

## NO. 145 MEASURES OF THE SATELLITES OF URANUS AND MARS

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### ABSTRACT

Relative measures are made of the satellites of Uranus and Mars, from plates taken with the 82-inch McDonald Observatory reflector telescope, and the 61-inch NASA telescope at the Catalina Observatory.

#### *82-Inch Reflector*

When the writer joined the Lunar and Planetary Laboratory at the University of Arizona, he found available there a considerable number of unmeasured plates of the Uranus system taken with the 82-inch reflector of the McDonald Observatory. The most extensive series was obtained after the discovery of the fifth satellite in 1948 by Dr. G. P. Kuiper by him and D. L. Harris. Shorter series were added by Kuiper in 1954, 1960 and 1961, and by the writer in 1962 and 1964.

On all the plates, the image of the planet was so overexposed that it was not possible to refer the satellites to the planet's center. Only intercomparisons of the satellites could be made. For that purpose the plates were measured in rectangular coordinates on the comparator of the Steward Observatory, using the *Astrographic Catalogue* as the source of the reference star coordinates. The deduced positions, reduced to the equinox of 1950.0, are affected by

the uncertainty of the plate constants of the *Astrographic Catalogue* but since only differences in position are used, these uncertainties enter only as a second-order effect and are therefore completely negligible.

The observation times are given in decimal fractions of UT days. The satellites are designated by the initials M (Miranda), A (Ariel), U (Umbriel), T (Titania), and O (Oberon).

The equatorial coordinates of the brightest satellite, Titania, are given for the epoch 1950.0. They are followed by the differences satellite minus Titania in  $x$  and  $y$ .

Measures of low weight are designated according to the following schedule:

- (1) Image faint
- (2) image very faint
- (3) all images poor
- (4) image affected by diffraction rays
- (5) image close to the planet

## OBSERVATIONS AT 82-INCH REFLECTOR, McDONALD OBSERVATORY

1948 Mar 1.10943	1948 Oct 25.37250(3)	1948 Oct 26.35918(3)
T 5 <sup>h</sup> 25 <sup>m</sup> 47 <sup>s</sup> 12 +23 <sup>o</sup> 22' 13.0"	T 6 <sup>h</sup> 1 <sup>m</sup> 54 <sup>s</sup> 14 +23 <sup>o</sup> 38' 47.5"	T 6 <sup>h</sup> 1 <sup>m</sup> 48 <sup>s</sup> 27 +23 <sup>o</sup> 38' 31.0"
M -23.32 + 1.15	M + 8.15 -27.43	A +24.92 + 3.36
A -44.06 +13.11	A +29.89 -34.06	U +27.31 -28.82
U -12.55 + 3.49	U - 1.67 -24.47	O - 7.70 +10.27
O -54.34 -31.15	O - 8.71 + 7.41	
1948 Mar 1.11499	1948 Oct 25.37940	1948 Oct 26.36479
T 5 25 47.13 +23 22 13.1	T 1 54.10 +23 38 47.4	T 6 1 48.23 +23 38 30.9
M -22.52 + 1.45	M(2) + 8.9 -27.58	A +24.81 + 3.43
A -44.24 +12.95	A +30.08 -33.73	U +27.56 -28.75
U -12.58 + 3.56	U - 1.58 -24.67	O - 7.83 +10.32
O -54.64 -31.30	O - 8.70 + 7.45	
1948 Oct 19.41542	1948 Oct 25.38338	1948 Oct 26.42062
T 6 2 15.93 +23 37 45.5	T 6 1 54.07 +23 38 47.3	T 6 1 47.96 +23 38 29.7
A + 4.16 +21.13	M + 8.45 -27.92	M +31.10 + 1.08
U +35.59 +31.34	A +30.25 -33.63	A +23.24 + 3.67
O +53.17 + 3.20	U - 1.43 -24.74	U +29.33 -27.84
	O - 8.61 + 7.37	O - 7.93 +10.51
1948 Oct 19.41875	1948 Oct 25.42210	1948 Oct 26.42514
T 6 2 15.98 +23 37 45.5	T 6 1 53.84 +23 38 47.0	T 6 1 47.92 +23 38 29.6
A + 4.06 +21.22	M(2) + 9.57 -28.99	M +30.70 + 1.45
O +52.96 + 3.17	A +31.60 -31.88	A +23.00 + 3.76
	U - 0.73 -25.43	U +29.18 -27.64
	O - 8.60 + 7.44	O - 7.82 +10.57
1948 Oct 21.45142	1948 Oct 25.42671	1948 Oct 26.43583
T 6 2 12.37 +23 37 54.0	T 6 1 53.82 +23 38 46.8	T 6 1 47.85 +23 38 29.4
A -33.78 +31.40	M + 9.55 -29.12	A +22.94 + 3.77
U -43.00 +17.28	A +31.68 -31.65	U +30.01 -27.43
O +14.20 +36.15	U - 0.74 -25.40	O - 8.02 +10.57
1948 Oct 21.45498	1948 Oct 25.43311	1948 Oct 26.43863
T 6 2 12.38 +23 37 53.8	T 6 1 53.78 +23 38 46.7	T 6 1 47.86 +23 38 29.4
A(2) -33.83 +31.36	M + 9.72 -29.25	A +22.87 + 3.80
U -43.38 +17.53	A +31.84 -31.37	U +29.90 -27.43
O +14.40 +36.01	U - 0.50 -25.47	O - 8.00 +10.63
1948 Oct 24.35066(3)	1948 Oct 25.43786	1948 Oct 26.47898
T 6 2 0.05 +23 38 51.3	T 6 1 53.76 +23 38 46.8	T 6 1 47.63 +23 39 28.4
M(1) - 2.74 -40.59	M(2) + 9.91 -29.43	A +21.96 + 3.88
A -18.52 -32.92	A +31.91 -31.12	U +31.18 -26.58
U - 3.02 -12.09	U - 0.18 -25.66	O - 8.12 +10.87
O -12.87 +10.96	O - 8.49 + 7.47	
1948 Oct 24.47990	1948 Oct 25.46947	1948 Oct 26.48178
T 6 1 59.27 +23 38 51.5	T 6 1 53.58 +23 38 46.3	T 6 1 47.63 +23 38 28.4
M(1) -12.50 -38.90	M +10.94 -30.31	A +22.00 + 3.81
A -14.26 -37.64	A +32.78 -29.68	U +31.31 -26.47
U - 3.82 -12.40	U + 0.12 -26.22	O - 8.02 +10.78
O -12.31 +10.07	O - 8.36 + 7.49	
1948 Oct 24.48939	1948 Oct 25.47377	1948 Oct 26.48634
T 6 1 59.21 +23 38 51.4	T 6 1 53.55 +23 38 46.3	T 6 1 47.61 +23 38 28.3
A -13.82 -37.88	A +33.05 -29.44	M +28.46 + 2.21
U - 3.86 -12.99	U + 0.15 -25.96	A +21.91 + 3.87
O -12.16 +10.19	O - 8.32 + 7.46	U +31.50 -26.47
		O - 8.12 +10.81
1948 Oct 24.49390	1948 Oct 25.48518	1948 Oct 26.49135
T 6 1 59.24 +23 38 51.4	T 6 1 53.49 +23 48 46.1	T 6 1 47.58 +23 38 28.2
A -13.82 -38.39	M +11.50 -30.62	M +28.42 + 2.33
U - 3.94 -12.64	A +33.23 -28.89	A +21.74 + 3.92
O -12.33 +10.05	U + 0.33 -26.44	U +31.84 -26.33
	O - 8.28 + 7.54	O - 8.07 +10.78
1948 Oct 24.50003	1948 Oct 25.48866	1948 Oct 26.49633
T 6 1 59.16 +23 38 51.4	T 6 1 53.47 +23 48 46.0	T 6 1 47.51 +23 38 28.0
A -13.58 -38.33	M(4) +11.84 -30.67	M +28.65 + 2.63
U - 4.00 -12.50	A +33.33 -28.72	A +21.57 + 3.82
O -12.28 +10.03	U + 0.39 -26.49	U +31.86 -26.14
	O - 8.30 + 7.63	O - 8.22 +10.90
1948 Oct 25.35384	1948 Oct 26.35302(3)	1948 Oct 27.31338
T 6 1 54.26 +23 38 47.6	T 6 1 48.30 +23 38 31.1	T 6 1 44.58 +23 38 10.5
M(2) + 7.58 -26.84	A +25.12 + 3.31	A +24.44 - 1.03
A +29.32 -34.76	U +27.07 -28.91	U +47.38 + 5.75
U - 1.97 -24.16	O - 7.81 +10.26	O -13.61 +13.60
O - 8.72 + 7.46		
1948 Oct 25.36771	1948 Oct 27.32473	1948 Oct 27.32473
T 6 1 54.17 +23 38 47.5	T 6 1 44.53 +23 38 10.3	T 6 1 44.53 +23 38 10.3
M + 8.14 -27.20	A +24.62 - 0.95	A +24.62 - 0.95
A +29.75 -34.22	U +47.38 + 6.22	U +47.38 + 6.22
U - 1.63 -24.41	O -13.64 +13.69	O -13.64 +13.69
O - 8.66 + 7.47		

