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19.

On the orbit of σ Coronae borealis.

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* The orbits calculated from the observations of σ Coronae borealis show great divergence, the periods ranging from 200 to upwards of 800 years. In order to investigate this feature I constructed normal places for 1832.5, 1864.5, and 1896.5. From these six data together with the period, which I successively assumed equal to 1100, 900, 700, and 500 years, the following four sets of elements were calculated.

Ω	5° 58'	10° 0'	20° 31'	50° 11'
λ	84 47	77 24	61 15	21 44
γ	28 54	26 28	22 25	22 25
e	0.8009	0.7773	0.7501	0.7178
P	1100.0	900.0	700.0	500.0
T	1827.93	1827.03	1826.08	1824.68
a	6"866	5"997	5"075	4"184
1781.79 $\theta_o - \theta_c$	+2°9	+7°2	+16°4	+34°8
ρ_c	3"30	3"17	3"02	2"89
1804.74 $\theta_o - \theta_c$	+1°5	+3°7	+9°9	+23°6
ρ_c	2"19	2"11	2"00	1"82

The modern observations are closely represented, especially by the first two orbits. We know that with a period of about 400 years it is possible to represent the

normal places to a tenth of a second of arc and Sir William Herschel's angles to about 10°, but it is impossible to represent the observations within their probable errors by any orbit with so short a period. The following elements are referred to the equinox 1900. As the arc described during the past 70 years is too short to fix the orbit, its accuracy depends upon Herschel's angles. If the angle measured in 1781 should happen to be some degrees in error, the period will be about half as many hundred years wrong, and the other elements would have to be changed by amounts indicated by the table given above:

Ω	= 357° 48'
λ	= 96 2
γ	= 29 3
e	= 0.8480
P	= 1679.2
T	= 1828.71
a	= 9"018
Motion direct.	

According to Burnham's way of writing the values of the elements: $\Omega = 177^\circ 48'$, $\lambda = 276^\circ 2'$, and $\gamma = \pm 29^\circ 3'$. The comparison with observation is as follows:

Observer	Epoch	θ_c	ρ_c	$\theta_o - \theta_c$	$\rho_o - \rho_c$
W. Herschel	1781.79	347°5	3"45	0°0	—
"	1804.74	11.1	2.24	+0.3	—
W. Struve	19.62	49.4	1.42	—1.4	—
J. Herschel	21.30	56.7	1.35	+8.5	—
W. Struve	22.67	63.0	1.30	—2.0	—
H. & S.	22.83	63.8	1.29	+7.7	+0"15
"	23.47	66.9	1.27	+6.0	—
South	25.44	77.2	1.22	+0.3	+0.26
W. Struve	27.02	85.7	1.20	+3.7	+0.11
Herschel	28.50	94.0	"	—1.9	—
W. Struve	30.11	102.8	1.22	+2.1	0.00
Herschel	30.28	103.9	"	+1.2	0.00
Dawes	30.52	105.2	"	+2.1	—
Smyth	30.76	106.5	"	+1.1	+0.08
Dawes	31.34	109.5	1.23	+2.0	+0.34
Herschel	31.36	109.6	"	—0.8	+0.15
Smyth	32.37	115.0	1.25	—0.1	+0.15
Herschel	32.52	115.7	"	—2.1	—0.18
Dawes	32.55	115.8	"	—0.4	—
W. Struve	32.99	117.9	1.26	+0.9	+0.04

