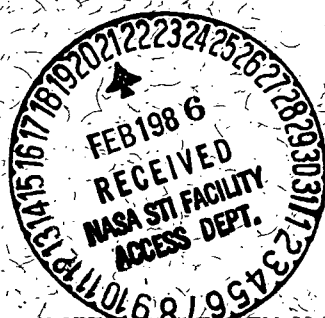


JPL PUBLICATION 85-79

Observations of Uranus' Satellites Bibliography and Literature Search

Robert A. Jacobson



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Space Administration

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Abstract

A literature search has yielded more than 10,000 observations of the satellites of Uranus made from 1787 to 1985. The type (photographic, micrometer) and the number of observations are tabulated in 5 year increments and a complete bibliography is provided.

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Introduction

A search of the astronomical literature was conducted to gather observations of the five satellites of Uranus. A subset of the collected observations was used in the development of the satellite ephemerides for the Voyager Uranus encounter.

Observations

Tables 1 and 2 summarize the type and number of observations located by the search for each five year period since the satellites' discovery. A total of 10032 observations were found consisting of

5043 photographic (1910-1985)
4989 micrometer (1787-1949)
10032

The photographic observations include both right ascension - declination and position relative to the planet or another satellite. A satellite relative observation was counted as an observation of only one satellite.

Literature Search

The initial literature search was conducted by the JPL library at the request of R. Doyle in 1980. Subsequent searches were made in 1981 for G. Null and in 1982 for R. Jacobson. Table 3 provides a list of the journals and observatory reports which were searched.

References for Observations

The references for the photographic observations appear in Table 4 and for the micrometer observations in Table 5. Each table is ordered alphabetically by author; with each reference is given the identification number of the observed satellites, the observation years, and the total number of observations. The identification numbers of the satellites are: 701 for Ariel, 702 for Umbriel, 703 for Titania, 704 for Oberon, and 705 for Miranda. The listed references include not only those found in the literature searches, but also private communications and JPL contractor reports. The observations reported by Dunham (1971), Veillet (1980-1983), Bergstrand (1904, 1909), Herschel (1815), and Struve (1928) also appear in other references and were not counted in the Table 1 and Table 2 summaries. Most of the observations used by Harris (1949) also appear elsewhere; a small number however do not, and these were counted in Table 1.

Storage of Observations

Copies of all of the cited references have been obtained by the author and will be retained by him. The observations used in

the Voyager ephemeris development have been formatted in the standard JPL computer format (Ref. 1) and placed on magnetic tape.

Request for Additional Observations

The list of references provided by Tables 4 and 5 should not be considered exhaustive. The author would appreciate being informed of any published or unpublished observations which have not been included.

Reference

1. Jacobson, R.A., "User's Guide for the Satellite Observations and Partial Generation Program," IOM 314.10-550, 8 March 1985, JPL internal document.

Table 1. Photographic Observations of the Uranian Satellites

Dates	Ariel	Umbriel	Titania	Oberon	Miranda
1910-14	5	5	16	13	0
1915-19	9	14	29	0	0
1920-24	0	0	0	0	0
1925-29	7	13	22	22	0
1930-34	0	0	0	0	0
1935-39	0	0	0	0	0
1940-44	0	0	0	0	0
1945-49	132	119	263	131	135
1950-54	4	4	4	4	3
1955-59	0	0	0	0	2
1960-64	80	110	113	100	90
1965-69	66	78	147	157	0
1970-74	53	66	105	104	29
1975-79	185	177	187	69	143
1980-84	468	465	477	59	452
1985-89	26	26	26	25	4