## OBSERVATIONS AT 82-INCH REFLECTOR, McDONALD OBSERVATORY

1948 Oct 27.33064	1948 Oct 27.47757	1948 Oct 31.46479
T 6 <sup>h</sup> 1 <sup>m</sup> 44 <sup>s</sup> 51 +23 <sup>o</sup> 38' 10.2	T 6 <sup>h</sup> 1 <sup>m</sup> 43 <sup>s</sup> 88 +23 <sup>o</sup> 38' 7.4	T 6 <sup>h</sup> 1 <sup>m</sup> 27 <sup>s</sup> 50 +23 <sup>o</sup> 38' 36.0
A +24.80 - 0.94	A +28.38 + 1.58	M(2) -27.01 -16.42
U +47.31 + 6.38	U +46.63 +13.85	A -38.43 + 4.40
O -13.67 +13.63	O -15.11 +13.87	U -12.12 -13.79
1948 Oct 27.34237	1948 Oct 27.48733(3)	1948 Oct 31.47044
T 6 1 44.45 +23 38 10.0	T 6 1 43.87 +23 38 7.0	T 6 1 27.46 +23 38 36.1
A +25.13 - 0.73	M +36.43 +15.84	M(2) -26.65 -16.58
U +47.39 + 7.06	A +28.49 + 1.74	A -38.65 + 4.18
O -13.79 +13.63	U +46.45 +14.23	U -11.91 -13.91
1948 Oct 27.35640	1948 Oct 27.49157	1948 Oct 31.47597
T 6 1 44.39 +23 38 9.7	T 6 1 43.85 +23 38 6.9	T 6 1 27.39 +23 38 36.5
A +25.37 - 0.55	M +28.68 + 1.84	M(2) -26.11 -16.70
U +47.29 + 7.78	U +46.45 +14.53	A -38.88 + 3.58
O -13.80 +13.76	O -15.25 +13.82	U -11.69 -13.85
1948 Oct 27.36730	1948 Oct 31.40562	1948 Oct 31.48150
T 6 1 44.30 +23 38 9.5	T 6 1 27.86 +23 38 34.5	T 6 1 27.39 +23 38 36.4
A +25.74 - 0.56	M -29.45 -15.70	M(2) -25.76 -16.79
U +47.34 + 7.91	A -37.05 + 6.74	A -38.95 + 4.30
O -13.99 +13.78	U -12.86 -14.05	U -11.87 -13.87
1948 Oct 27.37537	1948 Oct 31.41123	1948 Oct 31.48692
T 6 1 44.30 +23 38 9.4	T 6 1 27.83 +23 38 34.7	T 6 1 27.48 +23 38 36.3
A +25.87 - 0.36	M -28.69 -15.68	M(1) -26.29 -16.73
U +47.36 + 8.71	A -37.21 + 6.50	A -38.48 + 3.83
O -14.06 +13.74	U -12.90 -14.12	U -11.71 -13.91
1948 Oct 27.38366	1948 Oct 31.41677	1948 Nov 6.33889
T 6 1 44.26 +23 38 9.1	T 6 1 27.79 +23 38 34.9	T 6 0 48.68 +23 38 3.4
A +26.20 - 0.18	M -28.83 -15.75	M(2) +15.83 +29.89
U +47.33 + 9.38	A -37.36 + 6.16	A + 0.02 +19.22
O -14.26 +13.73	U -12.82 -14.14	U - 7.03 +46.65
1948 Oct 27.39648	1948 Oct 31.42326	1948 Nov 6.34444
T 6 1 44.23 +23 38 8.9	T 6 1 27.76 +23 38 35.1	T 6 0 48.65 +23 38 3.4
M(2) +35.90 + 8.73	M -28.66 -15.89	M(1) +15.26 +30.53
A +26.44 - 0.06	A -37.48 + 5.94	A + 0.01 +18.97
U +47.20 + 9.74	U -12.71 -14.14	U(4) - 7.21 +46.40
O -14.29 +13.72	O -16.44 -47.76	O + 7.49 +75.28
1948 Oct 27.40045	1948 Oct 31.42938	1948 Nov 6.35000
T 6 1 44.21 +23 38 8.7	T 6 1 27.80 +23 38 35.2	T 6 0 48.63 +23 38 3.3
A +26.56 - 0.02	M -28.55 -16.16	M(1) +15.80 +30.76
U +47.22 + 9.99	A -37.58 + 5.75	A - 0.05 +19.16
O -14.39 +13.85	U -12.79 -14.17	U(4) - 7.46 +46.69
1948 Oct 27.40370	1948 Oct 31.43535	1948 Nov 6.35556(3)
T 6 1 44.19 +23 38 8.8	T 6 1 27.68 +23 38 36.0	T 6 0 48.58 +23 38 3.5
A +26.57 - 0.02	M -28.13 -15.98	M(1) +15.56 +30.77
U +47.09 +10.08	A -37.76 + 5.46	A - 0.05 +18.96
O -14.36 +13.72	U -12.49 -14.03	U - 7.78 +46.38
1948 Oct 27.40816	1948 Oct 31.44056	1948 Nov 6.36875
T 6 1 44.20 +23 38 8.7	T 6 1 27.65 +23 38 35.6	T 6 0 48.53 +23 38 3.3
M(2) +37.04 + 9.07	M -27.85 -16.33	M(1) +14.71 +31.42
A +26.64 - 0.04	A -37.79 + 5.55	A - 0.04 +18.95
U +47.16 +10.07	U -12.37 -14.15	O + 6.51 +75.39
O -14.49 +13.73	O -15.84 -48.34	1948 Nov 6.37431
1948 Oct 27.46433(3)	1948 Oct 31.44682	1948 Nov 6.37431
T 6 1 43.96 +23 38 7.7	T 6 1 27.62 +23 38 35.6	T 6 0 48.50 +23 38 3.5
A +27.96 + 1.25	M -27.58 -16.28	M(1) +14.56 +31.67
U +46.70 +13.28	A -38.14 + 4.99	A - 0.12 +18.70
O -15.06 +13.75	U -12.39 -14.01	O + 6.29 +75.42
1948 Oct 27.46916(3)	1948 Oct 31.45894	1948 Nov 6.38056
T 6 1 43.92 +23 38 7.6	T 6 1 27.53 +23 38 35.9	T 6 0 48.46 +23 38 3.3
M(2) +36.64 +14.56	M -27.04 -16.42	M(1) +15.02 +31.81
A +28.11 + 1.32	A -38.35 + 4.77	A + 0.05 +18.78
U +46.66 +13.41	U -12.07 -13.96	O + 6.07 +75.47
O -14.99 +13.71	O -15.47 -48.29	
1948 Oct 27.47368(3)		
T 6 1 43.90 +23 38 7.5		
M +36.67 +14.96		
A +28.24 + 1.43		
U +46.56 +13.68		
O -15.10 +13.80		

