Appendix 2

Planetary Parameters

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Table A2.1. Jupiter's orbital parameters.

a (AU)	Period (Years)	e	i (degrees)	ϖ (degrees)	Ω (degrees)	λ (degrees)
5.203 363 01	11.862 615	0.048 392 66	1.305 30	14.753 85	100.556 15	34.404 38

Notes

These orbital data is given for Jupiter in epoch J2000 (JD2451545.0). The orbital elements in are

a	Orbital semi-major axis
Period	Sidereal orbital period
e	Orbital eccentricity
i	Orbital inclination (with respect to the ecliptic)
ϖ	Longitude of perihelion
Ω	Longitude of the ascending node
λ	Mean longitude

The last three quantities are taken with respect to the vernal equinox of J2000.

Data are from Seidelmann and Kenneth (1992) and can be found on JPL's Solar System Dynamics website (http://ssd.jpl.nasa.gov) maintained by Robert Jacobson.

Table A2.2. Rates of change in Jupiter's orbital parameters.

$\dot{a}$ (AU/century)	$\dot{e}$ (century^{-1})	$\dot{i}$ (arcsec/century)	$\dot{\varpi}$ (arcsec/century)	$\dot{\Omega}$ (arcsec/century)	$\dot{\lambda}$ (arcsec/century)
0.000 607 37	−0.000 128 80	−4.15	839.93	1217.17	10 925 078.35

Notes

Quantities are the same as in Table A2.1. Data are from Seidelmann and Kenneth (1992) and can be found on JPL's Solar System Dynamics website (http://ssd.jpl.nasa.gov) maintained by Robert Jacobson.

Table A2.3. Bulk physical data on Jupiter.

Mean Radius (km)	Mass (kg)	Density g cm^{-3}	Sidereal Rotation Period (hours)	Obliquity (degrees)	V(1,0) (mag)	Geometric Albedo
$69\,911 \pm 6$	1.8986×10^{27}	1.326	9.924 25	3.12	−9.4	0.52

Notes

Data are from Yoder (1995) and can be found on JPL's Solar System Dynamics website (http://ssd.jpl.nasa.gov) maintained by Robert Jacobson.

Table A2.4. Jupiter radii.

Radius	Value (km)
Mean[1]	$69\,911 \pm 6$
Equatorial[1]	$71\,492 \pm 4$
Polar[1]	$66\,854 \pm 10$
Ionospheric[2]	71 400

Notes

[1] Data from Lindal *et al.* (1981). These are data represent the 1 bar radius of the planet.

[2] From Dessler (1983)

With a spin period of just under 10 hours, Jupiter's equatorial and polar radii are significantly different. Additionally, there are several other radii that are commonly used in different fields.

Table A2.5. Higher order gravitational moments of Jupiter.

J_2	J_4	J_6
$(1.4697 \pm 0.0001) \times 10^{-2}$	$(-5.84 \pm 0.05) \times 10^{-4}$	$(3.1 \pm 2.0) \times 10^{-5}$

Notes
All of these are normalized so that $J_0 = 1$. See Chapter 3 for a more complete discussion of the derivation and use of these moments.
Data are based Campbell and Synnott (1985). An equatorial radius of 71 492 km was used to calculate these parameters. (Campbell and Synnott (1985) use a radius of 71 398 km, so there is a slight difference in these moments.)

Table A2.6. Zonal wind speeds on Jupiter.