Observer	Epoch	θ_c	ρ_c	$\theta_o - \theta_c$	$\rho_o - \rho_c$
Herschel	1833.26	119°2	1"27	+0°7	+0"06
Dawes	33.36	119.7	"	+0.9	+0.03
Smyth	33.58	120.8	1.28	—0.1	—0.08
Dawes	34.55	125.3	1.31	+0.3	—
Mädler	35.40	129.3	1.35	+5.6	—0.05
Smyth	35.50	129.7	"	+1.2	+0.05
W. Struve	35.50	"	"	+0.8	—0.04
Mädler	36.47	134.0	1.40	+4.5	—
W. Struve	36.59	134.5	"	+0.2	+0.04
Dawes	37.47	137.9	1.44	—1.1	—
W. Struve	37.55	138.2	"	+1.8	—0.02
"	38.45	141.5	1.49	+1.9	—0.01
Galle	39.52	145.3	1.54	+2.5	+0.01
Dawes	39.53	"	"	—1.0	+0.06
Smyth	39.67	145.8	1.55	—0.7	+0.05
Dawes	40.57	148.8	1.59	—0.9	+0.07
O. Struve	40.62	149.0	1.60	—1.5	—0.16
Dawes	41.48	151.6	1.64	—1.3	+0.02
Challis	41.54	151.8	"	—3.6	—0.08
Kaiser	41.56	151.9	"	—3.1	—0.07

Observer	Epoch	θ_c	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$
Mädler	1841.56	151.9	1.64	+0.4	-0.04
O. Struve	41.60	152.0	»	-0.1	-0.17
Mädler	42.31	154.0	1.68	+2.4	+0.13
Dawes	42.37	154.2	1.69	-0.9	-
Challis	42.41	154.3	»	-0.8	-0.34
Mädler	42.73	155.3	1.70	+2.3	+0.17
Smyth	43.35	157.0	1.74	-1.1	+0.06
Mädler	43.45	157.3	1.75	-0.5	+0.10
Dawes	43.47	»	»	-0.8	+0.02
Kaiser	43.68	157.8	1.76	-1.5	-0.10
Challis	43.68	»	»	+2.6	-0.13
Mädler	44.40	159.7	1.80	+0.9	+0.25
Greenwich	44.44	159.8	1.81	-2.6	-0.28
Mädler	45.51	162.3	1.87	+0.8	+0.16
Hind	46.32	164.1	1.91	-1.3	-
Jacob	46.36	164.2	»	-1.8	+0.34
Mädler	46.46	164.4	1.92	+0.7	+0.15
Smyth	46.60	164.7	»	-2.3	+0.08
O. Struve	46.68	164.8	1.93	+4.1	-0.09
Mädler	47.44	166.5	1.97	+0.1	+0.19
Dawes	47.44	»	»	-0.5	-0.08
O. Struve	47.69	167.0	1.98	+3.1	-0.23
Mitchell	47.70	»	»	-0.3	-0.65
Mädler	48.41	168.4	2.02	0.0	+0.38
Bond	48.42	»	»	+3.5	+0.18
Dawes	48.53	168.6	»	0.0	-0.02
O. Struve	48.74	169.1	2.03	+2.3	-0.02
Dawes	49.45	170.4	2.08	-0.3	+0.01
O. Struve	49.74	171.0	2.09	+2.0	-0.04
»	50.52	172.3	2.13	-2.3	-0.07
Mädler	50.70	172.7	2.14	+0.3	+0.09
Fletcher	51.22	173.6	2.16	+0.8	+0.16
Mädler	51.25	»	2.17	+0.9	+0.17
Dawes	51.42	173.9	2.18	-0.1	+0.09
O. Struve	51.63	174.3	2.19	-0.3	-0.04
Mädler	51.76	174.5	2.20	+1.7	+0.24
Miller	52.31	175.4	2.23	+1.0	+0.15
Mädler	52.60	175.9	2.25	+1.6	+0.14
O. Struve	52.63	»	»	-1.1	-0.11
Jacob	53.14	176.7	2.28	+1.2	-0.10
Possell	53.35	177.0	2.29	-1.8	-
Mädler	53.38	177.1	»	+0.6	+0.17
Dawes	53.63	177.4	2.31	+0.5	+0.08
O. Struve	53.66	»	»	-1.2	-0.14
Mädler	53.77	177.6	»	+1.1	+0.34
Jacob	54.05	178.0	2.33	-0.1	-0.08
Dawes	54.56	178.8	2.35	-0.3	-0.09
O. Struve	54.66	178.9	2.36	+1.1	-0.11
Morton	54.67	»	»	-0.3	-0.14
Dembowski	54.67	»	»	+0.9	0.00
Mädler	54.70	179.0	»	+0.4	+0.16
Dembowski	55.19	179.7	2.39	+0.2	0.00
Dawes	55.48	180.1	2.40	0.0	+0.03
Winnecke	55.54	»	»	+1.5	+0.09
Secchi	55.61	180.2	2.41	+0.6	-0.10
O. Struve	55.61	»	»	-0.2	-0.09

Observer	Epoch	θ_c	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$
Mädler	1855.78	180.5	2.42	+1.3	+0.22
Winnecke	56.39	181.4	2.45	+1.4	+0.07
Dembowski	56.42	»	»	+0.5	+0.23
Secchi	56.43	»	»	+1.0	0.00
O. Struve	56.57	181.6	2.46	-1.1	+0.01
Jacob	56.73	181.8	2.47	-0.6	+0.05
Mädler	57.39	182.8	2.51	+0.5	-0.05
Secchi	57.61	183.0	2.53	+0.6	-0.10
O. Struve	57.63	»	»	-0.9	-0.02
Dembowski	57.66	183.1	»	-3.1	-0.04
Jacob	57.66	»	»	0.0	0.00
»	58.20	183.8	2.56	+0.2	+0.01
Dembowski	58.50	184.2	2.57	+0.5	+0.12
Mädler	58.54	»	»	-0.6	+0.07
O. Struve	58.57	184.3	»	-1.6	-0.05
Morton	59.34	185.2	2.61	-0.3	+0.09
Mädler	59.49	185.4	2.62	+0.4	+0.07
O. Struve	59.68	185.6	2.63	+0.5	-0.03
Dawes	60.36	186.4	2.66	-0.9	+0.05
O. Struve	60.74	186.7	2.68	-0.4	+0.07
Mädler	61.55	187.5	2.72	+0.9	+0.23
O. Struve	61.58	187.6	»	-0.4	-0.04
Dembowski	62.54	188.6	2.77	+0.8	+0.03
Mädler	62.71	188.8	2.78	+1.7	+0.23
O. Struve	62.76	»	»	-0.2	+0.01
Dembowski	63.39	189.5	2.81	+1.0	-0.07
O. Struve	63.60	189.7	2.82	-1.8	-0.04
Engelmann	64.45	190.6	2.86	-0.1	+0.24
Dembowski	64.49	»	»	+0.2	-0.11
O. Struve	64.60	190.7	2.87	-1.1	+0.04
Dawes	65.38	191.5	2.91	0.0	+0.17
Engelmann	65.64	191.7	2.93	+2.6	-0.01
Romberg	65.72	191.8	»	-2.7	-
O. Struve	65.74	»	»	+0.2	+0.05
Secchi	65.81	191.9	2.94	+0.5	+0.04
Engelmann	66.31	192.3	2.96	-1.8	-0.14
Talmage	66.43	192.4	2.97	-3.2	+0.76
Dembowski	66.47	192.5	»	+0.4	-0.07
Winlock	66.55	»	»	+2.1	+0.26
Searle	66.59	192.6	»	+0.9	+0.25
O. Struve	66.61	»	»	-0.7	+0.04
Kaiser	66.67	»	2.98	+1.4	-0.12
Searle	67.30	193.2	3.00	-3.0	+0.15
Winlock	67.31	»	»	+1.8	-0.05
Knott	67.34	»	»	+1.2	0.00
Main	67.37	193.3	»	-1.2	0.00
Dembowski	67.46	193.4	3.01	+0.2	-0.15
Dunér	67.72	193.6	3.02	+1.9	-0.23
Talmage	68.29	194.1	3.05	-0.3	+0.57
Dembowski	68.36	194.2	»	+0.5	-0.11
Brünnow	68.55	194.3	3.06	-0.3	+0.05
O. Struve	68.59	194.4	»	-0.5	-0.10
Dunér	68.60	»	»	+0.3	+0.08
Dembowski	69.54	195.1	3.11	+0.9	-0.07
Talmage	69.57	»	»	+0.1	+0.49
Dunér	69.63	195.2	3.12	-0.1	-0.11