## OBSERVATIONS AT 82-INCH REFLECTOR, McDONALD OBSERVATORY

1948 Nov 6.38681	1948 Nov 7.36667	1948 Nov 10.34097
T 6 <sup>h</sup> 0 <sup>m</sup> 48 <sup>s</sup> 43 +23 <sup>o</sup> 38' 3.3	T 6 <sup>h</sup> 0 <sup>m</sup> 43 <sup>s</sup> 32 +23 <sup>o</sup> 38' 8.1	T 6 <sup>h</sup> 0 <sup>m</sup> 21 <sup>s</sup> 77 +23 <sup>o</sup> 39' 9.2
M(1) +14.69 +31.91	M -19.51 +19.49	A -15.25 -14.55
A + 0.18 +18.71	A - 4.46 +35.05	U -23.99 -11.56
O + 6.38 +75.44	U -30.82 +15.51	O -55.50 -38.56
1948 Nov 6.40208	1948 Nov 8.39444(3)	1948 Nov 10.34583
T 6 0 48.36 +23 38 3.4	T 6 0 37.12 +23 38 27.8	T 6 0 21.74 +23 39 9.1
M +14.41 +32.73	A -44.50 +11.56	A -15.57 -14.55
A + 0.47 +18.32	U -17.45 - 4.85	U -24.09 -11.41
O + 4.97 +75.54	O -64.57 +37.60	O -55.41 -38.63
1948 Nov 6.40903	1948 Nov 8.39931	1948 Nov 10.35069
T 6 0 48.33 +23 38 3.5	T 6 0 37.08 +23 38 28.0	T 6 0 21.69 +23 39 9.0
M +14.27 +32.92	A -44.53 +11.26	A -15.22 -14.60
A + 0.66 +18.41	U -17.49 - 4.85	U -23.91 -11.45
O + 4.65 +75.40	O -64.55 +37.42	O -55.13 -38.72
1948 Nov 6.41458	1948 Nov 8.40417	1948 Nov 10.37500
T 6 0 48.30 +23 38 3.4	T 6 0 37.06 +23 38 28.0	T 6 0 21.56 +23 39 9.6
M(1) +13.99 +33.20	A -44.67 +10.87	A -15.53 -14.95
A + 0.64 +18.28	U -17.53 - 4.83	U(4) -24.19 -12.02
O + 4.43 +75.46	O -64.84 +37.21	O -54.95 -39.47
1948 Nov 6.42014	1948 Nov 8.40903	1948 Nov 10.37986
T 6 0 48.27 +23 38 3.4	T 6 0 37.02 +23 38 28.2	T 6 0 21.43 +23 39 9.6
A + 0.76 +18.49	A -44.47 +10.64	A -15.88 -14.94
O + 4.18 +75.54	U -17.45 - 4.91	U(4) -23.17 -12.13
1948 Nov 6.44028	1948 Nov 8.41875	1948 Nov 10.38472
T 6 0 48.17 +23 38 3.3	T 6 0 36.95 +23 38 28.4	T 6 0 21.36 +23 39 9.8
M(1) +12.94 +34.46	A -44.63 + 9.98	A -15.68 -15.22
A + 1.04 +18.38	U -17.26 - 4.84	U(4) -24.04 -12.59
U(4) -11.30 +44.76	O -64.98 +36.53	O -54.25 -39.91
O + 3.44 +75.70	1948 Nov 8.42361	1948 Nov 10.38981
1948 Nov 6.44583	T 6 0 36.92 +23 38 28.5	T 6 0 21.32 +23 39 9.8
T 6 0 48.14 +23 38 3.3	A -44.61 + 9.96	A -15.25 -15.14
A + 1.10 +18.28	U -16.93 - 4.93	U(4) -24.26 -12.66
U -11.34 +44.75	O -65.02 +36.53	O -54.19 -40.01
O + 3.08 +75.70	1948 Nov 8.42847	1948 Nov 10.39653
1948 Nov 6.45208	T 6 0 36.88 +23 38 28.6	T 6 0 21.25 +23 39 9.9
T 6 0 48.10 +23 38 3.1	A -44.60 + 9.60	A -15.85 -15.35
A + 1.11 +18.29	U -17.06 - 4.72	U(4) -24.24 -12.79
U -11.74 +44.61	O -65.05 +36.55	O -53.99 -40.27
O + 2.95 +75.74	1948 Nov 10.31667	1948 Nov 10.40139
1948 Nov 6.45764	T 6 0 22.00 +23 39 8.7	T 6 0 21.22 +23 39 9.9
T 6 0 48.08 +23 38 3.1	A -14.85 -14.28	A -16.24 -15.32
A + 1.21 +18.37	U -23.75 -10.75	U(4) -24.48 -12.80
U -12.01 +44.67	O -56.06 -37.93	O -53.93 -40.27
O + 2.62 +75.79	1948 Nov 10.32153	1948 Nov 10.40625
1948 Nov 6.46319	T 6 0 21.96 +23 39 8.9	T 6 0 21.17 +23 39 10.0
T 6 0 48.05 +23 38 3.1	A -14.86 -14.23	A -16.11 -15.43
M +12.41 +35.18	U -23.96 -10.75	U -24.33 -12.85
A + 1.31 +18.15	O -55.90 -37.96	O -53.78 -40.49
U -12.48 +44.38	1948 Nov 10.32639	1948 Nov 10.41111
O + 2.21 +75.81	T 6 0 21.92 +23 39 8.8	T 6 0 21.13 +23 39 10.1
1948 Nov 6.46875	A -15.11 -14.09	A -16.22 -15.50
T 6 0 48.02 +23 38 3.2	U -24.09 -10.89	U -24.30 -13.03
A + 1.17 +18.37	O -55.98 -37.89	O -53.68 -40.57
U -12.15 +44.47	1948 Nov 10.33125	1948 Nov 10.42014
O + 2.27 +75.82	T 6 0 21.87 +23 39 9.0	T 6 0 21.06 +23 39 10.2
1948 Nov 7.35694	A -15.21 -14.42	A -16.21 -15.67
T 6 0 43.39 +23 38 7.8	U -24.04 -11.08	O -53.45 -40.97
M -19.46 +19.72	O -55.76 -38.24	1948 Nov 10.42500
A - 4.13 +34.85	1948 Nov 10.33611	T 6 0 21.01 +23 39 10.2
U -30.80 +15.85	T 6 0 21.82 +23 39 8.9	A -16.57 -15.78
O -34.82 +68.48	A -15.18 -14.41	O -53.37 -41.07
1948 Nov 7.36181	U -24.08 -11.12	1948 Nov 10.43056
T 6 0 43.35 +23 38 7.9	O -55.55 -38.24	T 6 0 20.95 +23 39 10.2
M -19.77 +19.46	1948 Nov 10.43056	A -16.40 -15.94
A - 4.17 +35.00	T 6 0 20.95 +23 39 10.2	O -53.18 -41.18
U -30.80 +15.72	1948 Nov 10.43056	
O -34.93 +68.47	T 6 0 20.95 +23 39 10.2	
	A -16.40 -15.94	
	O -53.18 -41.18	

OBSERVATIONS AT 82-INCH REFLECTOR, McDONALD OBSERVATORY

1948 Nov 10.43623	1949 Feb 27.16126	1950 Apr 15.20581
T 6 <sup>h</sup> 0 <sup>m</sup> 20 <sup>s</sup> 90 +23 <sup>o</sup> 39' 10.4"	T 5 <sup>h</sup> 44 <sup>m</sup> 51 <sup>s</sup> 39 +23 <sup>o</sup> 36' 14.0"	T 9 <sup>h</sup> 17 <sup>m</sup> 59 <sup>s</sup> 62 +16 <sup>o</sup> 28' 55.1"
A -16.56 -16.07	M(5) +15.70 +19.43	M +12.62 + 7.63
O -53.09 -41.27	A + 0.52 +33.79	A +16.42 +30.18
	U - 2.39 +17.68	U + 6.76 +19.76
	O -16.16 - 1.37	O - 6.50 + 7.19
1948 Nov 11.36389	1949 Feb 27.16682	1960 Apr 15.20961
T 6 0 12.38 +23 39 13.2	T 5 44 51.39 +23 36 13.9	T 9 17 59.62 +16 28 54.9
A + 2.16 -44.00	M(5) +16.01 +19.71	M +12.54 + 7.12
U - 8.09 -41.03	A + 0.23 +33.76	A +16.30 +30.15
O -22.69 -60.14	U - 2.46 +17.81	U + 6.73 +19.82
	O -16.19 - 1.33	O - 6.56 + 7.20
1948 Nov 11.36773	1949 Feb 27.17203	1960 Apr 15.25777
T 6 0 12.33 +23 39 13.2	T 5 44 51.39 +23 36 13.9	T 9 17 59.54 +16 28 54.2
A + 2.44 -44.14	M(5) +16.01 +19.71	M +13.23 + 6.24
U - 7.82 -40.94	A + 0.01 +33.64	A +15.25 +30.91
O -22.45 -59.99	U - 2.58 +17.54	U + 6.28 +19.47
	O -16.30 - 1.47	O - 6.85 + 7.81
1949 Feb 24.07847	1954 Jan 29.28264	1960 Apr 16.09625
T 5 44 56.70 +23 37 13.4	T 7 27 59.12 +22 24 42.5	T 9 17 58.42 +16 28 46.4
A +17.29 -15.13	A -36.23 -12.75	M + 9.80 +39.13
U(1) +26.30 -44.45	U -21.92 + 3.67	A + 4.08 +19.52
O -19.73 - 2.49	O + 7.62 + 6.82	U + 4.19 +11.57
		O -10.88 + 4.74
1949 Feb 24.08405	1954 Jan 29.28472	1960 Apr 16.09972
T 5 44 56.61 +23 37 13.4	T 7 27 59.09 +22 24 42.5	T 9 17 58.42 +16 28 46.3
A +17.26 -15.11	A -36.08 -12.77	M + 9.70 +39.28
U +26.61 -44.41	U -21.69 + 3.65	A + 3.92 +19.36
O -19.73 - 2.73	O + 7.65 + 6.80	U + 3.98 +11.72
		O -11.07 + 4.75
1949 Feb 24.08924	1954 Jan 29.29167	1960 Apr 16.10627
T 5 44 56.67 +23 37 13.3	T 7 27 59.01 +22 24 42.8	T 9 17 58.41 +16 28 46.3
A +17.15 -14.90	M -22.40 - 7.45	M + 9.62 +39.30
U +26.82 -44.18	A -36.13 -13.22	A + 4.12 +19.30
O -19.60 - 2.53	U -21.90 + 3.62	U + 4.15 +11.98
	O + 7.55 + 6.86	O -10.83 + 4.67
1949 Feb 24.09931	1954 Jan 29.29757	1960 Apr 16.12123
T 5 44 56.62 +23 37 13.1	T 7 27 58.94 +22 24 43.0	T 9 17 58.40 +16 28 46.3
A +16.87 -14.72	M(1) -22.28 - 7.10	M + 9.10 +39.09
U +27.43 -43.86	A -36.01 -13.60	A + 3.96 +19.00
O -18.94 - 2.62	U -21.78 + 3.48	U + 4.11 +11.62
	O + 7.71 + 6.82	O -11.13 + 4.59
1949 Feb 24.16045	1960 Apr 15.14141	1960 Apr 16.13097
T 5 44 56.39 +23 37 12.4	T 9 17 59.76 +16 28 55.9	T 9 17 58.38 +16 28 46.3
M +11.29 -35.12	A +18.01 +28.87	M + 8.84 +39.08
A +16.24 -13.86	U + 7.50 +20.23	A + 4.03 +18.96
U +29.89 -42.00	O - 6.28 + 7.03	U + 4.33 +11.41
O -18.99 - 2.95		O -11.18 + 4.50
1949 Feb 24.16667	1960 Apr 15.14433	1960 Apr 16.13444
T 5 44 56.37 +23 37 12.4	T 9 17 59.76 +16 28 55.9	T 9 17 58.38 +16 28 46.3
M(5) +11.69 -35.89	A +17.74 +29.02	M + 8.57 +38.94
A +16.01 -13.83	U + 7.28 +20.28	A + 4.15 +18.86
U +30.01 -41.78	O - 6.45 + 7.12	U + 4.30 +11.53
O -19.00 - 3.04		O -11.11 + 4.44
1949 Feb 27.10118	1960 Apr 15.14867	1960 Apr 16.17542
T 5 44 51.40 +23 36 14.6	T 9 17 59.75 +16 28 55.9	T 9 17 58.32 +16 28 46.2
A + 2.62 +35.17	A +17.56 +29.20	M + 7.44 +38.48
U - 2.15 +18.74	U + 7.28 +20.27	A + 4.27 +18.52
O -16.13 - 1.13	O - 5.96 + 7.14	U + 4.47 +11.50
		O -11.52 + 4.04
1949 Feb 27.11159	1960 Apr 15.15284	1960 Apr 16.17858
T 5 44 51.40 +23 36 14.6	T 9 17 59.74 +16 28 55.7	T 9 17 58.33 +16 28 46.2
M(5) +14.93 +18.58	A +17.57 +29.19	M + 4.10 +18.41
A + 2.22 +34.76	U + 7.37 +20.20	A + 4.36 +11.56
U - 2.19 +18.42	O - 6.35 + 7.01	O -11.51 + 4.11
O -15.84 - 1.27		
1949 Feb 27.11691	1960 Apr 15.18322	1960 Apr 16.21535
T 5 44 51.40 +23 36 14.5	T 9 17 59.69 +16 28 55.1	T 9 17 58.28 +16 28 46.1
M +14.97 +18.71	M +12.13 + 7.11	A + 4.36 +18.05
A + 2.02 +34.73	A +16.87 +29.68	U + 4.58 +11.63
U - 2.21 +18.56	U + 6.98 +19.98	O -11.70 + 3.72
O -15.94 - 1.22	O - 6.48 + 7.24	
1949 Feb 27.15733	1960 Apr 15.18582	
T 5 44 51.38 +23 36 14.0	T 9 17 59.64 +16 28 55.2	
M(1) +16.10 +19.61	M +12.36 + 7.13	
A + 0.72 +33.91	A +16.90 +29.65	
U - 2.16 +17.82	U + 7.01 +20.08	
O -16.09 - 1.37	O - 6.52 + 7.42	

## OBSERVATIONS AT 82-INCH REFLECTOR, McDONALD OBSERVATORY

1960 Apr 16.21830	1961 Apr 5.16101	1962 Mar 27.30163
T 9 <sup>h</sup> 17 <sup>m</sup> 58 <sup>s</sup> 27 +16 <sup>o</sup> 28' 46.1	T 9 <sup>h</sup> 37 <sup>m</sup> 30 <sup>s</sup> 67 +14 <sup>o</sup> 58' 45.6	T 9 <sup>h</sup> 37 <sup>m</sup> 20 <sup>s</sup> 56 +13 <sup>o</sup> 18' 42.2
A + 4.32 +18.13	M + 5.32 -36.16	M - 6.73 -43.57
U + 4.45 +11.51	A +11.16 -16.96	A - 7.83 -26.64
O -11.63 + 3.84	U +13.25 -12.45	U + 3.34 -25.31
	O +16.86 -53.45	O - 8.20 + 2.17
1960 Apr 16.22333	1961 Apr 5.16448	1962 Mar 27.30422
T 9 17 58.26 +16 28 46.0	T 9 37 30.63 +14 58 45.6	T 9 57 20.52 +13 18 43.2
A + 4.46 +17.87	M + 5.27 -35.17	M - 6.63 -43.40
U + 4.50 +11.62	A +11.14 -16.84	A(4) - 7.88 -26.58
O -11.55 + 3.82	U +13.33 -12.29	U + 3.25 -25.28
	O +16.78 -53.38	O - 8.22 + 2.20
1960 Apr 16.25493	1961 Apr 5.19243	1962 Mar 27.30644
T 9 17 58.24 +16 28 46.3	T 9 37 30.44 +14 58 45.7	T 9 57 20.52 +13 18 43.2
A + 4.36 +17.87	M + 5.54 -35.08	M - 6.64 -43.43
U + 4.52 +11.65	A +10.91 -15.63	A(4) - 8.07 -26.35
O -11.88 + 3.39	U +13.35 -11.30	U + 3.17 -25.68
	O +16.34 -52.45	O - 8.22 + 2.20
1960 Apr 16.25771	1961 Apr 5.19891	1962 Mar 27.32286
T 9 17 58.23 +16 28 46.0	T 9 37 30.44 +14 58 45.8	T 9 57 20.39 +13 18 43.8
A + 4.51 +17.67	M + 5.75 -35.03	M - 5.84 -43.36
U + 4.62 +11.57	A +11.19 -15.47	U + 3.38 -24.64
O -11.87 + 3.70	U +13.40 -11.04	O - 8.15 + 2.01
	O +17.56 -52.35	
1960 Apr 19.09591	1961 Apr 7.22528	1962 Mar 27.32614
T 9 17 55.93 +16 29 35.6	T(9) 37 30.14 +14 58 45.6	T 9 57 20.35 +13 18 43.9
A -15.10 -18.08	M(1) +16.34 +27.79	M - 5.86 -43.35
U -24.22 + 5.90	A +19.73 +12.16	A(4) - 9.48 -27.53
O -11.65 -45.25	U + 6.26 + 3.97	U + 3.52 -24.58
	O +34.99 +32.20	O - 8.13 + 1.95
1960 Apr 19.09939	1961 Apr 7.23002	1962 Mar 27.32830
T 9 17 55.93 +16 29 35.7	T 9 37 30.12 +14 58 45.6	T 9 57 20.34 +13 18 44.0
A -15.04 -18.19	M +16.66 +27.83	M - 5.97 -43.27
U -24.29 + 5.68	A +19.70 +12.37	U + 3.58 -24.44
O -11.62 -45.28	U + 6.42 + 3.80	O - 8.12 + 1.95
	O +35.10 +32.31	
1960 Apr 19.10286	1961 Apr 7.23535	1962 Mar 28.33171
T 9 17 55.92 +16 29 35.8	T 9 37 30.10 +14 58 45.6	T 9 57 12.59 +13 19 9.7
A -15.05 -18.29	M(1) +15.95 +27.79	A + 4.93 -35.48
U -24.49 + 5.38	A +19.82 +12.78	U + 5.32 - 3.68
O -11.56 -45.37	U + 6.47 + 3.80	O - 6.35 - 3.65
	O +35.02 +32.52	
1960 Apr 19.10779	1961 Apr 7.23925	1962 Mar 28.33414(3)
T 9 17 55.92 +16 29 35.8	T 9 37 30.07 +14 58 45.6	T 9 57 12.59 +13 19 9.7
A -14.86 -18.20	M +15.95 +27.76	A + 4.93 -35.41
U -24.45 + 5.27	A +19.93 +12.94	U + 4.94 - 3.65
O -11.50 -45.35	U + 6.55 + 3.83	O - 6.11 - 3.77
	O +35.08 +32.70	
1960 Apr 19.11084	1962 Mar 27.27569	1962 Mar 28.33744(3)
T 9 17 55.90 +16 29 36.0	T 9 57 20.75 +13 18 42.1	T 9 57 12.53 +13 19 9.7
A -14.63 -18.26	M - 7.48 -43.49	A + 5.30 -35.13
U -24.51 + 5.20	A - 8.07 -25.79	U + 5.18 - 3.58
O -11.50 -45.37	U + 3.02 -26.22	O - 6.19 - 3.54
	O - 8.21 + 2.54	
1960 Apr 19.11434	1962 Mar 27.27911	1962 Mar 28.34024(3)
T 9 17 55.90 +16 29 36.1	T 9 57 20.72 +13 18 42.4	T 9 57 12.51 +13 19 10.1
A -14.78 -18.37	M - 7.37 -43.60	A + 5.38 -35.10
U -24.35 + 5.02	A - 8.08 -25.97	U + 5.40 - 3.62
O -11.39 -45.41	U + 2.95 -26.10	O - 6.16 - 3.61
	O - 8.23 + 2.42	
1960 Apr 19.11744	1962 Mar 27.28287	1962 Mar 28.34317(3)
T 9 17 55.84 +16 29 36.2	T 9 57 20.70 +13 18 42.4	T 9 57 12.50 +13 19 10.3
A -14.76 -18.38	M - 7.24 -43.55	A + 5.34 -35.02
U -24.37 + 4.81	A - 8.14 -26.18	U + 5.42 - 3.49
O -11.50 -45.65	U + 2.98 -26.03	O - 6.34 - 3.68
	O - 8.15 + 2.41	
1961 Apr 5.15441	1962 Mar 27.28513	1962 Mar 28.34525(3)
T 9 37 30.70 +14 58 45.5	T 9 57 20.68 +13 18 42.5	T 9 57 12.48 +13 19 10.4
M + 4.47 -36.42	M - 7.06 -43.55	A + 5.19 -35.06
A +11.06 -17.27	A - 8.05 -26.17	U + 5.23 - 3.69
U +13.25 -12.59	U + 3.10 -25.80	O - 6.23 - 3.68
O +16.79 -53.82	O - 8.21 + 2.32	
1961 Apr 5.15763		1962 Mar 29.22078
T 9 37 30.67 +14 58 45.2		T 9 57 5.98 +13 19 22.0
M(1) + 4.27 -35.93		A +15.72 +10.24
A +11.04 -17.04		U + 3.37 - 6.70
U +13.30 -12.51		O - 4.71 - 2.33
O +16.79 -53.61		

MEASURES OF SATELLITES

OBSERVATIONS AT 82-INCH REFLECTOR, McDONALD OBSERVATORY

1962 Mar 29.22436	1962 Apr 17.17229	1962 Apr 26.17774
T 9 <sup>h</sup> 57 <sup>m</sup> 5.96 +13 <sup>o</sup> 19' 22.0"	T 9 <sup>h</sup> 55 <sup>m</sup> 25.64 +13 <sup>o</sup> 27' 3.3"	T 9 <sup>h</sup> 55 <sup>m</sup> 1.84 +13 <sup>o</sup> 28' 46.0"
A +15.67 +10.55	A + 7.37 +14.21	A +11.24 +45.19
U + 3.32 - 6.62	U +19.51 +39.88	U +12.08 +50.94
O - 4.49 - 2.24	O +20.11 + 2.81	O - 8.46 +11.77
1962 Mar 29.22772	1962 Apr 21.15153	1962 Apr 26.18105
T 9 57 5.92 +13 19 22.1	T 9 55 14.72 +13 28 51.2	T 9 55 1.84 +13 28 46.0
A +15.57 +10.57	M -13.22 -14.23	A +11.14 +45.10
U + 3.24 - 6.61	A -11.32 - 8.15	U +11.99 +50.87
O - 4.48 - 2.62	U - 4.73 -14.78	O - 8.48 +11.62
1962 Mar 29.22934	1962 Apr 21.15471	1964 May 28.18108
T 9 57 5.89 +13 19 22.1	T 9 55 14.72 +13 28 51.3	T 10 31 35.08 +10 6 16.1
A(4) +15.57 +10.70	M -13.35 -14.44	U - 2.97 -14.41
U + 3.26 - 6.73	A -11.44 - 8.13	O + 7.16 +16.26
O - 4.52 - 2.33	U - 4.75 -14.71	1964 May 28.18454
1962 Mar 29.23507	1962 Apr 24.16342(3)	T 10 31 35.07 +10 6 16.1
T 9 57 5.87 +13 19 22.1	T 9 55 5.70 +13 29 8.4	U - 2.89 -14.45
A +15.60 +10.78	U + 8.73 -26.82	O + 7.21 +16.41
O - 4.46 - 2.32	O + 0.01 +13.25	1964 May 29.12361
1962 Mar 29.23744	1962 Apr 24.16864(3)	T 10 31 37.47 +10 5 39.7
T 9 57 5.84 +13 19 22.3	T 9 55 5.70 +13 29 8.4	A(5) + 4.14 - 0.22
A +15.43 +10.73	U + 8.71 -26.66	U - 2.08 -22.81
O - 4.51 - 2.24	O - 0.16 +13.22	O + 9.27 +29.03
1962 Mar 29.28535	1962 Apr 24.17384	1964 May 30.12598
T 9 57 5.60 +13 19 22.2	T 9 55 5.68 +13 29 8.3	T 10 31 40.36 +10 4 55.5
A +15.20 +12.68	U + 8.81 -26.47	A + 6.25 - 0.08
O - 4.46 - 2.09	O - 0.21 +13.31	U + 8.14 - 1.19
1962 Mar 29.29358	1962 Apr 24.17940	O + 7.88 +39.15
T 9 57 5.44 +13 19 22.1	T 9 55 5.66 +13 29 8.1	1964 May 30.12818
M(1) +15.22 + 7.07	U + 8.97 -26.20	T 10 31 40.36 +10 4 55.4
A +15.28 +14.84	O - 0.10 +13.27	A + 6.28 - 0.12
U(4) + 3.77 - 5.22	1962 Apr 25.15449	U + 8.16 - 1.16
O - 4.39 - 2.34	T 9 55 3.49 +13 28 53.9	O + 8.01 +39.06
1962 Mar 29.29925	M +16.95 +24.16	1964 May 30.13058
T 9 57 5.39 +13 19 22.2	A +14.91 + 5.11	T 10 31 40.36 +10 4 55.3
M +15.24 + 7.50	U +21.17 +19.00	A + 6.34 - 0.11
A +15.36 +13.05	O -25.77 +16.57	U + 8.08 - 1.03
U(4) + 3.56 - 7.11	1962 Apr 25.15773	O + 7.83 +39.13
O - 4.42 - 2.01	T 9 55 3.47 +13 28 53.9	1964 May 30.13298
1962 Mar 29.30197(3)	M +17.10 +24.35	T 10 31 40.37 +10 4 55.1
T 9 57 5.37 +13 19 22.4	A +15.18 + 5.31	A + 6.42 + 0.08
M(1) +15.50 + 7.50	U +21.21 +19.07	U + 8.21 - 0.89
A +15.19 +13.18	O -25.90 +16.58	O + 7.92 +39.19
U(4) + 3.67 - 7.20	1962 Apr 25.16386	1964 May 30.13611
O - 4.45 - 1.80	T 9 55 3.41 +13 28 53.8	T 10 31 40.38 +10 4 55.0
1962 Mar 29.30411(3)	M +16.58 +24.52	A + 6.60 + 0.17
T 9 57 5.35 +13 19 22.4	A +15.01 + 5.61	U + 8.24 - 0.74
M +15.27 + 7.61	U +20.90 +19.36	O + 7.93 +39.04
A +15.20 +13.16	O -25.80 +16.58	1964 May 30.13819
U(4) + 3.67 - 7.36	1962 Apr 25.16745	T 10 31 40.38 +10 4 55.0
O - 4.44 - 1.77	T 9 55 3.46 +13 28 53.7	A + 6.55 + 0.04
1962 Apr 13.16347	M +16.88 +24.50	U + 8.27 - 0.77
T 9 55 42.84 +13 26 48.3	A +15.24 + 5.75	O + 8.09 +39.04
A - 3.63 -21.90	U +21.29 +19.54	1964 May 30.14051
U - 1.73 -16.49	O -26.08 +16.61	T 10 31 40.40 +10 4 54.7
O -26.96 -59.02	1962 Apr 26.17034	A + 6.49 + 0.37
1962 Apr 17.16014	T 9 55 1.85 +13 28 46.0	U + 8.32 - 0.55
T 9 55 25.62 +13 27 3.3	A +11.42 +45.14	O + 7.94 +39.25
A + 7.41 +14.28	U +12.26 +50.84	1964 May 30.14254
U +19.36 +40.08	O - 8.29 +11.79	T 10 31 40.40 +10 4 54.9
O +20.18 + 3.04	1962 Apr 26.17394	A + 6.52 + 0.20
1962 Apr 17.16604	T 9 55 1.85 +13 28 46.0	U + 8.38 - 0.72
T 9 55 25.66 +13 27 3.2	A +11.50 +45.17	O + 8.09 +39.05
A + 7.30 +14.26	U +12.43 +50.78	1964 June 2.12535
U +19.58 +39.64	O - 8.19 +11.70	T 10 31 51.83 +10 3 41.2
O +19.97 + 2.65		M + 1.57 +25.93
		U - 7.00 + 6.36
		O -14.42 -12.89

## OBSERVATIONS AT 82-INCH REFLECTOR, McDONALD OBSERVATORY

1964 June 2.12760

T	10 <sup>h</sup>	31 <sup>m</sup>	51 <sup>s</sup>	82	+10 <sup>o</sup>	3'	41.5"
M					+ 0.98		+25.87
U					- 7.19		+ 6.41
O					-14.66		-12.82

1964 June 2.12978

T	10	31	51.85	+10	3	41.7
M			+ 0.97	+25.73		
U			- 7.24	+ 6.14		
O			-14.62	-13.03		

1964 June 2.13226

T	10	31	51.84	+10	3	41.8
M			+ 1.07	+25.64		
U			- 7.24	+ 6.17		
O			-14.56	-12.99		

1964 June 2.13463

T	10	31	51.87	+10	3	42.0
M			+ 1.02	+25.56		
U			- 7.27	+ 5.76		
O			-14.60	-13.27		

1964 June 2.13701

T	10	31	51.86	+10	3	41.9
M			+ 1.28	+25.63		
U			- 7.22	+ 5.90		
O			-14.62	-13.15		

1964 June 2.13935

T	10	31	51.89	+10	3	41.8
M			+ 1.04	+25.57		
U			- 7.31	+ 5.60		
O			-14.67	-13.44		

1964 June 2.14208

T	10	31	51.87	+10	3	41.7
M			+ 1.08	+25.48		
U			- 7.34	+ 5.75		
O			-14.57	-13.23		

1964 June 2.14496

T	10	31	51.92	+10	31	41.8
M			+ 0.92	+25.44		
U			- 7.48	+ 5.31		
O			-14.86	-13.59		

1964 June 2.14754

T	10	31	51.91	+10	31	41.8
M			+ 0.82	+25.58		
U			- 7.48	+ 5.35		
O			-14.73	-13.69		

1964 June 2.15046

T	10	31	51.93	+10	31	41.6
M			+ 0.80	+25.41		
U			- 7.51	+ 5.34		
O			-14.78	-13.66		

1964 June 2.15301

T	10	31	51.94	+10	31	41.7
M			+ 0.85	+25.34		
U			- 7.50	+ 5.15		
O			-14.80	-13.74		

*Measures With 61-Inch NASA Reflector*

After the 61-inch reflector of the Lunar and Planetary Laboratory was put into operation on the Catalina Mountains in October 1965, a new series of plates of the Uranus satellites was obtained by the writer. The earth passed through the planes of the satellites' orbits, which were therefore seen edge on, early in 1966. On many nights some of the satellites were occulted by the planet. These plates were measured in the same way as the previous series, but there is a difference in the way the results are given: the coordinates of all the satellites are given in  $\alpha$  and  $\delta$  instead of giving these coordinates only for Titania with the differential coordinates for the other satellites. On many nights Titania was occulted by the planet so it could not be used as reference for the other satellites. Here again, it

should be noted that while the uncertainties in the plate constants of the *Astrographic Catalogues* affect the precision of the equatorial coordinates, they hardly affect the differences between the positions.

In the hope of strengthening the observational data by referring the satellites to the planet, several partial gratings over the incoming light beam were tried in order to obtain two fainter diffraction images of the planet, the mean of which could be substituted for the planet itself in the measures. Unfortunately, it was found that the oval-shaped secondary images of the planet did not lend themselves to measures with a precision comparable to the settings on the sharp small satellite images. Further trials were therefore abandoned.

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## OBSERVATIONS AT 61-INCH REFLECTOR, LUNAR AND PLANETARY LABORATORY

1966 Feb 14.35669

A	11 <sup>h</sup> 18 <sup>m</sup> 15 <sup>s</sup> 00	+5° 22'	16.6
U	14.88	22	7.0
T	15.67	22	47.2
O	14.54	21	51.2

1966 Feb 14.35912

A	11 18 15.05	+5 22	16.7
U	14.89	22	7.2
T	15.68	22	46.9
O	14.57	21	51.4

1966 Feb 14.36207

A	11 18 15.02	+5 22	17.0
U	14.86	22	6.6
T	15.63	22	47.0
O	14.54	21	51.8

1966 Feb 14.38290

A	11 18 14.82	+5 22	18.9
U	14.65	22	8.6
T	15.42	22	48.2
O	14.36	21	53.2

1966 Feb 14.38464

A	11 18 14.80	+5 22	19.1
U	14.62	22	8.6
T	15.40	22	48.3
O	14.30	21	53.0

1966 Feb 14.38626

A	11 15 14.84	+5 22	18.6
U	14.64	22	8.3
T	15.43	22	47.9
O	14.34	21	52.9

1966 Feb 17.24722

T	11 17 49.31	+5 24	38.6
O	50.15	25	27.9

1966 Feb 17.24896

T	11 17 49.31	+5 24	38.8
O	50.19	25	29.6

1966 Feb 17.25104

T	11 17 49.33	+5 24	38.6
O	50.19	25	29.7

1966 Feb 17.25382

T	11 17 49.33	+5 24	38.9
O	50.18	25	30.3

1966 Feb 17.25556

T	11 17 49.29	+5 24	38.8
O	50.16	25	30.6

1966 Feb 17.25764

T	11 17 49.27	+5 24	38.6
U	50.13	25	30.0

1966 Feb 19.33681

A	11 17 30.88	+5 27	3.5
U	31.93	27	59.3

1966 Feb 19.34132

A	11 17 30.84	+5 27	1.6
U	31.88	27	57.6

1966 Feb 19.34306

A	11 17 30.85	+5 27	1.7
U	31.86	27	57.3

1966 Feb 19.34514

A	11 17 30.83	+5 27	1.6
U	31.83	27	57.3

1966 Mar 29.26007

A	11 <sup>h</sup> 11 <sup>m</sup> 32 <sup>s</sup> 42	+6° 4'	46.0
U	32.79	5	6.8
T	33.13	5	24.5
O	32.79	5	5.0

1966 Mar 29.26250

A	11 11 32.40	+6 4	46.1
U	32.76	5	7.3
T	33.09	5	24.7
O	32.76	5	4.9

1966 Apr 12.20694

T	11 9 38.62	+6 16	15.4
O	39.24	16	48.1

1966 Apr 12.20937

T	11 9 38.60	+6 16	15.7
O	39.27	16	48.2

1966 Apr 12.21215

T	11 9 38.60	+6 16	15.8
O	39.20	16	48.3

1966 Apr 13.21736

A	11 9 30.95	+6 17	21.6
(3) U	30.83	17	15.2
(5) T	31.38	17	43.5
O	31.86	18	9.9

1966 Apr 13.22326

A	11 9 30.88	+6 17	21.9
(3) U	30.82	17	15.0
(5) T	31.30	17	43.9
O	31.78	18	10.3

1966 Apr 13.22639

A	11 9 30.87	+6 17	22.1
(3) U	30.82	17	14.7
(5) T	31.29	17	44.1
O	31.75	18	10.6

1966 Apr 13.22986

A	11 9 30.86	+6 17	22.5
(3) U	30.71	17	13.3
T	31.29	17	44.5
O	31.73	18	10.6

1966 Apr 13.23264

A	11 9 30.82	+6 17	22.5
(3) U	30.70	17	13.3
T	31.26	17	44.5
O	31.75	18	10.6

1966 Apr 13.23542

A	11 9 30.83	+6 17	22.7
(3) U	30.67	17	13.2
T	31.23	17	44.7
O	31.73	18	10.8

1966 Apr 14.17569

A	11 9 24.90	+6 18	10.5
(4) U	24.54	17	48.7
T	25.15	18	23.7
O	25.43	18	40.2

1966 Apr 14.17887

A	11 9 24.90	+6 18	10.7
(4) U	24.53	17	48.6
T	25.14	18	23.9
O	25.43	18	40.3

1966 Apr 14.18194

A	11 9 24.87	+6 18	10.7
(4) U	24.50	17	48.9
T	25.11	18	24.0
O	25.49	18	40.2

1966 Apr 14.18472

A	11 <sup>h</sup> 9 <sup>m</sup> 24 <sup>s</sup> 84	+6° 18'	10 <sup>m</sup> .2
T	25.10	18	23.5
O	25.39	18	39.8

