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9.

ASTROMETRIC AND PHOTOMETRIC OBSERVATIONS OF 115 THYRA AT THE 1978-79 APPARITION

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A number of English observers have obtained photographic positions of 115 Thyra, which are given below. The coordinates of most of these have been previously published in the Minor Planet Bulletin¹, the others are:

Observer	Place	Coordinates
Armstrong	Loudwater	Latitude 51°36'29"N, longitude 0°42'15"W, altitude 70 meters.
Ridley	Godalming	-λ 359°9, Δxy -268 ΔZ -331 (from IAUCs)

Armstrong used a 300 mm f/5.6 telephoto lens and Ridley a 500 mm focal length lens. All positions were measured by myself at the University of London Observatory.

Planet	1978/79 UT	RA (1950)	Dec	Observer
115 Oct	7.06131	4 ^h 44 ^m 49 ^s .4	+40°11'59"	Birtwhistle
115	7.06793	4 44 50.8	+40 12 00	Birtwhistle
115 Nov	26.8090	4 27 24.70	+42 11 38.9	Scott
115	26.8694	4 27 20.29	+42 11 18.2	Manning
115	26.8774	4 27 19.70	+42 11 15.9	Manning
115	27.8375	4 26 10.63	+42 05 37.4	Scott
115	27.89031	4 26 06.99	+42 05 19.0	Hurst
115	28.8642	4 24 56.24	+41 59 12.8	Manning
115	28.8726	4 24 55.57	+41 59 09.6	Manning
115	30.7792	4 22 38.14	+41 46 09.5	Scott
115	30.8215	4 22 34.91	+41 45 49.8	Scott
115 Dec	6.8861	4 15 30.86	+40 56 12.7	Scott
115	9.7903	4 12 22.47	+40 28 20.0	Scott
115	17.9517	4 04 50.28	+39 00 12.5	Armstrong
115	19.8925	4 03 24.0	+38 37 31	Armstrong
115	25.7847	3 59 59.88	+37 27 40.5	Van Looy
115	25.9277	3 59 55.60	+37 25 59.6	Van Looy
115	27.9666	3 59 06.13	+37 01 37.2	Van Looy
115	28.0062	3 59 05.41	+37 01 02.3	Van Looy
115 Jan	2.8395	3 57 47.06	+35 52 07.1	Van Looy
115	2.9126	3 57 46.24	+35 51 11.5	Van Looy
115	27.7878	4 08 03.09	+31 44 04.9	Manning
115	27.7969	4 08 03.55	+31 43 59.9	Manning
115	30.7632	4 10 44.57	+31 20 58.4	Scott
115 Feb	22.8557	4 39 08.58	+29 02 31.6	Manning
115	23.8198	4 40 34.03	+28 57 56.8	Manning
115	25.90972	4 43 42.14	+28 48 13.9	Ridley
115	28.87485	4 48 16.22	+28 35 01.7	Birtwhistle
115	28.89510	4 48 17.95	+28 34 56.1	Birtwhistle

From 20 observations, 1978 Nov 26 to 1979 Feb 28, I have calculated an orbit for 115 Thyra as follows:

T = 1978 Oct 1.5518 ET
 $\omega = 95.9948$
 $\Omega = 308.7000$
 $i = 11.5782$
 $q = 1.921199$ AU
 $e = 0.192619$
 $a = 2.379545$ AU
 $n^{\circ} = 0.2685116$
 $P = 3.671$ years

The mean residual is 1''.42. Residuals of the individual observations from the elements above are given here, with residuals in () not used in computation.

1978 UT	Δα, Δδ	1978/9 UT	Δα, Δδ
Oct 7.061 (-7''.3 +4''.0)		Dec 25.784 +1.3 -0.3	
7.067 (+5.1 +1.7)		25.927 +0.6 +0.9	
Nov 26.809 -0.3 +0.9		27.966 (-0.8 +4.3)	
26.869 -0.1 -0.5		28.006 +1.8 -1.7	
26.877 -0.0 -0.2		Jan 2.839 (+0.5 +3.7)	
27.837 +1.5 +0.6		2.912 -2.3 -0.9	
27.890 (+4.6 +0.3)		27.787 -1.2 +1.8	
28.864 -0.0 +0.6		27.796 -1.1 +1.1	
28.872 -0.5 +0.5		30.763 +1.8 -1.4	
30.779 +0.1 +0.7		Feb 22.855 -2.4 +0.6	
30.821 -1.5 -1.7		23.819 -1.0 +0.2	
Dec 6.886 (+0.5 +4.7)		25.909 +1.2 -1.4	
9.790 (+3.5 +0.8)		28.874 +2.1 +0.4	
17.951 (-5.1 +1.4)		28.895 +0.1 +0.2	
19.892 (-7.4 -10.0)			