Table 2. Micrometer Observations of the Uranian Satellites

Dates	Ariel	Umbriel	Titania	Oberon
1787-1834	0	0	49	59
1835-39	0	0	11	15
1840-44	0	0	0	0
1845-49	16	24	37	56
1850-54	59	53	79	79
1855-59	9	7	17	20
1860-64	19	24	64	66
1865-69	2	2	13	18
1870-74	21	33	138	133
1875-79	60	50	202	200
1880-84	19	14	47	51
1885-89	15	10	0	0
1890-94	28	19	78	66
1895-99	117	95	170	174
1900-04	94	82	383	381
1905-09	57	58	298	229
1910-14	55	52	170	153
1915-19	12	8	66	76
1920-24	0	0	78	79
1925-29	0	0	38	44
1930-34	0	0	0	0
1935-39	0	0	0	0
1940-44	0	0	0	0
1945-49	31	3	2	2

Table 3. Journals and Reports Searched for
Uranian Satellite Observations

Title

Annals of the Strasbourg Observatory
Astronomische Nachrichten
Astronomy and Astrophysics
Astronomy and Astrophysics Supplement
Bulletin Astronomique
Journal des Observateurs
Journal of the British Astronomical Society
Lick Observatory Bulletin
Lunar and Planetary Laboratory Communications
Memoirs of the Royal Astronomical Society
Monthly Notices of the Royal Astronomical Society
Publications of the Tashkent Observatory
The Astronomical Journal
The Washington Observations (1875-1879)
Tokyo Astronomical Bulletin

Table 4. Photographic Uranian Satellite Observations

Reference	Sat	Dates	Num
Dunham, D.D., (1971) Ph.D. Thesis - Yale University	701	1905-66	327
	702	1905-66	360
	703	1905-66	439
	704	1905-66	347
	705	1948-66	120
Harris, D.L., (1949) The Satellite System of Uranus (U. of Chicago)	701	1905-48	53
	702	1905-48	58
	703	1905-48	87
	705	1948	17
Harrington, R.S., (1984) Astronomical Journal 89, 889-898	701	1979-83	88
	702	1979-83	85
	703	1979-83	88
	704	1979-83	88
	705	1979-83	30
	700	1978-83	14
Harrington, R.S., (1985) U.S. Naval Observatory, Private Communication	701	1985	26
	702	1985	26
	703	1985	26
	704	1985	25
	705	1985	4
Ianna, P.A., (1984) Leander McCormick Observatory, Private Communication	701	1983	41
	702	1983	43
	703	1983	51
	704	1983	52
	700	1983	12
Mulholland, J.D., (1985) U. of Texas, JPL Contract #956787, Final Report	701	1974-82	74
	702	1974-82	71
	703	1974-82	73
	704	1974-82	74
	705	1974-82	42
	700	1974-76	25
Nicholson, S., (1915) Lick Observatory Bulletin 269, 143	701	1914	5
	702	1914	5
	703	1914	5
	704	1914	5
Pascu, D., (1985) U.S. Naval Observatory, Private Communication	705	1981-83	40

Table 4. Photographic Uranian Satellite Observations (continued)

	Reference	Sat	Dates	Num
Rosanof, A., 224, 409	(1925) <i>Astronomische Nachrichten</i>	703	1913-14	8
		704	1913-14	8
Soulie, G., 51, 315-328	(1968) <i>Journal des Observateurs</i>	703	1966-67	14
		704	1966-67	10
		700	1966-67	48
Soulie, G., Supplement 6, 311-326	(1972) <i>Astronomy and Astrophysics</i>	702	1968	3
		703	1968-69	35
		704	1968-69	34
		700	1968-69	50
Soulie, G., Supplement 22, 49-61	(1975) <i>Astronomy and Astrophysics</i>	703	1970-71	18
		704	1970-71	13
		700	1970-71	24
Soulie, G., Supplement 33, 257-264	(1978) <i>Astronomy and Astrophysics</i>	702	1972-74	10
		703	1972-74	33
		704	1972-74	35
		700	1972-74	56
Sytinskaia, N.N., 54	(1930) <i>Pub. Tashkent Obs.</i> 3,	701	1926	7
		702	1926	13
		703	1926	22
		704	1926	22
Tomita, K., and Soma, M. Astronomical Bulletin, 2nd Series, 261, 2977-2981	(1979) Tokyo	701	1964-77	34
		702	1964-77	37
		703	1964-77	39
		704	1964-77	46
van Biesbroeck, G., Lab. Comm. 145, 179	(1970) <i>Lunar and Planetary</i>	701	1948-66	250
		702	1948-66	272
		703	1948-66	308
		704	1948-66	297
		705	1948-66	103
van Biesbroeck, G., Journal 81, 122	(1976) <i>Astronomical</i>	701	1966	17
		702	1966	17
		703	1966	22
		704	1966	28
Veillet, C., 89, 342-344	(1980) <i>Astronomy and Astrophysics</i>	705	1977-79	58

Table 4. Photographic Uranian Satellite Observations (continued)

	Reference	Sat	Dates	Num
Veillet, C., 118, 211-216	(1983) Astronomy and Astrophysics	705	1980-81	112
Veillet, C., Universite de Paris	(1983) These de Doctorat d'Etat -	701	1977-82	347
		702	1977-82	344
		703	1977-82	347
		705	1977-82	233
Veillet, C., Communication	(1985) CERGA, Private	701	1977-84	456
		702	1977-84	453
		703	1977-84	456
		705	1977-84	314
Walker, R.L., 838-844	(1978) Astronomical Journal 83,	701	1975-77	27
		702	1975-77	27
		703	1975-77	27
		704	1975-77	27
		705	1975-77	25
		700	1974-77	22
Whitaker, E., Comm. 194, 70-80	(1973) Lunar and Planetary Lab.	705	1948-73	133

Table 5. Micrometer Uranian Satellite Observations

	Reference	Sat	Dates	Num
Aitken, R.G., 76	(1898) Astronomical Journal 19,	701	1898	15
		702	1898	13
		703	1898	18
		704	1898	18
Aitken, R.G., 151, 105	(1899) Astronomische Nachrichten	701	1899	26
		702	1899	26
		703	1899	26
		704	1899	26
Aitken, R.G., 7, 36	(1901) Lick Observatory Bulletin	701	1900-01	24
		702	1900-01	26
		703	1900-01	40
		704	1900-01	34
Aitken, R.G., 51, 160	(1904) Lick Observatory Bulletin	701	1903	24
		702	1903	22
		703	1903	38
		704	1903	38
Aitken, R.G., 94, 31	(1905) Lick Observatory Bulletin	701	1904-05	22
		702	1904-05	20
		703	1904-05	26
		704	1904-05	26
Aitken, R.G., 172, 169	(1909) Lick Observatory Bulletin	701	1906-07	18
		702	1906-07	18
		703	1906-07	22
		704	1906-07	16
Aitken, R.G., 207, 1	(1912) Lick Observatory Bulletin	701	1910-11	24
		702	1910-11	20
		703	1910-11	20
		704	1910-11	14
Aitken, R.G., 269, 142	(1914) Lick Observatory Bulletin	701	1914	16
		702	1914	12
		703	1914	14
		704	1914	8
Barnard, E.E., 10, 73	(1896) Astronomical Journal 16,	701	1894-95	67
		702	1894-95	42
		703	1894-95	142
		704	1894-95	119

Table 5. Micrometer Uranian Satellite Observations (continued)