Observer	Epoch	θ_c	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$
Gledhill	1870.38	195.8	3.15	+1.0	+0.20
Dembowski	70.43	»	3.16	+0.7	-0.07
Dunér	70.56	195.9	»	+0.7	+0.02
Peirce	71.41	196.7	3.21	+1.2	+0.02
Talmage	71.42	»	»	0.0	+0.09
Gledhill	71.44	196.8	»	-0.3	+0.07
Dembowski	71.46	»	»	+0.4	-0.10
Wilson	71.51	»	»	-2.5	+0.30
Knott	71.54	»	»	-1.3	0.00
Dunér	71.61	196.9	3.22	-0.4	-0.08
Copeland	72.28	197.4	3.25	-0.9	-
Talmage	72.29	»	»	+0.6	+0.09
Dembowski	72.43	197.5	3.26	+0.3	-0.10
Wilson	72.53	197.6	»	+0.1	-0.01
O. Struve	72.57	»	»	-3.2	+0.01
Copeland	73.40	198.2	3.31	-1.5	-
Wilson	73.42	»	»	+0.2	-0.17
Dembowski	73.49	»	»	+0.1	-0.06
Talmage	73.55	198.3	»	+2.3	+0.33
O. Struve	73.56	»	»	-1.6	-0.17
H. Struve	73.57	»	»	+1.3	-
Gledhill	73.68	198.4	3.32	+0.5	+0.08
Copeland	74.33	198.9	3.34	-0.1	-
Main	74.44	199.0	3.35	+1.5	+0.20
Talmage	74.46	»	»	+0.2	-0.18
Dembowski	74.49	»	»	-0.2	-0.04
O. Struve	74.61	199.1	»	-0.5	+0.09
Dembowski	75.40	199.6	3.39	-0.1	-0.14
Talmage	75.42	»	»	+0.2	-0.83
Schiaparelli	75.46	199.7	»	-1.1	-0.05
Seabroke	75.50	»	»	+0.9	+0.08
Dunér	75.54	»	»	-0.1	-0.11
Nobile	75.69	199.8	3.40	+0.8	+0.36
Doberck	76.29	200.3	3.43	-1.0	-
Hall	76.45	200.4	3.44	-0.4	+0.06
Dembowski	76.47	»	»	+0.3	-0.11
Gledhill	76.48	»	»	+0.2	-0.16
Plummer	76.52	»	»	-1.2	+0.34
Talmage	76.57	»	»	-0.6	+0.01
O. Struve	76.61	200.5	»	-4.2	-0.10
Doberck	77.33	201.0	3.47	-1.4	+0.11
Wilson	77.46	201.1	3.48	+1.1	+0.20
Schiaparelli	77.49	»	»	-1.0	+0.01
Dembowski	77.50	»	»	+0.2	-0.02
Jedrzejewicz	77.53	»	»	+0.5	+0.13
O. Struve	77.58	201.2	»	-1.1	+0.02
Plummer	77.65	»	3.49	+1.1	+0.13
Burnham	78.39	201.7	3.52	+0.6	-0.01
Dembowski	78.50	201.8	»	+0.2	-0.01
Doberck	78.51	»	»	-0.7	-0.13
Schiaparelli	78.54	»	»	-0.6	+0.01
Wilson	78.55	»	»	+0.5	+0.04
Hall	79.45	202.4	3.56	+0.1	+0.10
Schiaparelli	79.54	»	»	-0.3	+0.12
Seabroke	79.64	202.5	3.57	+0.7	-0.33
Burnham	80.39	203.0	3.60	0.0	+0.01

