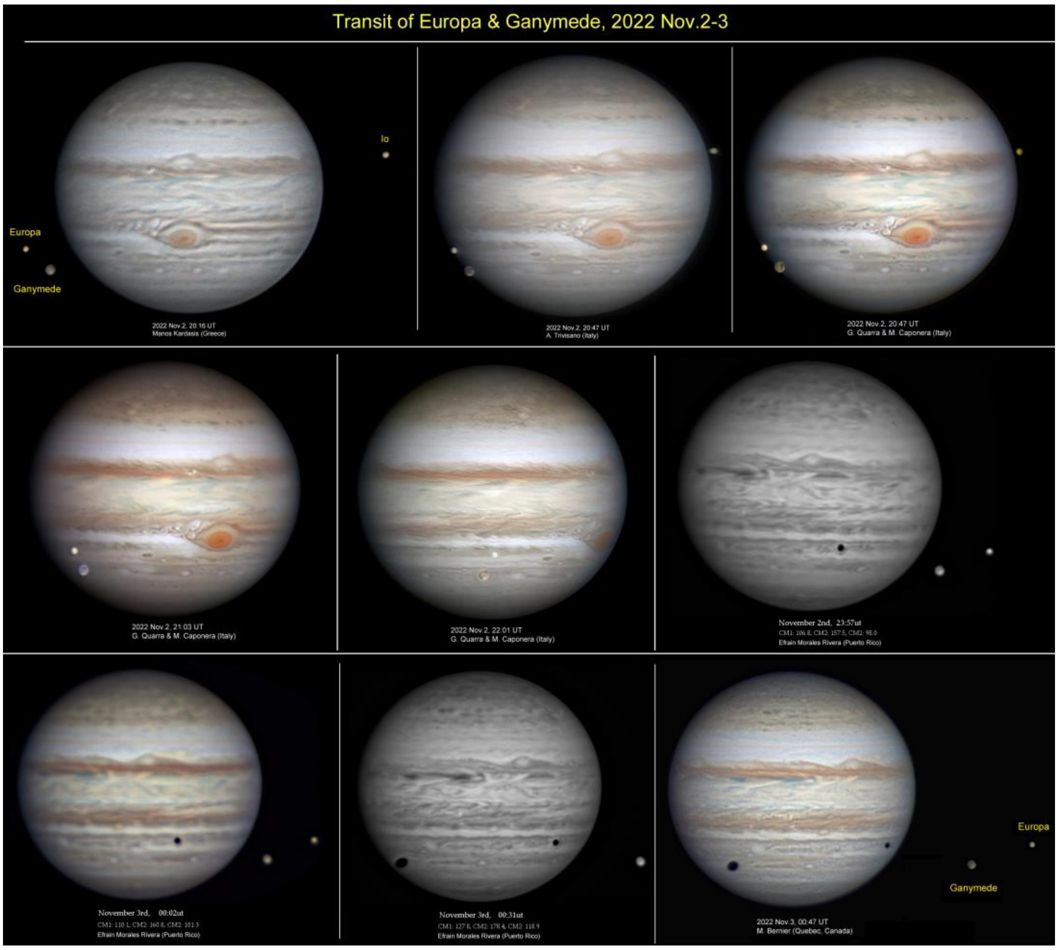

Figure 9:

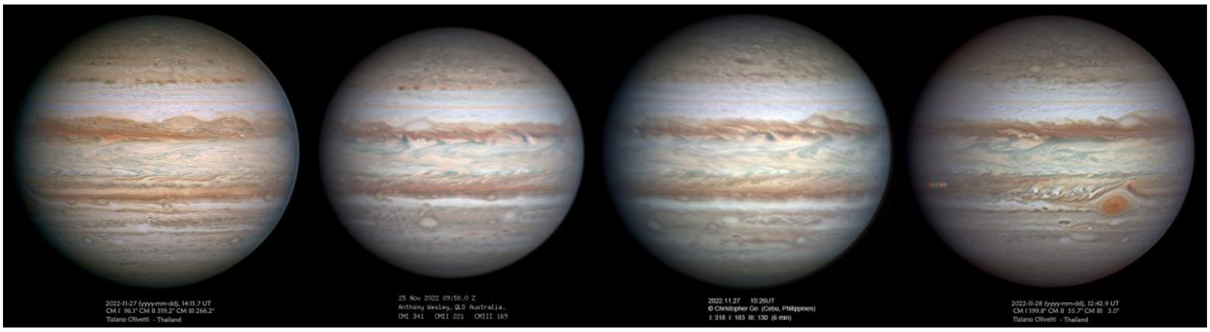

Figure 10: