End of Apparition Report: Jupiter 2013-2014

Paul G. Abel

Start Date: 2013 September 05 **End Date:** 2014 March 16th

Opposition: 2014 January 05 (Gemini)

Instruments used:
1. 203mm Newtonian Reflector
2. 508mm Planewave DK (University of Leicester's Main Observatory)

Number of observations: 19* (21 disk drawings, 1/3 rotation map)

*Poor weather proved to be a nuisance during the apparition.

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1 Introduction

Presented here is a short report summarizing Jupiter observations made by the author during the 2013-14 apparition. Throughout the whole of the apparition, the planet was was in an excellent position for UK observers residing in the constellation of Gemini. Opposition occurred on the 2014 January 05, and around this time it would have been possible to observe the whole planet once in an entire rotation.

The first observation of the 13-14 apparition was made on 2013 September 05 in good seeing conditions. The final observation was made on 2014 March 16. Although it was glimpsed a month later with the University of Leicester's 508mm DK, conditions were so poor that nothing could be made out, and so the 2014 March 16 observations is regarded as the last meaningful observation of the planet.

All observations made were visual; disk drawings were made at the telescope in black and white together with notes on intensity and colour. Separate colour drawings were then reconstructed shortly afterwards. All times were recorded using an accurate radio controlled clock. All drawings are given with three CM longitudes obtained from WINJUPOS:

- System I (CM1): Equatorial Zone (rotation $9^h\ 50^m\ 30.003^s$)
- System II (CM2): Rest of the planet (rotation $9^h\ 55^m\ 40.623^s$)
- System III (CM3): Magnetosphere (rotation $9^h\ 55^m\ 29.711^s$)

Drawings were made in integrated light (IL) unless otherwise stated, in which case, the W# is given. Intensity estimates were also made both in IL and with a W#25A (red) filter and a W#80A filter. The use of a W#11 (yellow) filter helped enhance general surface features.

Observations were sent to Dr. John Rogers, Director of the Jupiter Section at the BAA, along with the ALPO Japan and John McAnally of the US ALPO.

The outline of the report is as follows: the next section of the report looks at all of the observed features starting in the south and working north. In section 3, the only large scale strip map is presented, while in section 4 an interesting transit of Callisto is discussed. In section 5 the intensity estimates made during the apparition are given while in section 6 there are some concluding remarks.

The author would like to thank Dr. Hugh Sasse for his help and assistance when using the University of Leicester's observatory during the 2013-14 apparition.

2 The Planet

We now examine the various features observed on the disk during the apparition. We start in the south and move northwards.

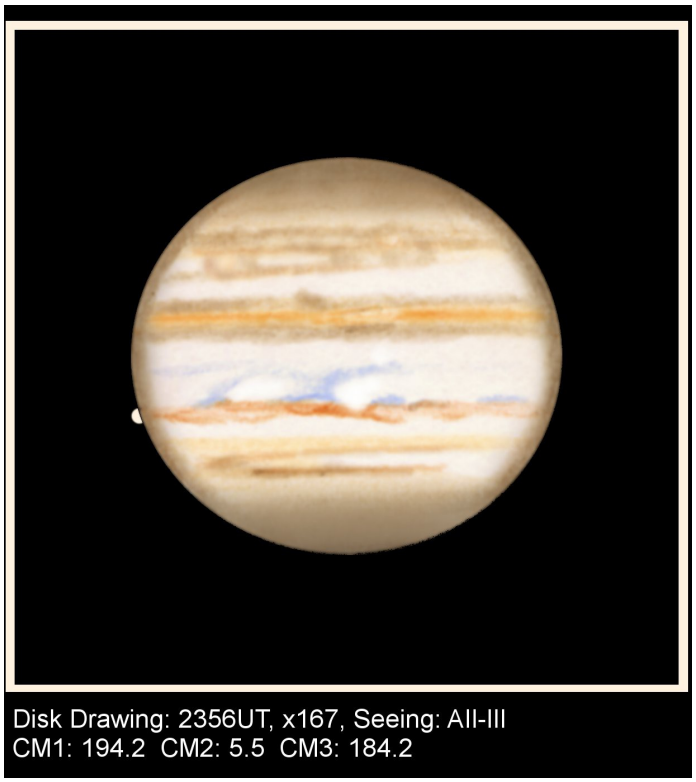
Southern Polar Region [SPR]: A vague greyish feature, occasionally fairly dark

South South Temperate Belt [SSTB]: Normally observed in reasonable conditions and fairly well defined in some longitudes. In moments of good seeing, a vague SSSTB could be made out.

South South Temperate Zone [SSTZ]: Often present in moments of average seeing or better and taking the form of a fairly uniform yellowish-grey zone.