Observer	Epoch	θ_c	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$
Doberck	1880.45	203.1	3.60	+0.9	-0.05
Schiaparelli	80.55	»	»	+0.3	+0.11
Hough	81.05	203.4	3.63	-2.8	+0.31
Doberck	81.26	203.6	3.64	+0.4	+0.04
Hall	81.46	203.7	3.65	-0.7	-0.01
Seabroke	81.67	203.8	3.66	+0.5	+0.02
Hodges	81.73	»	»	-1.0	-
Smith	81.74	»	»	+1.4	-0.29
Hall	82.43	204.3	3.70	-1.7	+0.05
Schiaparelli	82.51	»	»	-0.5	+0.09
O. Struve	82.52	»	»	-0.2	+0.20
Seabroke	82.65	204.4	3.71	+0.5	-
Jedrzejewicz	82.71	»	»	+1.3	+0.21
Engelmann	82.79	»	»	+0.4	-0.01
Hall	83.47	204.8	3.75	-0.3	+0.02
Küstner	83.47	»	»	-0.1	+0.20
Perrotin	83.49	»	»	-1.6	+0.04
Schiaparelli	83.56	»	»	-0.1	0.00
Jedrzejewicz	83.64	204.9	3.76	+1.1	+0.23
Engelmann	83.73	»	»	+1.1	+0.09
Hall	84.48	205.3	3.79	+0.7	+0.01
Perrotin	84.53	»	»	+0.5	+0.07
Pritchett	84.53	»	»	-0.6	-0.05
O. Struve	84.53	»	»	-2.9	-0.16
Schiaparelli	84.54	»	»	+0.1	-0.03
Hall	85.43	205.8	3.83	-0.1	+0.06
L. de Ball	85.43	»	»	-0.4	+0.05
Perrotin	85.53	»	»	-0.9	+0.10
Schiaparelli	85.55	»	»	0.0	+0.03
Jedrzejewicz	85.66	205.9	3.84	+0.9	+0.09
Engelmann	85.74	»	»	+1.4	+0.25
Perrotin	86.47	206.4	3.88	-0.8	+0.11
Hall	86.48	»	»	+0.5	+0.08
Tarrant	86.49	»	»	+1.6	+0.13
Smith	86.56	»	»	0.0	-0.43
Hall	87.44	206.9	3.93	-1.4	+0.06
Schiaparelli	87.53	»	»	+0.2	-0.15
Jedrzejewicz	87.74	207.0	3.94	+1.3	+0.17
Hall	88.44	207.4	3.97	-0.8	-0.06
Schiaparelli	88.57	»	»	0.0	-0.05
Maw	88.62	»	»	+0.4	-0.14
O. Struve	89.14	207.7	3.99	0.0	+0.09
Glasenapp	89.52	207.9	4.01	+0.5	+0.04
Schiaparelli	89.52	»	»	+0.9	-0.07
Burnham	90.33	208.3	4.04	-0.5	+0.04
Glasenapp	90.44	208.4	4.05	+0.5	-0.12
Bigourdan	90.70	208.6	4.06	-1.3	-0.06
Highton	91.48	208.9	4.09	+0.1	+1.21
Schiaparelli	91.49	»	»	-0.4	-
Gledhill	92.56	209.3	4.13	-2.6	-0.13
Comstock	92.62	209.4	»	+0.5	-0.07
Bigourdan	92.64	»	»	-0.1	+0.08
Schiaparelli	92.64	»	»	0.0	-0.08
Jones	93.37	209.7	4.17	-0.1	+0.12
Collins	93.44	209.8	»	-0.9	-0.01
Gledhill	93.45	»	»	-0.2	+0.03