1966 Apr 14.19028

A	11 9 24.80	+6 18	10.6
T	25.05	18	23.8
O	25.34	18	40.0

1966 Apr 14.19340

A	11 9 24.80	+6 18	10.6
T	25.03	18	23.9
O	25.32	18	40.0

1966 Apr 23.15937

A	11 8 26.71	+6 23	23.0
U	27.19	23	50.1
T	27.50	24	7.7
O	26.47	23	8.3

1966 Apr 23.16285

A	11 8 26.67	+6 23	23.2
U	27.18	23	50.2
T	27.49	24	7.8
O	26.46	23	8.1

1966 Apr 23.16840

A	11 8 26.63	+6 23	23.5
U	27.15	23	50.9
T	27.46	24	8.1
O	26.41	23	8.8

1966 Apr 23.17066

A	11 8 26.63	+6 23	23.3
U	27.15	23	50.4
T	27.45	24	8.2
O	26.42	23	8.7

1966 Apr 23.17257

A	11 8 26.65	+6 23	23.3
U	27.15	23	50.6
T	27.45	24	8.4
O	26.42	23	8.5

1966 Apr 25.16788

U	11 8 15.61	+6 24	32.4
T	16.07	25	59.8
O	16.08	24	52.5

1966 Apr 25.17222

U	11 8 15.60	+6 24	32.3
T	16.03	25	59.9
O	16.04	24	52.8

1966 Apr 25.17431

U	11 8 15.57	+6 24	32.3
T	16.03	25	59.7
O	16.04	24	52.7

1966 Apr 25.17691

U	11 8 15.54	+6 24	33.1
T	16.01	25	0.7
O	16.00	24	53.9

1966 Apr 25.17812

U	11 8 15.55	+6 24	33.1
T	16.03	25	0.8
O	16.02	24	53.7

1966 Apr 25.18056

U	11 8 15.57	+6 24	33.3
T	16.03	25	1.0
O	16.03	24	53.9

1966 May 9.22155

T	11 7 17.48	+6 30	28.1
O	17.67	30	37.2

OBSERVATIONS AT 61-INCH REFLECTOR, LUNAR AND PLANETARY LABORATORY

1966 May 9.22346	1966 May 11.21376	1966 May 12.14929
T 11 <sup>h</sup> 7 <sup>m</sup> 17.47 +6° 30' 28.1	T 11 7 12.47 +6 31 17.6	A 11 7 9.90 +6 31 13.0
O 17.68 30 37.3	O 12.68 31 28.1	U 9.32 30 41.1
1966 May 9.22485	1966 May 11.21610	T 10.06 31 23.9
T 11 7 17.49 +6 30 28.3	T 11 7 12.47 +6 31 17.7	O 10.39 31 41.5
O 17.68 30 37.4	O 12.68 31 28.3	1966 May 13.13733
1966 May 9.23735	1966 May 11.22088	A 11 7 7.20 +6 30 55.5
T 11 7 17.45 +6 30 28.3	T 11 7 12.43 +6 31 17.8	U 7.35 31 0.5
O 17.67 30 37.5	O 12.63 31 28.3	O 8.07 31 1.4
1966 May 9.23856	1966 May 11.22366	1966 May 13.13958
T 11 7 17.45 +6 30 28.5	T 11 7 12.42 +6 31 17.6	A 11 7 7.21 +6 30 55.6
O 17.64 30 37.4	O 12.62 31 28.0	U 7.35 31 0.3
1966 May 9.23961	1966 May 11.23199	O 8.08 31 1.2
T 11 7 17.44 +6 30 28.7	T 11 7 12.42 +6 31 17.9	1966 May 13.14167
O 17.64 30 37.3	O 12.63 31 28.4	A 11 7 7.22 +6 30 55.8
1966 May 10.14390	1966 May 12.13993	U 7.34 31 0.2
U 11 7 15.05 +6 30 49.5	A 11 7 9.93 +6 31 12.6	O 8.08 31 1.0
T 15.17 30 55.1	U 9.35 30 41.0	1966 May 13.14392
O 15.36 31 5.2	T 10.09 31 23.6	A 11 7 7.22 +6 30 55.5
1966 May 10.14581	O 10.43 31 41.0	U 7.34 31 0.4
U 11 7 15.05 +6 30 49.5	1966 May 12.14371	O 8.06 31 1.2
T 15.18 30 55.0	A 11 <sup>h</sup> 7 <sup>m</sup> 9.594 +6° 31' 12.7	1966 May 13.14583
O 15.36 31 5.2	U 9.35 30 41.1	A 11 7 7.20 +6 30 55.5
1966 May 10.17745	T 10.10 31 23.7	U 7.34 31 0.5
U 11 7 14.98 +6 30 50.4	O 10.45 31 41.1	O 8.06 31 1.2
T 15.08 30 56.0	1966 May 12.14429	1966 May 13.14809
O 15.29 31 5.8	A 11 7 9.95 +6 31 12.7	A 11 7 7.20 +6 30 55.4
1966 May 10.17845	U 9.36 30 41.0	U 7.36 31 0.5
U 11 7 14.97 +6 30 50.4	T 10.11 31 23.6	O 8.05 31 1.1
T 15.08 30 55.9	O 10.44 31 41.2	1966 May 24.14483
O 15.28 31 6.1	1966 May 12.14618	U 11 6 55.49 +6 31 42.1
1966 May 10.18001	A 11 7 9.91 +6 31 12.8	T 55.15 31 19.8
U 11 7 14.96 +6 30 50.4	U 9.33 30 41.2	O 56.43 32 31.4
T 15.06 30 56.0	T 10.07 31 23.9	1966 May 24.14760
O 15.25 31 6.2	O 10.41 31 41.3	U 11 6 55.51 +6 31 42.2
1966 May 11.21012	1966 May 12.14740	T 55.14 31 19.8
T 11 7 12.48 +6 31 17.6	A 11 7 9.90 +6 31 12.8	O 56.44 32 31.5
O 12.69 31 28.0	U 9.32 30 41.1	1966 May 24.15021
	T 10.06 31 24.0	U 11 6 55.50 +6 31 42.4
	O 10.41 31 41.3	T 55.15 31 19.9
		O 56.43 32 31.5

MEASURES OF MARS' SATELLITES BY G. VAN BIESBROECK ON PLATES TAKEN IN 1956 AT THE CASSEGRAIN FOCUS OF THE 82-INCH MCDONALD REFLECTOR, BY G. P. KUIPER

U.T.	Phobos (1900.0)		(Deimos - Phobos) (1900)	
	$\alpha$	$\delta$	x	y
1956 Sept 5.27028	23 <sup>h</sup> 28 <sup>m</sup> 55.55	-10° 1' 31.1"	-6.50	-27.63
5.27751	28 55.13	1 31.2	-5.30	-28.88
5.28735	28 54.51	1 31.6	-2.84	-29.54
6.22230	27 55.91	6 9.1	-102.31	-42.49
6.22549	27 55.75	6 9.1	-102.94	-43.42
6.23307	27 55.33	6 9.1	-103.69	-46.78
6.23741	27 55.06	6 9.0	-103.48	-48.10
6.24175	27 54.80	6 9.2	-103.39	-49.63
6.26501	27 53.05	6 10.9	-98.14	-56.60
6.26796	27 52.80	6 11.3	-96.58	-57.08
6.27317	27 52.31	6 12.3	-94.00	-58.07
6.28376	27 51.32	6 14.9	-87.88	-59.40
6.28584	27 51.11	6 15.0	-86.65	-59.61
6.28723	27 50.91	6 15.6	-85.44	-59.74
6.29748	27 49.92	6 18.2	-78.45	-60.13
10.18817	23 35.80	24 12.2	-6.83	-43.42
10.21282	23 33.36	24 25.7	+11.72	-33.28
10.21620	23 33.08	24 27.4	+13.81	-31.99
10.23765	23 31.36	24 38.8	+24.18	-23.70
10.24025	23 31.20	24 40.0	+25.08	-22.86
12.34429	21 14.50	32 41.8	-88.20	-21.37
12.34670	23 21 16.28	-10 32 41.3	-87.87	-21.94