South Temperate Zone [STZ]: A light yellowish region.

South Temperate Belt [STB]: Quite a prominent belt at some longitudes and normally greyish-brown in colour. The belt was not always uniform, and sometimes took the appearance of being rather irregular along it's edges (see drawing 1).



Drawing 1: Jupiter on 2014 February 20-21 with a 203mm Newtonian. The STB is somewhat irregular and there appears to be interaction with material in the STropZ. Also shown, Io is on the prec. Limb.

The STB was also home to a number of white ovals, however these were harder to make out than in previous years- possibly due to a decrease in size of perhaps a general fade in brightness. Certainly they were not discernible in poor seeing. The 'Mickey Mouse Spots' could also be seen in moments of good seeing. There were other interesting structures present in the STB/STZ at times (see drawing 2)

South Tropical Zone [STropZ]: A bright zone, normally white in colour. The zone was host to the famous Great Red Spot and a South Tropical Band which was visible at some longitudes. This band was brownish in colour and was strongest in the region fol. the GRS (drawings 1 and 2)

Drawing 2: Drawing of Jupiter from 2014 March 14 with a 203mm Newtonian. A faint STropB is present, and the STB shows a number of interesting features. Shadow of Callisto is also shown.

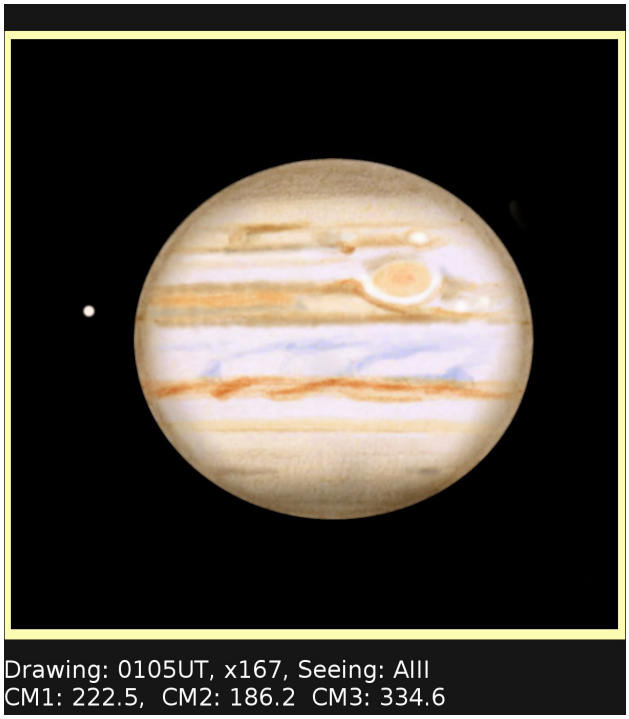
Oval BA: During the last apparition, Oval BA showed some slight orange colour and could be observed in moderate seeing. During the 2013-14 apparition however, Oval BA was much harder to see and no colour seemed to be present. Indeed, it was only the dark material surrounding BA which hinted at its presence.

The Great Red Spot and Red Spot Hollow [GRS and RSH]: The GRS was notably smaller and darker during this apparition compared to previous ones. The colour was rather

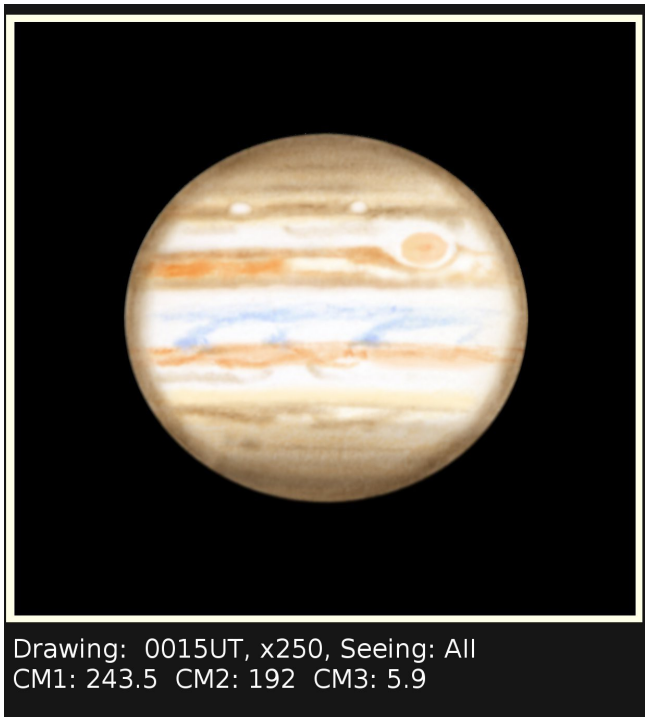
prominent and looked to be a rather dark orange. Very often the GRS appeared to have a darker core. The RSH was always visible and it was normally possible to see the white STropZ just north of the Great Red Spot.

Southern Equatorial Belt [SEB]: One of the main prominent belts visible on the disk, and probably the broadest and the most active. The belt appeared to be composed of three parts: a greyish southern component (SEBs), a darker zone (SEBz) which was often a dark orange colour in many places, and a dark greyish-brown northern component (SEBn). The SEBz seemed to be the most active part of the belt, especially near the GRS, and for a good section of longitude following it.

On 2013 October 30th, the author observed a brighter section in the SEBz in the region immediately prec. the GRS. The region was light, and a pale orange in colour (drawing 3). This feature seemed to remain the SEBz, and as the GRS moved away from the region, it became somewhat elongated (drawing 4).



Drawing 3: Drawing of Jupiter made on 2014 October 30th with a 203mm Newtonian. A bright section is visible in the SEBz.



Drawing 4: Jupiter on 2014 February 03 again with a 203mm Newtonian reflector. The brighter zone now seems to have increased in width.

Another feature of the SEBz was the impressive degree of turbulence which was apparent in the region immediately following the GRS and for a good section of longitude thereafter. As can be seen in Drawing 2. In moments of very good seeing the structure in the region just fol. The GRS was very complex and hard to render accurately.

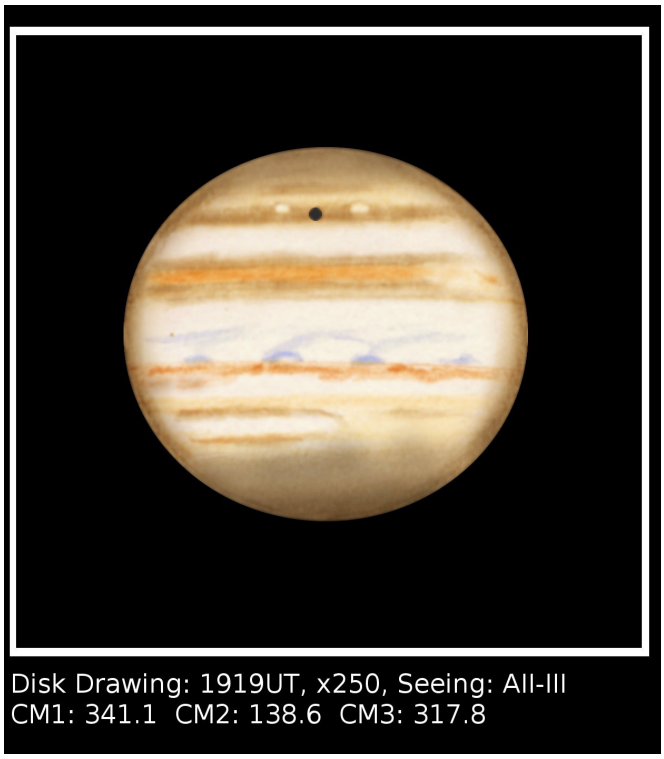
Equatorial Zone [Ez]: Probably the brightest region on the disk. The zone contained a number of dark festoons which appeared distinctly bluish in colour. The festoons originated along the northern border of the NEB and usually moved diagonally into the EZ. On a number of occasions it

appeared that they were connected to a lighter equatorial belt. At times it appeared that the festoons enclosed brighter regions within the EZ.

North Equatorial Belt [NEB]: Another prominent belt, and always noticeably thinner than the SEB. The belt had a orange-brown colour and often contained many interesting darker sections and lighter rifts (drawing 2). Occasionally at some longitudes it seemed that material from the NEB was extending down into the NTropZ (see drawing 4).

North Tropical Zone [NTropZ]: A bright zone, normally white in colour. At some longitudes thin greyish material could be seen interacting/close to the northern edge of the NEB.