The orbit was calculated to provide distance information for the asteroid, so that the magnitude reductions by Hurst could be analysed. The magnitudes were reduced using comparisons from the SAOC, USNOC, and various AAVSO fields. 63 magnitude reductions were used to produce the following formula:

$$m_{pv} = 6.86(\pm 0.05) + 5 \log D + 5 \log r + 0.061(\pm 0.003)\theta^{\circ}$$

Standard errors are quoted. The standard deviation of individual magnitudes was $\pm 0''.16$.

This result is significantly different from data available in the "Ephemerides of Minor Planets." The observed magnitude around opposition was about 8.9^m_{pv}. As the observations fall into two distinct ranges of phase angle, from 10-16° and 22-28°, an error in zero pointing for the brighter magnitudes (as possibly indicated by the opposition brightness being about 1 magnitude brighter than expected) would produce an anomalously bright value of the absolute magnitude m_0 and a correspondingly large value for the phase constant. These findings will have to be reviewed during a subsequent opposition.

All magnitude observations are given below. Four of these from Jan 2 were not used, these being about 0.5-0.6 magnitudes fainter than other estimates would suggest. Inclusion into the reduction changes the results by less than the given errors. The four observations are marked with a ? on the diagram of the phase function.

1978 UT	m_{pv} obs	1978/9 UT	m_{pv} obs	1979 UT	m_{pv} obs
Oct 7.06 +10.4 B		Dec 15.93 +9.1 S		Jan 2.91 +10.2 VL	
7.06 10.3 B		17.80 9.1 S		2.91 10.3 VL	
Nov 26.80 8.8 S		17.80 9.3 VL		11.76 10.0 S	
26.86 9.0 M		17.81 9.2 VL		16.86 10.4 S	
26.87 9.0 M		18.80 9.1 VL		20.91 10.4 S	
27.83 8.9 S		18.81 9.1 VL		23.88 10.5 S	
27.89 8.9 H		18.85 9.1 H		26.98 10.6 VL	
28.86 8.9 M		18.86 9.1 A		27.79 10.7 VL	
28.87 8.9 M		19.85 9.2 S		27.79 10.7 VL	
28.93 9.1 VL		19.88 9.2 H		27.84 10.8 VL	
28.94 9.1 VL		19.88 9.3 H		27.84 10.8 VL	
29.96 9.2 VL		19.88 9.3 H		29.91 10.6 VL	
29.96 9.2 VL		25.78 9.1 VL		29.92 10.6 VL	

10.

30.77	8.9 S	25.78	9.0 VL	30.76	10.6 S
30.82	9.0 S	25.85	9.2 S	Feb 2.75	10.8 S
30.92	9.2 VL	25.92	9.1 VL	14.82	11.0 S
30.92	9.2 VL	26.93	9.1 VL	22.78	11.2 S
Dec 1.82	8.9 S	26.96	9.2 VL	22.85	11.4 M
4.83	8.8 S	27.96	9.2 VL	23.78	11.4 S
6.88	8.8 S	28.00	9.2 VL	23.81	11.3 M
9.79	9.2 S	Jan 2.83	10.3 VL	24.87	11.4 S
13.90	9.1 S	2.84	10.2 VL	25.80	11.3 S
				28.86	11.5 S

1. Pilcher, F., MPB Vol 7, No. 1, 1979 Jul-Sept, p.6

OCULTATION NEWS

Several occultations of stars by some of the brighter minor planets will be occurring in the near future. As has been discussed in previous issues of MPB, carefully timed observations by many observers can yield fairly accurate diameter determinations for the planets involved; secondary occultation events confirmed independently by observers at different stations would constitute strong evidence for the existence of satellites orbiting these planets.

4 VESTA. On 1979 November 23 at about 2h30^m UT minor planet 4 Vesta will occult the star SAO 110541 which is of 3.7 magnitude. The path of this event is expected to cross Canada, and should be more than 540 km wide.

27 EUTERPE. On 1979 December 8 between 5h28^m and 5h44^m UT observers in northeastern Europe will have an opportunity to observe the occultation of the 9.0 magnitude star SAO 77426 by 27 Euterpe. The minor planet and the star will be of nearly equal brightness; their combined brightness will drop by 0.8 magnitude during the event. Duration along the central path should be about 17 seconds.