Observer	Epoch	θ_c	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$	Observer	Epoch	θ_c	ϱ_c	$\theta_o - \theta_c$	$\varrho_o - \varrho_c$
Bigourdan	1893.55	209.8	4".17	-0.5	+0".11	Gledhill	1897.51	211.6	4".33	-2.8	-0".03
Coleman	93.60	"	"	-0.3	-0.12	Doolittle	97.52	"	"	+0.2	+0.12
Maw	93.64	209.9	"	-0.1	+0.07	Comas	97.59	"	"	+0.1	+0.06
Gledhill	94.33	210.2	4.20	+0.1	-0.20	Doberck	97.70	211.7	4.34	0.0	-0.02
Highton	94.49	210.3	4.21	+0.2	+0.29	Aitken	97.77	"	"	-1.8	-0.03
Seabroke	94.50	"	"	+1.1	-0.01	Hussey	97.99	211.8	4.35	-0.3	+0.10
Coleman	94.53	"	"	+0.4	+0.06	Glaserapp	98.43	212.0	4.37	+0.9	-0.08
Glaserapp	94.57	"	"	-0.5	-0.13	Gledhill	98.52	"	"	-2.4	-0.27
Hough	95.17	210.5	4.24	-0.9	+0.23	Bryant	98.64	212.1	"	+1.8	+0.21
Coleman	95.45	210.7	4.25	+0.8	-0.20	Doolittle	99.41	212.4	4.41	-0.2	+0.15
Comstock	95.49	"	"	+0.1	+0.03	Greenwich Ph.	99.53	"	"	+0.6	-0.03
Gledhill	95.50	"	"	+1.2	+0.15	Bryant	99.53	"	"	+0.2	-0.07
Schiaparelli	95.54	"	"	0.0	-0.09	Gledhill	1900.35	212.8	4.45	-0.1	-0.05
Glaserapp	95.55	"	"	+0.5	-0.21	Doolittle	00.50	"	"	-0.1	+0.04
Collins	95.59	"	"	-0.3	-0.02	Doberck	00.58	"	"	-0.1	+0.15
Schwarzschild	95.59	"	"	-0.8	0.00	Boeger	00.58	"	"	+4.8	-0.12
See	95.72	210.8	4.26	-1.9	0.00	Maw	00.61	"	"	0.0	+0.26
Comstock	96.41	211.1	4.29	-3.1	-0.03	Burnham	01.29	213.1	4.48	+0.1	-0.16
Leavenworth	96.44	"	"	0.0	+0.01	Bryant	01.69	213.3	4.50	+1.7	+0.03
Bowyer	96.45	"	"	-2.1	-0.12	Doberck	02.74	213.7	4.54	+0.4	+0.03
Lewis	96.45	"	"	+1.0	-0.15	Doolittle	03.39	214.0	4.57	+0.4	-0.06
Knorre	96.5	"	"	-0.9	0.00	Doberck	03.43	"	"	-0.5	+0.01
Lewis	97.37	211.6	4.33	0.0	+0.09	Biesbroeck	03.53	"	"	+0.3	-0.05
Glaserapp	97.50	"	"	+1.8	+0.05						

In the following table the probable errors of the annual means of each observer's measures are given. The constant error in distance signifies: observation—calculation. Sixty years ago, and earlier, σ Coronae was considered to be a very difficult object, since then it has constantly become easier to measure it.