	Reference	Sat	Dates	Num
Barnard, E.E., 47	(1909) <i>Astronomical Journal</i> 26,	701	1907-09	25
		702	1907-09	24
		703	1907-09	119
		704	1907-09	107
Barnard, E.E., 105	(1912) <i>Astronomical Journal</i> 27,	701	1910	11
		702	1910-11	12
		703	1910-11	76
		704	1910-11	75
Barnard, E.E., 39	(1915) <i>Astronomical Journal</i> 29,	701	1913	2
		702	1913	2
		703	1913	12
		704	1913	12
Barnard, E.E., 20	(1916) <i>Astronomical Journal</i> 30,	701	1915	2
		702	1915	2
		703	1915	18
		704	1915	16
Barnard, E.E., 105-107	(1919) <i>Astronomical Journal</i> 32,	701	1916	6
		702	1916	2
		703	1916-18	40
		704	1916-18	44
Barnard, E.E., 125	(1927) <i>Astronomical Journal</i> 37,	701	1919	4
		702	1919	4
		703	1919-22	50
		704	1919-22	59
Bergstrand, O., Scient. Ups. Series III, 20	(1904) <i>Nove Acta Reg. Soc.</i>	701	1852-99	240
		701	1900-01	60
Bergstrand, O., Astronomi och Fysik 6, 6	(1909) <i>Arkiv for Matematik,</i>	702	1894-99	109
		702	1900-01	26
Davis, C.H., Astron. Soc. 35, 51-55	(1875) <i>Monthly Notices Roy.</i>	701	1874	9
		702	1874	16
		703	1874	53
		704	1874	50
Dinwiddie, W.W., 24, 26	(1903) <i>Astronomical Journal</i>	703	1903	20
		704	1903	6

Table 5. Micrometer Uranian Satellite Observations (continued)

	Reference	Sat	Dates	Num
Eppes, J.B., 188	(1912) Astronomical Journal 27,	701	1911	2
		702	1911	6
		703	1911	34
		704	1911	32
Frederick, C.W., Nachrichten 168, 281	(1908) Astronomische	703	1904	40
		704	1904	30
Frederickson, M., 26, 17	(1909) Astronomical Journal	703	1907	46
		704	1907	46
Hall, A., 131	(1876) Astronomische Nachrichten 88,	701	1876	21
		702	1876	14
		703	1876	43
		704	1876	37
Hall, A., 161	(1877) Astronomische Nachrichten 90,	701	1876	1
		702	1876	2
		703	1876	8
		704	1876	10
Hall, A., 65	(1878) Astronomische Nachrichten 93,	702	1878	4
		703	1878	4
		704	1878	6
Hall, A., (1911) Astronomical Journal 27, 17		703	1908-10	95
		704	1909-10	46
Hall, A., Jr., 5	(1921) Astronomical Journal 34,	703	1920	26
		704	1920	24
Hall, A., Jr., 116	(1923) Astronomical Journal 35,	703	1922	10
		704	1922	12
Henry, P., (1884) Bulletin Astronomique 1, 89		703	1884	2
		704	1884	8
Henry, P., 178-179	(1884) Bulletin Astronomique 1,	701	1884	3
		702	1884	6
		703	1884	12
		704	1884	14
Henry, P., 329-330	(1884) Bulletin Astronomique 1,	701	1884	10
		702	1884	6
		703	1884	15
		704	1884	14

Table 5. Micrometer Uranian Satellite Observations (continued)

	Reference	Sat	Dates	Num
Herschel, W., 293	(1815) Phil. Trans. for 1815,	703	1787-99	32
		704	1787-99	32
Herschel, J.F.W., Soc. 8, 1	(1833) Mem. Roy. Astron.	703	1787-98	32
		703	1828-32	17
		704	1787-98	32
		704	1828-32	27
Holden, E.S., for 1875, 361-363	(1875) Washington Observations	701	1875	8
		702	1875	7
		703	1875	66
		704	1875	66
Holden, E.S., for 1876	(1876) Washington Observations	701	1876	20
		702	1876	13
		703	1876	43
		704	1876	37
Holden, E.S., for 1877, 230-231	(1877) Washington Observations	701	1877	1
		702	1877	2
		703	1877	8
		704	1877	10
Holden, E.S., for 1878, 91	(1878) Washington Observations	701	1878	1
		702	1878	4
		703	1878	6
		704	1878	10
Holden, E.S., for 1879	(1879) Washington Observations	701	1879	2
		703	1879	10
		704	1879	12
Hough, G.W., 98, 25	(1880) Astronomische Nachrichten	701	1880	6
		702	1880	2
		703	1880	18
		704	1880	15
Hussey, W.J., 17, 149	(1902) Lick Observatory Bulletin	701	1897-98	13
		702	1897-98	12
		703	1897-98	15
		704	1896-98	20
Lamont, F., 51	(1837) Mem. Roy. Astron. Soc. 11,	703	1837	11
		704	1837	15

Table 5. Micrometer Uranian Satellite Observations (continued)

Reference	Sat	Dates	Num
Lassel, W., (1847) Monthly Notices Roy. Astron. Soc. 8, 43	701	1848	6
	702	1848	2
	703	1848	19
	704	1848	22
Lassel, W., (1848) Monthly Notices Roy. Astron. Soc. 9, 105	702	1848	11
	704	1848	11
Lassel, W., (1849) Monthly Notices Roy. Astron. Soc. 10, 7, 135	701	1849	6
	702	1849	8
	704	1849	2
Lassel, W., (1851) Monthly Notices Roy. Astron. Soc. 12, 15, 152	701	1851	9
	702	1851	9
	703	1851	7
	704	1851	8
Lassel, W., (1852) Astronomische Nachrichten 34, 327	701	1847-51	19
	702	1847-51	15
	703	1847-51	39
	704	1847-51	42
Lassel, W., (1853) Monthly Notices Roy. Astron. Soc. 13, 148	701	1852-53	35
	702	1852-53	32
	703	1852-53	51
	704	1852-53	50
Lassel, W., (1857) Monthly Notices Roy. Astron. Soc. 17, 175	701	1856	9
	702	1856	7
	703	1856	17
	704	1856-57	20
Lassel, W., (1865) Mem. Roy. Astron. Soc. 36, 1	701	1863-65	15
	702	1863-65	17
	703	1863-65	53
	704	1863-65	58
Marth, A., (1864) Monthly Notices Roy. Astron. Soc. 24, 209	701	1863-64	6
	702	1863-64	9
	702	1863-64	24
	704	1863-64	26
Newcomb, S., (1875) Washington Observations for 1873, App. 1, 7	701	1874-75	15
	702	1874-75	18
	703	1874-75	64
	704	1874-75	60

Table 5. Micrometer Uranian Satellite Observations (continued)

Reference	Sat	Dates	Num
Perrotin, M., (1887) Bull. Astron. 4, 340	701	1887	15
	702	1887	10
Rosse, E., (1875) Monthly Notices Roy. Astron. Soc. 35, 300	701	1872-73	3
	702	1872-73	3
	703	1872-74	35
	704	1872-74	35
Schaeberle, J.M., (1895) Astronomical Journal 15, 25-26	703	1894	24
	704	1894	24
Schaeberle, J.M., (1897) Astronomical Journal 18, 5-6	701	1897	24
	702	1897	21
	703	1896-97	46
	704	1895-97	45
See, T.J.J., (1900) Astronomische Nachrichten 154, 89-92	703	1900	70
	704	1900	68
See, T.J.J., (1902) Astronomische Nachrichten 159, 214-226	701	1901	38
	702	1901	30
	703	1901	80
	704	1901	156
See, T.J.J., (1907) Astronomische Nachrichten 176, 293	703	1902	87
	704	1902	41
Steavenson, W.H., (1948) Monthly Notices Roy. Astron. Soc. 108, 183-188	701	1947-48	23
	702	1947-48	3
	703	1947-48	2
	704	1947-48	2
Steavenson, W.H., (1964) Journal of the British Astronomical Society 74, 54-59	701	1949	8
Struve, H., (1912) Abh. der Konigl. Preuss. Akademie der Wissenschaft. I, 1-109	703	1894-99	172
	703	1894-99	611
	704	1900-11	162
	704	1900-11	728
Struve, G., (1928) Astronomische Nachrichten 233, 17	703	1927-28	38
	704	1927-28	44
Wirtz, C., (1910) Ann. Obs. Stasbourg 4, 291	703	1905	12
	704	1905	8

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