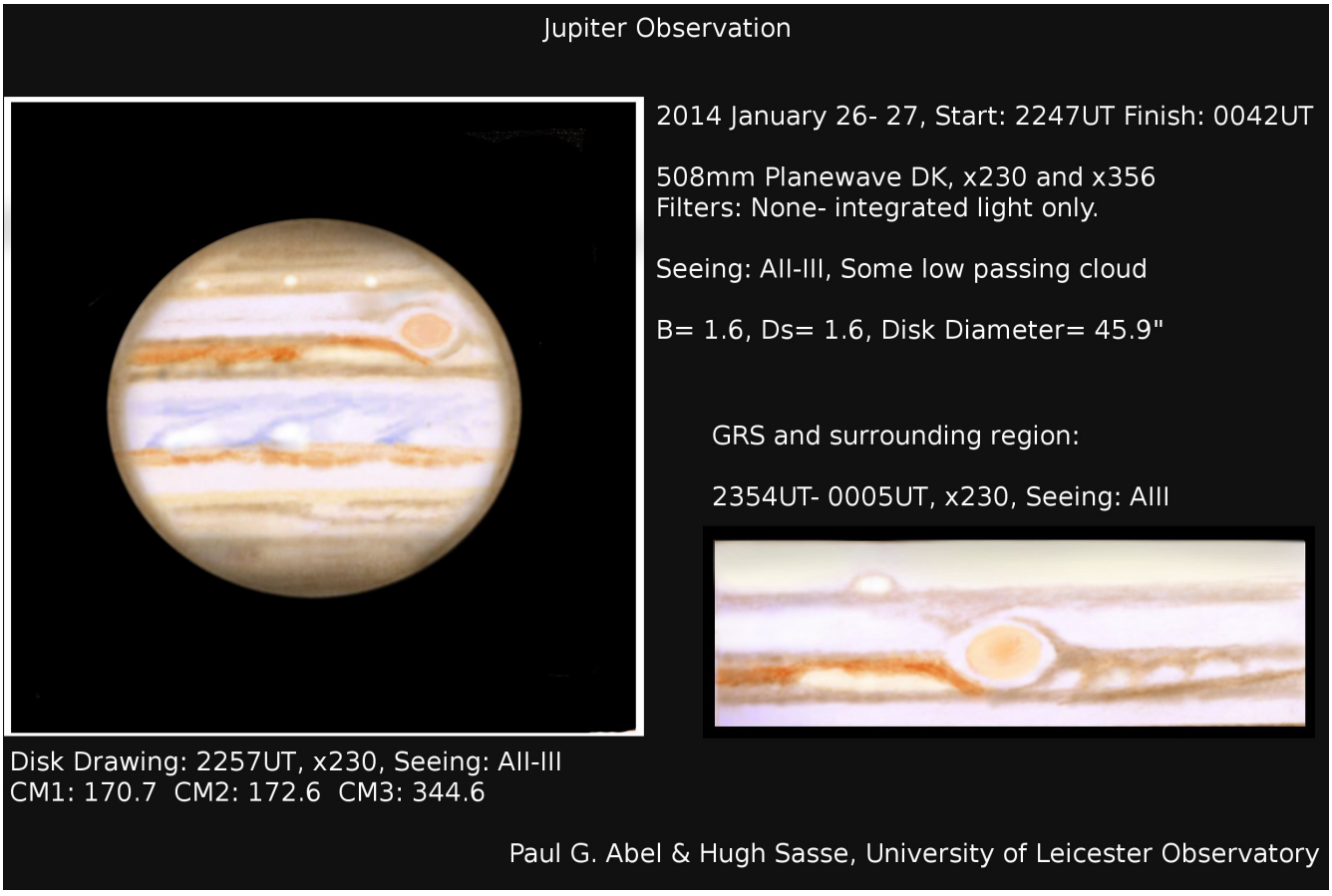
North Temperate Belt [NTB]: A very interesting feature for much of the apparition. At some sections of longitude, the NTB had the form of a thin golden colour belt. At other sections of longitude, it seemed to have a darker greyish-brown northern boundary which could appear rather irregular.



Drawing 5: Jupiter on 2014 February 22 with a 203mm Newtonian reflector. The northern border of the NTB has a dark irregular edge. Also shown, Callisto in transit looking unusually dark. Indeed, first impressions were that Ganymede was in transit.

At other sections of longitude, it seemed as though material was spilling out from the NTB into the NTZ. This can be seen in drawings 4 and 6. In moments of good seeing, the NTB showed some

interesting delicate structures.

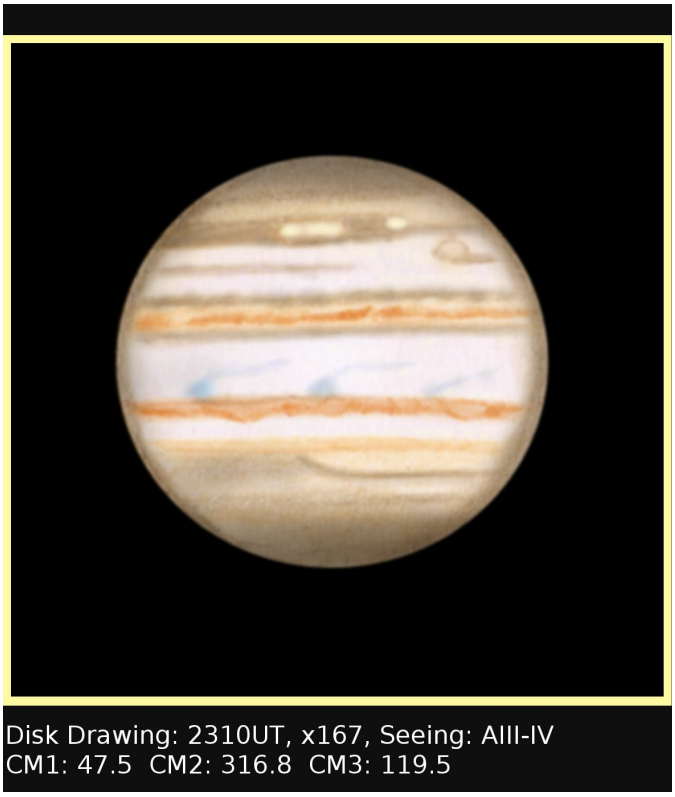


Drawing 6: Observation of Jupiter made with Dr. H Sasse. Material from the NTB seems to be interacting with material in the NTZ.

North Temperate Zone [NTZ]: An interesting zone which was never uniform in appearance. At some sections of longitude the zone had it's customary pale yellowish hue. At other sections it had a much darker appearance and it looked as though material from the NTB had entered the NTZ. An interesting observation was made on 2013 December 22nd whereby there appeared to be an interesting thin belt in the NTZ which curved up to join the NTB at about CM2= 316 (see drawing 7)

North North Temperate Belt [NNTB]: This belt normally took at form of a thin greyish belt, although at some longitudes it had a brown colouration. Occasionally darker sections could be made out in the belt.

North Polar Regions [NPR]: A dark dusky region, normally greyish-yellow in colour. The region often looked mottled as if there were darker spots and features present, but due to conditions or telescope aperture, they remain unresolved. At times the NPR looked darker than the SPR.



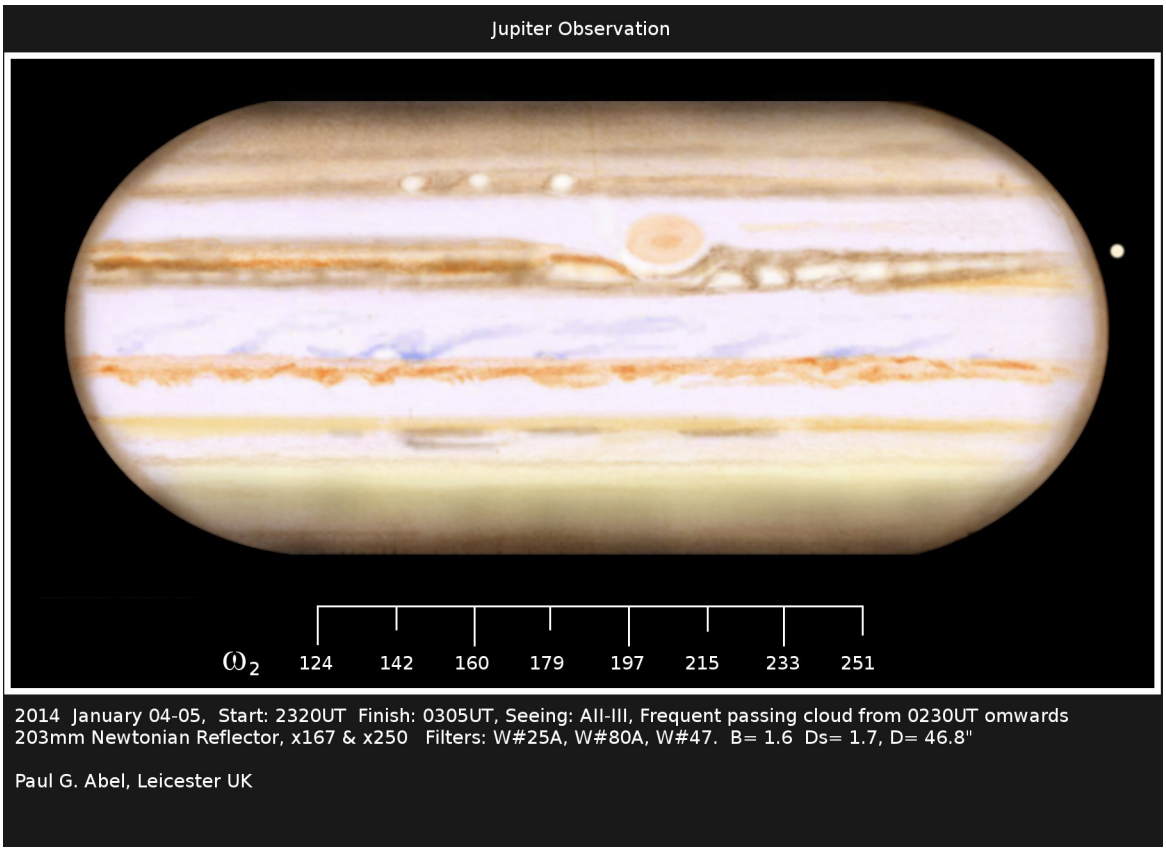
Drawing 7: An interesting observation made on 2013 December 22nd with a 203mm Newtonian. A thin belt in the NTZ appears to be connected to the NTB.

3 Planet Maps

The author had intended to get a number of half and full planet rotation maps. Alas, poor weather ruled this out, however a strip map showing the features for a 1/3 rotation was obtained and is given in drawing 8.

This strip drawing, although not showing the full planet, does give a reasonable visual summary of the many interesting features seen on Jupiter during the 13/14 apparition. Of particular interest are:

- The white ovals in the STB
- The GRS and its interaction with the SEB
- The intricate structures in the SEB close to the GRS and the disruption in the SEBz in the regions following the GRS
- Some intricate festoons in the EZ
- The dark sections of the NEB and the irregular northern boundary
- Dark sections in the NTB
- Dark sections in the NTZ close to the NTB.



Drawing 8: Third of a rotation strip map of Jupiter made on 2014 January 04-05 with a 203mm Newtonian. The map provides a good visual summary of the many interesting features observed on Jupiter in the 2013-14 apparition.

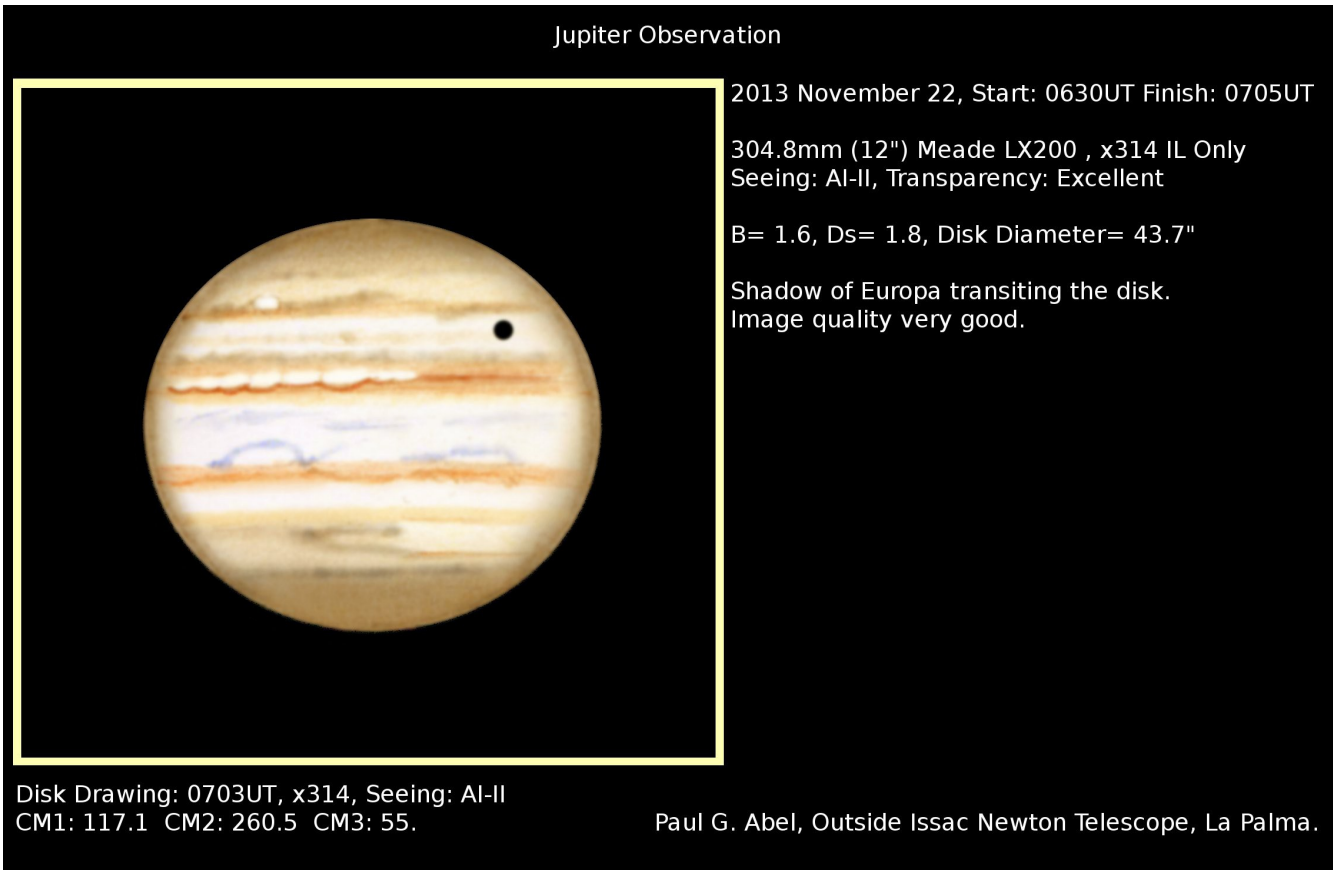
4 Satellite Phenomena

On 2014 February 22nd, Callisto made a transit of Jupiter, passing above the STB. The author observed the transit with his 203mm Newtonian reflector from Leicester UK. Interestingly (drawing 5), Callisto appeared to be very dark; indeed the author had never observed Callisto this dark before and the first impressions were that it was a shadow of a satellite on the disk. The program WINJUPOS revealed the shadow to be Callisto.

The transit was observed in a number of filters with some interesting results:

- 1934UT: Callisto was much harder to discern in the W#25A filter
- 1938UT: Callisto very easy to see in a W#80A filter, appearing to have intensity at about 8.5 (the same as in IL)
- 1940UT: Callisto could not be made out in the W#47 filter
- 1942UT: Callisto appears to be the lightest in a W#58 (green) filter at around 7.5. The satellite appeared to be a dark greyish circle set against the STB.