Observer	Angle			Distance			Observer	Angle			Distance		
	at 3"	P. E.	arc	Constant	P. E.	n		at 3"	P. E.	arc	Constant	P. E.	n
Herschel and South	± 1.26	± 0.065	9	$+0.073$	± 0.104	6	Talmage	± 0.80	± 0.042	9	$+0.148$	± 0.316	9
Smyth	± 0.41	± 0.021	7	$+0.056$	± 0.038	7	Gledhill	± 1.16	± 0.061	11	-0.028	± 0.104	11
Dawes	± 0.42	± 0.022	18	$+0.043$	± 0.058	13	Schiaparelli	± 0.40	± 0.021	15	-0.011	± 0.064	14
W. Struve	± 0.66	± 0.034	9	$+0.017$	± 0.036	7	Hall	± 0.75	± 0.039	10	$+0.037$	± 0.033	10
O. Struve	± 1.02	± 0.052	32	-0.042	± 0.061	32	Seabroke	± 0.80	± 0.042	5	-0.060	± 0.131	4
Mädler	± 0.75	± 0.039	24	$+0.153$	± 0.068	23	Doberck	± 0.63	± 0.033	7	$+0.019$	± 0.066	7
Jacob	± 0.47	± 0.025	6	$+0.037$	± 0.100	6	Burnham	± 0.39	± 0.020	4	-0.030	± 0.063	4
Secchi	± 0.59	± 0.031	4	-0.040	± 0.058	4	Jedrzejewicz	± 1.08	± 0.056	5	$+0.166$	± 0.042	5
Demkowski	± 0.47	± 0.025	21	-0.041	± 0.055	21	Perrotin	± 1.17	± 0.061	4	$+0.080$	± 0.024	4
Engelmann	± 1.25	± 0.065	6	$+0.070$	± 0.115	6	Glaserapp	± 1.02	± 0.053	6	-0.075	± 0.076	6
Dunér	± 0.71	± 0.037	6	-0.072	± 0.076	6	Doolittle	± 0.32	± 0.017	4	$+0.067$	± 0.070	4

The following ephemeris has been calculated from the formulae:

$$\varrho \cos \theta = +0.548 - 4.8095 \sin(E + 7^\circ 44') \quad \varrho \sin \theta = -6.674 + 7.874 \sin(88^\circ 8' - E)$$

$$\pm z = -3.693 + 4.362 \sin(86^\circ 48' - E)$$

but the ephemeris shows apparent places:

t	θ_c	ϱ_c	z	Δ	t	θ_c	ϱ_c	z	Δ
1900.5	212.8	4.451	1.419	0.107	1916.5	218.5	5.051	1.832	0.099
1904.5	214.4	4.607	1.525	0.105	1920.5	219.7	5.194	1.930	0.097
1908.5	215.8	4.757	1.629	0.103	1924.5	220.8	5.333	2.026	0.095
1912.5	217.2	4.906	1.731	0.101					

This ephemeris shows the value, z , of the invisible line of sight coordinate, as well as the rate, Δ , at which this increases in four years. This latter quantity is required by spectroscopists, who wish to determine the parallax by comparing Δ with the line of sight velocity expressed in diameters of the earth's orbit per annum. Owing to the moderate value of the inclination of the orbit of σ Coronae it is perhaps not likely that the latter quantity will be measured for

some years, but I am computing the same data for other binary stars. Taking the hypothetical parallax into account hints may thus be obtained as to which binary stars are most suitable for observing the difference between the line of sight motion of the two components. The hypothetical parallax is equal to 0".064 but the actual parallax is probably smaller, and the mass of this system is probably greater than the mass of the sun.

Hongkong Observatory, 1905 May 14.

W. Doberck.

Observations of Jupiter's sixth satellite

from photographs taken with the 30inch reflector of the Thompson equatorial at the Royal Observatory, Greenwich.