Planetographic Latitude (degrees)	Planetocentric Latitude (degrees)	Wind Speed (m s^{-1})	Planetographic Latitude (degrees)	Planetocentric Latitude (degrees)	Wind Speed (m s^{-1})	Planetographic Latitude (degrees)	Planetocentric Latitude (degrees)	Wind Speed (m s^{-1})
−53	−49	39	−15	−13	13	22	19	137
−52	−48	23	−14	−12	34	23	20	162
−51	−47	5	−13	−11	35	24	21	169
−50	−46	0	−12	−11	44	25	22	89
−49	−45	−3	−11	−10	56	26	23	61
−48	−44	−3	−10	−9	75	27	24	39
−47	−43	5	−9	−8	81	28	25	22
−46	−42	16	−8	−7	105	29	26	9
−45	−41	23	−7	−6	125	30	27	−19
−44	−40	39	−6	−5	91	31	28	−30
−43	−39	40	−5	−4	103	32	29	−16
−42	−38	22	−4	−3	94	33	30	1
−41	−37	5	−3	−3	88	34	31	27
−40	−36	0	−2	−2	89	35	31	34
−39	−35	3	−1	−1	92	36	32	19
−38	−34	17	0	0	93	37	33	3
−37	−33	25	1	1	88	38	34	−10
−36	−32	32	2	2	102	39	35	−15
−35	−31	12	3	3	96	40	36	−9
−34	−31	−3	4	3	101	41	37	4
−33	−30	−21	5	4	102	42	38	22
−32	−29	−24	6	5	93	43	39	10
−31	−28	4	7	6	98	44	40	−2
−30	−27	29	8	7	93	45	41	−2
−29	−26	44	9	8	67	46	42	7
−28	−25	42	10	9	54	47	43	22
−27	−24	48	11	10	45	48	44	15
−26	−23	38	12	11	44	49	45	0
−25	−22	22	13	11	30	50	46	−9
−24	−21	1	14	12	15	51	47	−14
−23	−20	−10	15	13	−3	52	48	−12
−22	−19	−18	16	14	−20	53	49	−6
−21	−19	−49	17	15	−31	54	50	1
−20	−18	−59	18	16	−24	55	51	13
−19	−17	−59	19	17	−1	56	52	14
−18	−16	−49	20	18	36	57	53	2
−17	−15	−32	21	19	74	58	54	10
−16	−14	−6						

Notes
The data are based on Simon and Beebe (1996). Note that latitude on Jupiter (as an oblate planet) can be given in two ways: planetocentric and planetographic[1]. The former is based on the angle between the equator and the point in question, as seen from the planet's center. The latter is the angle between the local gravity vector and the equatorial plane. See Chapter 6 for further discussion of jovian winds.
[1] The conversion between the two forms is (approximately):

$$\tan\left(\theta_{\text{graphic}}\right) = (R_{\text{eq}}/R_{\text{p}})^2 \tan\left(\theta_{\text{centric}}\right)$$

where the R_{eq} is the equatorial radius of Jupiter and R_{p} is the polar radius. (See Table A2.4.)

Table A2.7. Jupiter's magnetic field.

Magnetic Moment (gauss)	Tilt (degrees)	Tilt Longitude	λ_{III} (LH) (degrees)	Tilt Longitude	λ_M (RH) (degrees)	Offset (R_J)	Offset Latitude (degrees)	Offset Longitude (degrees)
4.300	9.4		200.1		159.9	0.119	1.44	150.2

Notes

Offset, tilted dipole (the O_6 model of Connerney (1993)) model of the jovian magnetic field. For a detailed discussion of the magnetic field of Jupiter, please see Chapter 24. Longitudes given here are in "System III", a left-handed coordinate system where longitude increases clockwise as seen from about the north pole of the planet. This system was chosen so that the longitude will always be increasing as an outside observer looks at the rotating planet from space. The spin period of System III is the spin period of the jovian magnetosphere, as judged by the radio emissions. Subtracting λ_{III} from 360° provides λ_M longitude, a right-handed system used in Chapter 24. A more detailed discussion of coordinate systems, including history, is available in Appendix B of Dessler (1983).

Table A2.8. A comparison of jovian magnetic field models.

Parameter	P11	O4	O6	*Ulysses*	VIP4	Amalthea
M (gauss)	4.208	4.278	4.300	4.118	4.264	4.195
θ_M(deg)	10.0	9.6	9.4	10.2	9.5	10.0
λ_M (deg) RH	161.2	158.3	159.9	161.2	159.2	162.7
λ_{III}(deg) LH	198.8	201.7	200.1	198.8	200.8	197.3

Note

Note that in Chapter 24, the right-handed coordinate system was used. We give both right-handed (RH) and left-handed (LH) systems here.

Table A2.9. Discovery circumstances for named satellites of Jupiter.

Satellite	Number	Discovery Date	Discoverer
Metis (S/1979 J3)	XVI	1980	S. P. Synnott/*Voyager 2*
Adrastea (S/1979 J1)	XV	1979	D. C. Jewitt, E. Danielson
Amalthea	V	1892	E. E. Barnard
Thebe (S/1979 J2)	XIV	1980	S. P. Synnott/*Voyager 1*
Io	I	1610	Galileo
Europa	II	1610	Galileo
Ganymede	III	1610	Galileo
Callisto	IV	1610	Galileo
Themisto (S/1975 J1)[1]	XVIII	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Leda	XIII	1974	C. Kowal
Himalia	VI	1904	C. Perrine
Lysithea	X	1938	S. Nicholson
Elara	VII	1905	C. Perrine
Euporie (S/2001 J10)	XXXIV	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Orthosie (S/2001 J9)	XXXV	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Euanthe (S/2001 J7)	XXXIII	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Thyone (S/2001 J2)	XXIX	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Harpalyke (S/2000 J5)	XXII	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Hermippe (S/2001 J3)	XXX	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Praxidike (S/2000 J7)	XXVII	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Iocaste (S/2000 J3)	XXIV	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Ananke	XII	1951	S. Nicholson
Eurydome (S/2001 J4)	XXXII	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Autonoe (S/2001 J1)	XXVIII	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Pasithee (S/2001 J6)	XXXVIII	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Chaldene (S/2000 J10)	XXI	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Isonoe (S/2000 J6)	XXVI	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Kale (S/2001 J8)	XXXVII	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Aitne (S/2001 J11)	XXXI	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Erinome (S/2000 J4)	XXV	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Taygete (S/2000 J9)	XX	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Carme	XI	1938	S. Nicholson
Sponde (S/2001 J5)	XXXVI	2001	S. S. Sheppard, D. C. Jewitt, J. Kleyna
Kalyke (S/2000 J2)	XXIII	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Pasiphae	VIII	1908	P. Melotte
Megaclite (S/2000 J8)	XIX	2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier
Sinope	IX	1914	S. Nicholson
Callirrhoe (S/1999 J1)	XVII	1999	J. V. Scotti, T. B. Spahr, R. S. McMillan, J.A. Larsen, J. Montani, A. E. Gleason, T. Gehrels

Notes

Satellites are listed with their numeric designation, their IAU Designation, discovery year and discoverers. Check http://ssd.jpl.nasa.gov for up to date information. For references, see Chapter 1 in Burns and Matthews (1986).

[1] S/1975 J1 is also S/2000 J1.

Table A2.10. Discovery data for unnamed satellites of Jupiter (as of July 2003).

Satellite	Number	Discovery Date	Discoverer	Reference
S/2000 J11		2000	S. S. Sheppard, D. C. Jewitt, Y. Fernandez, G. Magnier	
S/2003 J20		2003	S. S. Sheppard	IAUC 8125
S/2003 J3		2003	S. S. Sheppard	IAUC 8087
S/2003 J18		2003	B. Gladman	IAUC 8116
S/2003 J12		2003	S. S. Sheppard	IAUC 8089
S/2003 J4		2003	S. S. Sheppard	IAUC 8087
S/2003 J16		2003	B. Gladman	IAUC 8116
S/2003 J21		2003	S. S. Sheppard, B. Gladman	IAUC 8138
S/2003 J6		2003	S. S. Sheppard	IAUC 8087
S/2003 J8		2003	S. S. Sheppard	IAUC 8088
S/2003 J10		2003	S. S. Sheppard	IAUC 8089
S/2003 J15		2003	S. S. Sheppard	IAUC 8116
S/2003 J11		2003	S. S. Sheppard	IAUC 8089
S/2003 J17		2003	B. Gladman	IAUC 8116
S/2002 J1		2002	S. S. Sheppard	IAUC 8035
S/2003 J9		2003	S. S. Sheppard	IAUC 8089
S/2003 J7		2003	S. S. Sheppard	IAUC 8087
S/2003 J19		2003	B. Gladman	IAUC 8125
S/2003 J13		2003	S. S. Sheppard	IAUC 8116
S/2003 J1		2003	S. S. Sheppard	IAUC 8087
S/2003 J14		2003	S. S. Sheppard	IAUC 8116
S/2003 J5		2003	S. S. Sheppard	IAUC 8087
S/2003 J2		2003	S. S. Sheppard	IAUC 8087

Notes

Satellites listed with their numeric designation, their IAU Designation, discovery year and discoverers. Check http://ssd.jpl.nasa.gov for up to date information. See Chapter 12 for further discussion.

Table A2.11. Orbital data for named satellites.

Satellite	a[1] (km)	a (R_J)	Period (days)	e[1]	i (degrees)	ω (degrees)	Ω (degrees)	M (degrees)	Epoch
Metis	128 000	1.79	0.295	0.0012	0.019	297.177	146.912	276.047	1997 Jan. 16.00
Adrastea	129 000	1.8	0.298	0.0018	0.054	328.047	228.378	135.673	1997 Jan. 16.00
Amalthea	181 400	2.53	0.498	0.0031	0.388	147.025	112.472	190.516	1997 Jan. 16.00
Thebe	221 900	3.1	0.675	0.0177	1.070	233.544	235.925	136.441	1997 Jan. 16.00
Io	421 800	5.89	1.769	0.0041[3]	0.036	83.898	44.208	342.021	1997 Jan. 16.00
Europa	671 100	9.38	3.551	0.0094[3]	0.469	88.684	219.383	171.016	1997 Jan. 16.00
Ganymede	1 070 400	14.97	7.155	0.0011[3]	0.170	203.214	63.692	306.589	1997 Jan. 16.00
Callisto	1 882 700	26.33	16.69	0.0074	0.187	57.714	294.195	180.997	1997 Jan. 16.00
Themisto[2]	7 507 000	105	130.02	0.2420	43.075	219.572	191.674	161.838	2002 May. 6.00
Leda	11 165 000	156.17	240.92	0.1636	27.457	272.349	217.137	228.076	2000 Jan. 1.00
Himalia	11 461 000	160.31	250.56	0.1623	27.496	331.995	57.245	68.721	2000 Jan. 1.00
Lysithea	11 717 000	163.89	259.20	0.1124	28.302	49.486	5.528	329.121	2000 Jan. 1.00
Elara	11 741 000	164.22	259.64	0.2174	26.627	143.591	109.373	332.962	2000 Jan. 1.00
Euporie	19 302 000	269.98	550.67	0.1435	145.761	89.191	62.714	276.032	2002 May. 6.00
Orthosie	20 721 000	289.83	622.58	0.2809	145.923	222.684	226.598	341.279	2002 May. 6.00
Euanthe	20 799 000	290.92	620.55	0.2319	148.906	325.452	258.586	113.453	2002 May. 6.00
Thyone	20 940 000	292.89	627.26	0.2287	148.507	101.530	237.433	13.663	2002 May. 6.00
Harpalyke[2]	21 105 000	295.2	623.34	0.2259	148.644	140.582	37.241	351.698	2002 May. 6.00
Hermippe	21 131 000	295.57	633.91	0.2096	150.724	308.195	335.429	258.264	2002 May. 6.00
Praxidike[2]	21 147 000	295.79	625.30	0.2296	148.957	196.312	287.581	251.792	2002 May. 6.00
Iocaste[2]	21 269 000	297.5	631.49	0.2156	149.430	68.383	276.786	345.814	2002 May. 6.00
Ananke	21 276 000	297.59	629.77	0.2435	148.889	100.619	7.615	248.793	2000 Jan. 1.00
Eurydome	2 286 5000	319.82	717.31	0.2757	150.267	231.843	308.830	358.395	2002 May. 6.00
Autonoe	23 039 000	322.25	762.70	0.3344	152.957	57.595	276.654	190.397	2002 May. 6.00
Pasithee	23 096 000	323.05	719.48	0.2668	165.116	241.559	333.594	282.260	2002 May. 6.00
Chaldene[2]	23 179 000	324.21	723.78	0.2512	165.182	255.961	145.096	330.735	2002 May. 6.00
Isonoe[2]	23 217 000	324.74	725.52	0.2461	165.247	125.239	138.805	186.925	2002 May. 6.00
Kale	23 217 000	324.74	729.47	0.2599	164.996	52.394	64.623	272.063	2002 May. 6.00
Aitne	23 231 000	324.94	730.22	0.2643	165.093	110.658	15.910	167.510	2002 May. 6.00
Erinome[2]	23 279 000	325.61	728.26	0.2659	164.914	20.041	326.342	325.594	2002 May. 6.00

(cont.)

Table A2.11. (*cont.*)

Satellite	a^1 (km)	a (R_J)	Period (days)	e^1	i (degrees)	ω (degrees)	Ω (degrees)	M (degrees)	Epoch
Taygete[2]	23 360 000	326.74	732.24	0.2516	165.236	239.927	312.849	154.133	2002 May. 6.00
Carme	23 404 000	327.36	734.17	0.2533	164.907	28.199	113.738	234.027	2000 Jan. 1.00
Sponde	23 487 000	328.52	748.33	0.3121	150.999	71.674	123.963	228.584	2002 May. 6.00
Kalyke[2]	23 583 000	329.86	742.98	0.2453	165.198	232.812	56.027	311.028	2002 May. 6.00
Pasiphae	23 624 000	330.44	743.63	0.4090	151.431	170.450	312.990	280.193	2000 Jan. 1.00
Megaclite[2]	23 806 000	332.98	752.82	0.4210	152.846	287.799	286.848	189.655	2002 May. 6.00
Sinope	23 939 000	334.84	758.90	0.2495	158.109	346.394	303.081	168.397	2000 Jan. 1.00
Callirrhoe[2]	24 102 000	337.12	758.77	0.2827	147.138	30.484	291.638	152.557	2002 May. 6.00

Notes

All elements are referenced to the local Laplace plane, unless otherwise stated. See Table A2.1 for the meanings of the columns except for M (the mean anomaly) and ω (the argument of pericenter). Note: Because of the short orbital periods of these satellites, the data should *not* be used for accurate ephemeris calculations. See http://ssd.jpl.nasa.gov/sat_elem.html for updated data.

[1] The perijove (q) and apojove (Q) distances can be calculated from the quantities given by the following formulae:

$$q = a(1 - e)$$

$$Q = a(1 + e)$$

[2] Orbital elements are with respect to the ecliptic.

[3] Indicates that the eccentricity is forced. Tidal damping would damp these eccentricities to lower values, but the Laplace resonance continues to pump them back up.

Table A2.12. Orbital data for unnamed satellites (as of July 2003).

Satellite	a^1 (km)	a (R_J)	Period (days)	e^1	i (degrees)	ω (degrees)	Ω (degrees)	M (degrees)	Epoch
S/2000 J11[2]	12 555 000	175.61	286.95	0.2484	28.273	184.835	290.313	309.949	2002 May. 6.00
S/2003 J20[2]	17 033 000	238.25	454.13	0.2886	55.280	80.718	47.627	265.519	2003 Jun. 10.00
S/2003 J3[2]	17 929 000	250.78	490.45	0.2217	143.685	99.374	239.469	348.880	2003 Jun. 10.00
S/2003 J18[2]	18 445 000	258	511.75	0.2322	145.061	122.004	183.886	286.594	2003 Jun. 10.00
S/2003 J12[2]	19 028 000	266.15	536.23	0.3679	146.458	30.297	59.446	215.595	2003 Jun. 10.00
S/2003 J4[2]	19 294 000	269.87	547.50	0.3664	141.494	167.921	198.633	213.345	2003 Jun. 10.00
S/2003 J16[2]	20 464 000	286.24	598.04	0.2419	148.655	79.473	21.772	295.305	2003 Jun. 10.00
S/2003 J21[2]	20 813 000	291.12	613.40	0.1886	147.577	60.735	16.731	247.911	2003 Jun. 10.00
S/2003 J6[2]	20 890 000	292.2	616.82	0.1411	156.558	298.054	100.343	58.268	2003 Jun. 10.00
S/2003 J8[2]	21 038 000	294.27	623.39	0.2372	152.027	202.199	328.396	147.849	2003 Jun. 10.00
S/2003 J10[2]	21 078 000	294.83	625.16	0.3491	163.022	168.255	175.572	212.451	2003 Jun. 10.00
S/2003 J15[2]	22 253 000	311.26	678.19	0.1199	141.313	31.846	242.182	345.419	2003 Jun. 10.00
S/2003 J11[2]	22 792 000	318.8	702.95	0.2623	163.787	9.784	37.640	326.209	2003 Jun. 10.00
S/2003 J17[2]	22 918 000	320.56	708.81	0.1947	163.830	343.271	306.867	36.844	2003 Jun. 10.00
S/2002 J1	22 931 000	320.74	723.90	0.2588	165.001	182.824	349.907	101.046	2002 May. 6.00
S/2003 J9[2]	23 020 000	321.99	713.51	0.2133	165.167	322.374	58.887	227.741	2003 Jun. 10.00
S/2003 J7[2]	23 030 000	322.13	714.00	0.4030	159.045	92.185	193.650	62.388	2003 Jun. 10.00
S/2003 J19[2]	23 348 000	326.58	728.84	0.3108	163.205	184.822	36.886	112.678	2003 Jun. 10.00
S/2003 J13[2]	23 648 000	330.77	742.93	0.4320	141.363	208.677	257.729	353.121	2003 Jun. 10.00
S/2003 J1[2]	23 749 000	332.19	747.70	0.2976	163.214	341.868	215.763	90.642	2003 Jun. 10.00
S/2003 J14[2]	24 039 000	336.24	761.45	0.3070	139.150	127.266	340.475	299.243	2003 Jun. 10.00
S/2003 J5[2]	24 450 000	341.99	781.03	0.1634	165.013	126.980	196.004	212.150	2003 Jun. 10.00
S/2003 J2[2]	26 658 000	372.88	889.20	0.3316	151.191	170.990	4.588	38.590	2003 Jun. 10.00

Notes

All elements are referenced to the local Laplace plane, unless otherwise stated. See Table A2.1 for the meanings of the columns except for M (the mean anomaly) and ω (the argument of pericenter). Note: Because of the short orbital periods of these satellites, the data should *not* be used for accurate ephemeris calculations. See http://ssd.jpl.nasa.gov/sat_elem.html for updated data.

[1] The perijove (q) and apojove (Q) distances can be calculated from the quantities given by the following formulae:

$$q = a(1 - e)$$

$$Q = a(1 + e)$$

[2] Orbital elements are with respect to the ecliptic.

Table A2.13. Physical data for named satellites of Jupiter.

Satellite	Mass (kg)	Mean Radius (km)	Density (g cm^{-3})	Geometric Albedo
Metis	(1.1 ± 0.3)[1] × 10^{17}	21.5 ± 2.0	3.0[3]	0.061 ± 0.003
Adrastea	(7.4 ± 4.4)[1] × 10^{15}	8.2 ± 2.0	3.0[3]	0.1 ± 0.045
Amalthea	(2.09 ± 0.6) × 10^{18}	83.45 ± 2.4	0.862 ± 0.257	0.090 ± 0.005
Thebe	(1.49 ± 0.1)[1] × 10^{18}	49.3 ± 2.0	3.0[3]	0.047 ± 0.003
Io	(8.9354 ± 0.000029) × 10^{22}	1821.6 ± 0.5	3.528 ± 0.006	0.62
Europa	(4.8017 ± 0.000014) × 10^{22}	1560.8 ± 0.5	3.014 ± 0.005	0.68
Ganymede	(1.4824 ± 0.000003) × 10^{23}	2631.2 ± 1.7	1.942 ± 0.005	0.44
Callisto	(1.0763 ± 0.000003) × 10^{23}	2410.3 ± 1.5	1.834 ± 0.004	0.19
Themisto	6.8[1] × 10^{14}	4.0[2]	2.6[3]	0.04[4]
Leda	1[1] × 10^{16}	10[2]	2.6[3]	0.04[4]
Himalia	6.7[1] × 10^{18}	85[2]	2.6[3]	0.04[4]
Lysithea	6.2[1] × 10^{16}	18[2]	2.6[3]	0.04[4]
Elara	8.6[1] × 10^{17}	43[2]	2.6[3]	0.04[4]
Euporie	1.4[1] × 10^{13}	1.0[2]	2.6[3]	0.04[4]
Orthosie	1.4[1] × 10^{13}	1.0[2]	2.6[3]	0.04[4]
Euanthe	4.4[1] × 10^{13}	1.5[2]	2.6[3]	0.04[4]
Thyone	8.9[1] × 10^{13}	2.0[2]	2.6[3]	0.04[4]
Harpalyke	1.1[1] × 10^{14}	2.2[2]	2.6[3]	0.04[4]
Hermippe	8.9[1] × 10^{13}	2.0[2]	2.6[3]	0.04[4]
Praxidike	4.3[1] × 10^{14}	3.4[2]	2.6[3]	0.04[4]
Iocaste	1.9[1] × 10^{14}	2.6[2]	2.6[3]	0.04[4]
Ananke	2.9[1] × 10^{16}	14[2]	2.6[3]	0.04[4]
Eurydome	4.4[1] × 10^{13}	1.5[2]	2.6[3]	0.04[4]
Autonoe	8.9[1] × 10^{13}	2.0[2]	2.6[3]	0.04[4]
Pasithee	1.4[1] × 10^{13}	1.0[2]	2.6[3]	0.04[4]
Chaldene	7.4[1] × 10^{13}	1.9[2]	2.6[3]	0.04[4]
Isonoe	7.4[1] × 10^{13}	1.9[2]	2.6[3]	0.04[4]
Kale	1.4[1] × 10^{13}	1.0[2]	2.6[3]	0.04[4]
Aitne	4.4[1] × 10^{13}	1.5[2]	2.6[3]	0.04[4]
Erinome	4.4[1] × 10^{13}	1.6[2]	2.6[3]	0.04[4]
Taygete	1.6[1] × 10^{14}	2.5[2]	2.6[3]	0.04[4]
Carme	1.3[1] × 10^{17}	23[2]	2.6[3]	0.04[4]
Sponde	1.4[1] × 10^{13}	1.0[2]	2.6[3]	0.04[4]
Kalyke	1.9[1] × 10^{14}	2.6[2]	2.6[3]	0.04[4]
Pasiphae	2.9[1] × 10^{17}	30[2]	2.6[3]	0.04[4]
Megaclite	2[1] × 10^{14}	2.7[2]	2.6[3]	0.04[4]
Sinope	7.4[1] × 10^{16}	19[2]	2.6[3]	0.04[4]
Callirrhoe	8.6[1] × 10^{14}	4.3[2]	2.6[3]	0.04[4]

Notes

Note that most satellites are too small to measure the radii directly. In these cases, an albedo has been assumed so that a radius can be estimated. Also, very few satellites have had their masses measured directly, so in most cases a density has been assumed so that the mass can be calculated. For a discussion of the Galilean satellites' interiors, see Chapter 13.

[1] Indicates that mass is derived from an assumed density and/or an estimated radius. (See subsequent notes.)

[2] Indicates that radius is derived from visual magnitude and assumed albedo.

[3] Indicates that density is assumed.

[4] Indicates that albedo is assumed.

Table A2.14. Physical data for unnamed satellites (as of July 2003).

Satellite	Mass (kg)	Mean Radius (km)
S/2000 J11	8.9[1] × 10^{13}	2.0[2]
S/2003 J20	4.4[1] × 10^{13}	1.5[2]
S/2003 J3	1.4[1] × 10^{13}	1.0[2]
S/2003 J18	1.4[1] × 10^{13}	1.0[2]
S/2003 J12	1.4[1] × 10^{12}	0.5[2]
S/2003 J4	1.4[1] × 10^{13}	1.0[2]
S/2003 J16	1.4[1] × 10^{13}	1.0[2]

(cont.)

Table A2.14. (*cont.*)

Satellite	Mass (kg)	Mean Radius (km)
S/2003 J21	1.4[1] $\times 10^{13}$	1.0[2]
S/2003 J6	8.9[1] $\times 10^{13}$	2.0[2]
S/2003 J8	4.4[1] $\times 10^{13}$	1.5[2]
S/2003 J10	1.4[1] $\times 10^{13}$	1.0[2]
S/2003 J15	1.4[1] $\times 10^{13}$	1.0[2]
S/2003 J11	1.4[1] $\times 10^{13}$	1.0[2]
S/2003 J17	1.4[1] $\times 10^{13}$	1.0[2]
S/2002 J1	4.4[1] $\times 10^{13}$	1.5[2]
S/2003 J9	1.4[1] $\times 10^{12}$	0.5[2]
S/2003 J7	8.9[1] $\times 10^{13}$	2.0[2]
S/2003 J19	1.4[1] $\times 10^{13}$	1.0[2]
S/2003 J13	1.4[1] $\times 10^{13}$	1.0[2]
S/2003 J1	8.9[1] $\times 10^{13}$	2.0[2]
S/2003 J14	1.4[1] $\times 10^{13}$	1.0[2]
S/2003 J5	8.9[1] $\times 10^{13}$	2.0[2]
S/2003 J2	1.4[1] $\times 10^{13}$	1.0[2]

Notes

Note that all of these satellites are too small to measure the radii directly. Therefore, a geometric albedo of 0.04 has been assumed so that a radius can be estimated. In addition, these satellites have not had their masses measured directly, so a density of 2.6 g cm^{-3} has been assumed so that the mass can be estimated.

Table A2.15. Shape data on selected satellites.

Satellite	Subplanetary Equatorial Radius (km)	Along Orbit Equatorial Radius (km)	Polar Radius (km)
Metis[1]	30.0 ± 2.0	20.0 ± 2.0	17.0 ± 2.0
Adrastea[1]	10.0 ± 2.0	8.0 ± 2.0	7.0 ± 2.0
Amalthea[1]	125.0 ± 2.0	73.0 ± 2.0	64.0 ± 2.0
Thebe[1]	58.0 ± 2.0	49.0 ± 2.0	42.0 ± 2.0
Io[2]	1826.5 ± 0.12	1815.7 ± 0.12	1812.2 ± 0.12
Europa[2]	1562.4 ± 0.65	1560.2 ± 0.65	1559.4 ± 0.65
Ganymede[2]	2635.2 ± 0.3	2633.8 ± 0.3	2633.4 ± 0.3
Callisto[2]	2408.4 ± 0.29	2408.3 ± 0.29	2408.2 ± 0.29

Notes

These are the only satellites for which the data allow these calculations. The polar radius measures the radius from center of the satellite to either of the poles. The subplanetary radius measures the radius from the center of the moon to the sub-jovian point. (All of these satellites are synchronously rotating.) The final radius, along the orbit in the equator, measures from the center of the satellite to the surface in the direction of the satellite's orbit.

[1] Data from Thomas *et al.* (1998).

[2] Data from Davies *et al.* (1998).

Table A2.16. Data on Jupiter's rings.

Ring	Inner Edge (km)	Outer Edge (km)	Thickness (km)	Optical Depth
Halo	92 000	122 500	12 500[1]	3×10^{-6}
Main	122 500	128 940	<300	5×10^{-6}
Gossamer	128 940	250 000	1 300	1×10^{-7}

Notes

Optical depth data are from Yoder (1995), thickness and boundaries are from Ockert-Bell *et al.* (1999). Inner and outer edges are measured from the center of Jupiter. Thickness is the full thickness from below the equatorial plane to above it, except for the halo.

[1] The halo thickness is the full-width half-maximum thickness of the halo component.

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