Without a doubt, the finest view of Jupiter the author obtained so far was on 2013 November 22nd outside the Issac Newton Telescope at La Palma whilst filming *The Sky at Night*. We had managed to loan a Meade LX200 12" SCT, and at the top of the mountain the seeing was AI. Jupiter looked like photograph (drawing 9) and the view was breath taking!



Drawing 9: Best view of Jupiter so far! Outside the INT, la Palma whilst shooting The Sky at Night. The shadow of Europa is also shown.

5 Intensity Estimates

Intensity estimates were made in integrated light (IL), and with a W#25A (red) and a W#80A (light blue) filter. As usual the Jupiter section BAA intensity scale was adopted: 0 (very bright) to 10 (black sky).

(i) Integrated Light

THE BAA JUPITER SECTION: VISUAL INTENSITY REPORT FORM: Integrated Light

OBSERVER: Paul G. Abel **LOCATIONS:** **Leicester UK**
YEAR 2013-2014

Month	October	October	Jan 2014	February	March			
DAY	6	30	5	20	3			
UT	03:52	01:16	01:40	23:34	23:13			
INSTR	203 New t	203 New t	203 New t	203 New t	203 New t			
MAGNIFICATION	x167	x167	x250	x250	x250			
SEEING	AIII	AIII	AII	AIII	AIII			
CM1								
CM2								
CM3								
INTENSITY OBSERVATIONS						**INTENSITY AVERAGE FOR THE APPARITION**	**NUMBER OF ESTIMATES**	**STANDARD DEVIATION**
THE PLANET								
SPR	3.5	3	3	3.5	3.5	3.30	6	0.27
SSTB	3	-	-	3.25	3	3.08	4	0.14
STZ	2.5	2	2	2	2.25	2.15	6	0.22
STB	4	4.5	4	4.5	3.5	4.10	6	0.42
STropZ	1.5	1.25	1.25	1	1	1.20	6	0.21
StropB	-	-	-	-	-			
GRS	-	4.5	4	-	4	4.17	4	0.29
RSH	-	-	-	-	-	#DIV/0!	0	#DIV/0!
SEB(S)	5	5	4.5	4.5	5	4.80	6	0.27
SEBz	6	5	5.5	5	5.25	5.35	6	0.42
SEB(N)	5	5	4.5	4.5	5	4.80	6	0.27
EZ	1	1	0.75	1	1	0.95	6	0.11
NEB	6	6	6	6	6	6.00	6	0.00
NTropZ	1.25	1	1	1	1	1.05	6	0.11
NTB	3.75	3.5	3	3	3	3.25	6	0.35
NTZ	2	2.5	2.25	2	2	2.15	6	0.22
NNTB	-	-	-	-	-	#DIV/0!	0	#DIV/0!
NPR	3.5	3	3	3.5	3.5	3.30	6	0.27

(ii) W#25A (red)