9 METIS. On 1979 December 11 between 8h05^m and 8h17^m UT the minor planet 9 Metis (then magnitude 10.0) will occult the moderately bright star SAO 80950 (magnitude 6.8), causing a dramatic 3.2 magnitude decline in combined brightness for observers in the eastern Caribbean Sea, western Venezuela, and Colombia. The path width of the event will be somewhat more than 160 km, the diameter of Metis. Observers elsewhere, especially on neighboring islands, Central America, and the southeastern United States should watch for possible secondary occultations which might be caused by possible satellites. (The Recorder will attempt observation in the Virgin Islands).

3 JUNO. On 1979 December 11 about 9^h UT the bright minor planet Juno will occult the 9.0 magnitude star SAO 115946. The exact path has not yet been determined, but will involve eastern Canada to the west coast of the United States. Path width will be more than 240 km. The asteroid is brighter than the star so that reliable detection will probably require photoelectric photometry. Brief secondary events might be observable by experienced visual observers.

48 DORIS. On 1980 January 4, between about 23h05^m and 23h12^m UT planet 48 Doris (then magnitude 11.2) will occult the star SAO 94441 (magnitude 7.7). The path of this occultation begins in Europe, crosses the Atlantic Ocean and eastern Canada, and will terminate near Lake Superior. During the event the brightness of the combined objects will decline dramatically by 3.1 magnitudes for a duration of up to about 15 seconds. Path width will be more than 150 km, the diameter of Doris.

All occultation observations, both positive and

negative should be reported without delay to Dr. David W. Dunham, P.O. Box 488, Silver Spring, Maryland 20907, U.S.A. Please be aware that predictions regarding the paths of these events are often in error by several hundreds of kilometers because of our imperfect knowledge of precise minor planet and star positions. Observers in bordering regions therefore should also attempt observation of these events.

MINOR PLANET NEWS

1977 HA RECOVERED. The Apollo-type asteroid 1977 HA was recovered by C.T. Kowal on exposures with the 122 cm Schmidt telescope at Mt. Palomar made on 1979 June 1 and June 2. At the time the planet was magnitude 19. (Cf. IAU Circular 3371)

1972 RA RECOVERED. The Amor-type asteroid 1972 RA was recovered by E. Helin on exposures made with the 122 cm Schmidt telescope at Palomar Mountain Observatory on 1979 August 23. Further observations of this object were secured by G. Schwartz and C.-Y. Shao at Harvard College Observatory, Agassiz Station on August 31 and September 1. At the time of Helin's observation 1972 RA was estimated to be photographic magnitude 17 or 17½. (Cf. IAU Circular 3398)

1979 QA DISCOVERED. Eleanor Helin discovered this fast-moving asteroidal object on exposures made with the 122 cm Schmidt telescope at Mt. Palomar on 1979 August 22 and 23. Its estimated magnitude was then 18½ to 19. At time of discovery 1979 QA was apparently becoming fainter and drawing away from the Earth. It is unfortunate that more observations over a longer period of time have not been reported.

1979 QB DISCOVERED. On the same plates which revealed 1977 QA Eleanor Helin also found another object in direct motion at opposition, now designated 1977 QB. It is an Amor-type planet with the following orbital elements by Brian G. Marsden:

T = 1979 Sept. 25.005 ET	
Ω = 119.304	e = 0.44299
Δ = 342.155	a = 2.33379 AU
i = 3.381	n° = 0.276446
q = 1.29996 AU	P = 3.57 years

(Cf. IAU Circulars 3401 and 3412)

LONG-LOST PLANET 612 VERONIKA RECOVERED. Lost since its discovery in 1906, the minor planet 612 Veronika has been identified by Brian G. Marsden with six single observations variously reported as 1950 LN, 1962 VB, 1973 RE, 1973 TQ, 1973 UH3 and 1974 XS. At opposition this year (November) Veronika is expected to be magnitude 16.4 photographic, too faint for most amateur telescopes. (Cf. IAU Circular 3411)

DR. KARL REINMUTH

Dr. Karl Reinmuth, who discovered more minor planets than any other person, died on 1979 May 6 at age 87 in Heidelberg. He spent his entire astronomical career there at Königstuhl Observatory from 1912 to 1957, during which time he discovered about 270 planets which have received permanent numbers.

Dr. Reinmuth's first discovery was 796 Sarita on October 15, 1914. He also discovered about one third of the currently numbered Trojan planets, and in 1937 found unnumbered Hermes, now lost, which swept past the Earth at about twice the Moon's distance. A very active observer, he obtained 12,500 precise positions of minor planets measured on Königstuhl photographs -- an enormous achievement before automatic measuring engines and electronic computers!