1905	Gr. M. T.	ϕ	s	Tab.—Obs. *)		Exp.
		ϕ	s	ϕ	s	
Aug. 23	13 ^h 30 ^m	311° 9'	25' 30"	—	—	30 ^m
23	14 23	310 45	25 33	—	—	31
Sept. 3	15 17	290 51	36 59	+4.8	-0.5	40
7	13 26	286 54	40 52	+3.9	-1.0	60
7	15 32	286 48	40 54	+4.0	-1.0	55
8	12 56	285 54	41 43	+3.7	-0.9	30
12	14 37	281 29	45 16	+4.0	-1.5	20
12	15 5	281 26	45 17	+4.0	-1.5	20
12	15 42	281 32	45 17	+4.0	-1.5	30
30	12 17	267 34	54 53	+3.2	-0.6	60
Oct. 4	12 25	264 51	55 29	+2.8	-0.5	40
4	16 38	264 41	55 31	+2.9	-0.5	39
5	11 52	264 3	55 33	+2.7	-0.5	30

Royal Observatory, Greenwich, 1905 Oct. 7.

*) Vgl. die Ephemeride von F. E. Ross A. N. 4042. Kr.

The photographs were taken by Mr. *Melotte*, with the exception of two taken by Mr. *Edney* (Sept. 8 and Oct. 4) and two taken by Mr. *Davidson* (Oct. 5).

Supplementary exposures were given on several of the plates for determination of orientation, and the position angles were inferred from these by reference to a pair of stars common to all the plates.

The over-exposed image of Jupiter was reduced with ferri-cyanide of potassium, leaving a reversed image which was easily measurable.

The measures of position angle and distance from Jupiter, made in the position micrometer, are to be considered as merely provisional pending more complete measures with the help of reference stars. No corrections have as yet been applied for differential refraction or aberration.

Elementi del pianeta (554) Peraga.

Il pianeta Peraga scoperto da P. Götz a Königstuhl-Heidelberg l' 8 Gennaio 1905 fu osservato in questa prima apparizione, per quanto è a mia conoscenza, ad Arcetri, Düsseldorf, Padova, Roma, Vienna. Con le tre osservazioni fatte a Padova all'equatoriale Dembowsky, due dal prof. Antoniazzi nelle notti 13 Gennaio e 24 Febbrajo ed una da me nella notte del 3 Febbrajo, seguendo il metodo di Encke-Tietjen, ho ottenuto questi elementi:

Epoca 1905 Gennaio 0.0 t. m. Berlino.

$$\left. \begin{aligned} M &= 39^{\circ} 15' 59''.8 \\ \omega &= 127 44 38.4 \\ \Omega &= 295 39 11.9 \\ i &= 2 53 23.1 \\ \varphi &= 8 27 41.0 \\ \mu &= 976''.034 \\ \log a &= 0.373695 \end{aligned} \right\} 1905.0$$

Una effemeride calcolata su questi elementi per l'intervallo di tempo dal 10 Gennaio al 13 Marzo 1905 mi ha permesso di calcolare le differenze O—C in ascensione retta ed in declinazione per ciascuna delle 58 osservazioni ese-

guite nel predetto intervallo e nei luoghi sopra indicati. Tali differenze furono raggruppate nei tre seguenti luoghi normali fondati rispettivamente sopra 18, 22, 18 osservazioni considerate tutte come di uguale peso:

T. m. Berlino 1905	O—C		1905.0	
	$\Delta\alpha$	$\Delta\delta$	α	δ
Gen. 17.5	-0.46	-0.8	8 ^h 23 ^m 51.96	+18° 51' 25".8
Febr. 8.5	+0.33	-3.7	8 1 11.84	+19 25 37.9
Marz. 6.5	-2.17	+5.3	7 50 15.65	+19 28 7.1

Partendo da questi tre luoghi ho ricalcolato l'orbita ed ho ottenuto gli elementi eclittici:

Epoca 1905 Gennaio 0.0 t. m. Berlino.

$$\left. \begin{aligned} M &= 41^{\circ} 20' 15''.3 \\ \omega &= 124 25 29.3 \\ \Omega &= 295 43 16.2 \\ i &= 2 56 13.2 \\ \varphi &= 8 54 53.0 \\ \mu &= 969''.164 \\ \log a &= 0.375740 \end{aligned} \right\} 1905.0$$