THE BAA JUPITER SECTION: VISUAL INTENSITY REPORT FORM:W#25A

OBSERVER: Paul G. Abel **LOCATIONS:** **Leicester**
YEAR 2013-2014

Month	October	October	Jan 2014	February	March			
DAY	6	30	5	20	3			
UT	03:58	01:20	01:42	23:38	23:18			
INSTR	203 New t	203 New t	203 New t	203 New t	203 New t			
MAGNIFICATION	x167	x167	x167	x167	x167			
SEEING	AIII	AIII	AII	AIII	AIII			
CM1								
CM2								
CM3								
INTENSITY OBSERVATIONS						**INTENSITY AVERAGE FOR THE APPARITION**	**NUMBER OF ESTIMATES**	**STANDARD DEVIATION**
THE PLANET								
SPR	3.5	3.75	3	3.5	3.25	3.40	6	0.29
SSTB	-	-	-	3	-	3.00	2	#DIV/0!
STZ	2.5	2.25	2	2.5	2	2.25	6	0.25
STB	3	3	3	3.5	3	3.10	6	0.22
STropZ	1	1	1	1	2	1.20	6	0.45
StropB	-	-	-	-	-			
GRS	-	2	2	-	-	2.00	3	0.00
RSH	-	-	-	-	-	#DIV/0!	0	#DIV/0!
SEB(S)	4.75	3	3	3	4	3.55	6	0.80
SEBz	5	3	3	3.25	3.5	3.55	6	0.84
SEB(N)	4.75	3	3	3	4	3.55	6	0.80
EZ	1	1	1	1	1	1.00	6	0.00
NEB	5	5	4	4	4	4.40	6	0.55
NTropZ	2	1	1.5	1.5	2	1.60	6	0.42
NTB	3	2.5	2.5	2.5	2.5	2.60	6	0.22
NTZ	2	2	-	2.25	2.5	2.19	5	0.24
NNTB	-	-	-	-	-	#DIV/0!	0	#DIV/0!
NPR	3.5	3.5	3	3	3	3.20	6	0.27

(iii) W#80A (blue)

THE BAA JUPITER SECTION: VISUAL INTENSITY REPORT FORM: W#80A

OBSERVER: Paul G. Abel **LOCATIONS:** **Leicester**
YEAR 2012-2013

Month	October	October	Jan 14	February	March			
DAY	6	30	5	20	3			
UT	04:07	01:27	01:47	23:44	23:24			
INSTR	203 Newt	203 Newt	203 Newt	203 Newt	203 Newt			
MAGNIFICATION	x167	x167	x167	x167	x167			
SEEING	AIII	AIII	AII	AIII	AIII-IV			
CM1								
CM2								
CM3								
INTENSITY OBSERVATIONS						**INTENSITY AVERAGE FOR THE APPARITION**	**NUMBER OF ESTIMATES**	**STANDARD DEVIATION**
THE PLANET								
SPR	3.75	3.5	3.5	3.5	3.5	3.55	6	0.11
SSTB	-	3	-	3.5	3	3.17	4	0.29
STZ	3	2.5	-	2.5	2.5	2.63	5	0.25
STB	3.25	4	4.5	4.5	3.25	3.90	6	0.63
STropZ	1.5	2	2	1	1	1.50	6	0.50
StropB	-	-	-	-	-			
GRS	-	3.5	4	-	5	4.17	4	0.76
RSH	-	1	1	-	-	1.00	3	0.00
SEB(S)	6	5.5	4	5	5	5.10	6	0.74
SEBz	6.25	4	5	6	6	5.45	6	0.94
SEB(N)	6	5.5	4	5	5	5.10	6	0.74
EZ	1.25	1.25	1.25	1	1	1.15	6	0.14
NEB	6.25	6.25	6.25	6.25	6.25	6.25	6	0.00
NTropZ	1	1	1.25	1	1	1.05	6	0.11
NTB	3	3	2.5	3	3	2.90	6	0.22
NTZ	2	2.75	2	2	2.75	2.30	6	0.41
NNTB	-	-	-	-	-	#DIV/0!	0	#DIV/0!
NPR	3	3.5	3	3	4	3.30	6	0.45

6 Concluding Remarks

The 2013-14 apparition was an interesting one, and due to the planet residing in the constellation of Gemini, it reached an excellent altitude. The main points of interest for this observer during the apparition were:

1. The region STB to SSTB showed a lot of fine features (irregular darker sections and subtle lighter zones) in good seeing.
2. The white ovals in the STB were much harder to see, although the 'Mickey Mouse Spots' were visible in good seeing.
3. The STropZ contained a darker STropB at some sections of longitudes.
4. The GRS was notably darker and smaller during this apparition
5. The SEB displayed a great deal of turbulence near the GRS. The SEBz presented a disrupted appearance for some distance following the GRS.
6. A number of dark festoons were observed in the EZ
7. NEB dark and very often had an irregular northern edge. The belt contained numerous lighter and darker sections.
8. NTB contained a darker northern edge in places, and this material may have been interacting with material in the NTZ.
9. NTZ contained some darker regions.