ELLIPTICAL ORBIT OF ASTEROID 1986 QE1

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ABSTRACT

We present the orbital elements of asteroid QE1 (provisional designation) identified in august 26, 1986, on a photographic plate obtained at the GPO telescope of the European Southern Observatory (ESO), La Silla, Chile, as well as the positions (AR and Dec) referred to 1950.0. Residues (O - C) of the position in AR and Dec of the asteroid are given, both before and after applying variation in the geocentric distance.

INTRODUCTION

We have determined 39 positions of the asteroid QE1 (provisional designation), discovered during observations august 26 and september 14, 1986, at the astrometric GPO telescope (D= 40 cm; F= 4 m) of the European Southern Observatory - ESO, La Silla, Chile. Based on such positions, which are referred to the 1950.0 equinox, computations were performed in order to obtain the orbital parameters, through the Gauss-Encke method.

OBSERVATIONAL METHOD

Kodak II aO plates (16 cm x 16 cm) previously hypersensitized were used. We have employed the classical method of three esposures with displacements in declination and dephasings in time. This method yelds an economy both in time and photographic material, also making easier the posterior identification of the celestial bodies in relation to the stellar field.

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Due to the exceptional conditions of atmospheric transparency at La Silla, and to the operation of hypersensitizing the plates, stellar magnitude 18 can be attained with an 8 minutes exposure. The astrometric GPO telescope (D=40 cm; F=4 m) at ESO, La Silla, was utilized in this observational program.

REDUCTION

Obtention of positions

After identifying the five reference stars through the SAO Star Catalogue and the SAO Star Atlas, for which the equinox is 1950.0, we have performe the reduction through the "Uccle five stars" program, using the least squares method (Machado and Debehogne, 1979).

Obtention of orbital elements

The three basic positions for computations were those of 1986 sept. 2.22253, 1986 sept. 4.24684 and 1986 sept. 7.23966. The method of Gauss-Encke, with successive improvements through variations of geocentric distances of the asteroid has yielded the orbital elements (Debehogne, 1964).

The residues O-C in right ascension ($\Delta\alpha \cos\delta$) and in declination ($\Delta\delta$), before and after variation in the geocentric distance, were also listed, for the sake of control.

RESULTS

Positions

Table 1 gives the data in U.T., the positions (AR and Dec) referred to 1950.0, and the residues in AR and Dec, before and after applying the variation in the geocentric distance of the asteroid. Residues are published to show the precision of the results.

Orbital elements

The orbital elements computed from the data in Table 1 are:

Epoch 1986 1 18.0 UT

M_o = -4.32407°
Ω = 75.21962°
ω = 262.72835°
i = 2.83621°
a = 2.251413 AU
e = 0.1604811 or φ = 9.23482°
μ = 0.2917570°/d = 1050.325"/d
T = 1986 9 1.820784 (perihelium passage)
g = 15.8 (absolute magnitude)

Direction co-sinus of the coordinate axes are:

P'_x = 0.9256684 P'_y = -9.3246528 P'_z = -0.1942640
Q'_x = 0.3752985 Q'_y = 0.8528788 Q'_z = 0.3629723

ACKNOWLEDGEMENTS

The European Southern Observatory has furnished the photographic plates and covered expenses of air fare Brussels--Santiago-Brussel as well as trips and lodging of Dr. Debehogne in Chile.

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TABLE I

DATE	POSITIONS RA(1950.0) H M S	POSITIONS D(1950.0) ° ′ ″	RESIDUALS BEFORE VARIATION RA S	RA ″	DEC ″	RESIDUALS AFTER VARIATION RA S	RA ″	DEC ″
1986 8 26.17844	22 50 40.672	-13 49 3.86	.575	8.57	1.70	.005	.07	.51
1986 8 26.18399	22 50 40.349	-13 49 5.87	.549	8.00	1.68	-.020	-.30	.52
1986 8 26.18955	22 50 40.055	-13 49 7.55	.583	8.49	1.71	.014	.20	.55
1986 8 27.11246	22 49 53.534	-13 54 33.84	.448	6.52	1.59	.002	.03	.74
1986 8 27.11807	22 49 53.554	-13 54 35.51	.446	6.49	1.62	.000	.01	.77
1986 8 27.12357	22 49 53.259	-13 54 37.76	.449	6.54	1.66	.004	.06	.82
1986 8 29.21107	22 48 5.862	-14 6 46.03	.242	3.52	.77	.012	.18	.42
1986 8 29.21663	22 48 5.557	-14 6 48.02	.245	3.57	.69	.016	.23	.34
1986 8 29.22219	22 48 5.270	-14 6 50.18	.267	3.58	.44	.038	.55	.09
1986 9 1.16281	22 45 31.439	-14 23 19.19	.004	.05	-.45	-.032	-.46	-.45
1986 9 1.16767	22 45 31.178	-14 23 20.51	.017	.25	-.46	-.019	-.27	-.50
1986 9 1.17253	22 45 30.919	-14 23 22.30	.032	.47	-.55	-.005	-.05	-.59
1986 9 2.21767	22 44 35.568	-14 29 .22	-.024	-.35	-.08	-.024	-.35	-.08
1986 9 2.22253	22 44 35.317	-14 29 1.69	.000	.00	.00	.000	.00	.00
1986 9 2.22740	22 44 35.061	-14 29 3.10	.019	.27	.07	.019	.27	.07
1986 9 3.31142	22 43 37.526	-14 34 44.59	-.019	-.28	.00	.001	.02	.01
1986 9 3.31628	22 43 37.257	-14 34 46.38	-.018	-.27	+.03	.002	.03	-.01
1986 9 3.32115	22 43 36.986	-14 34 47.85	-.021	-.30	-.03	-.001	-.01	-.01
1986 9 4.24198	22 42 48.709	-14 39 31.62	-.016	-.24	.00	.016	.23	.01
1986 9 4.24684	22 42 48.432	-14 39 33.07	.000	.00	.00	.032	.46	.01
1986 9 4.25170	22 42 48.197	-14 39 34.55	.018	.26	-.03	.050	.72	-.02
1986 9 5.34371	22 41 50.551	-14 45 .58	-.020	-.29	-.64	.007	.09	-.65
1986 9 5.34892	22 41 50.265	-14 45 2.11	-.025	-.35	-.79	.002	.02	-.80
1986 9 5.35378	22 41 49.997	-14 45 3.49	-.027	-.39	-.71	-.001	-.01	-.70
1986 9 6.31003	22 41 .135	-14 49 29.80	-.017	-.25	-.04	.000	.00	-.01
1986 9 6.31490	22 40 59.925	-14 49 41.08	-.015	-.23	.04	-.003	-.04	.01
1986 9 6.31976	22 40 59.665	-14 49 42.31	-.014	-.20	.02	.002	.03	.01
1986 9 7.23503	22 40 12.351	-14 53 59.15	.015	.18	.10	.013	.19	.19
1986 9 7.23966	22 40 12.353	-14 54 .30	.000	.00	.00	.000	.00	.00
1986 9 7.24452	22 40 11.986	-14 54 1.82	.001	.01	-.01	.000	.01	-.01
1986 9 9.19573	22 38 32.207	-15 2 38.68	.055	.79	-.75	-.005	-.06	-.77
1986 9 9.19059	22 38 32.569	-15 2 37.79	.080	1.16	-.65	.022	.32	-.55
1986 9 9.19545	22 38 32.311	-15 2 39.16	.055	1.23	-.77	.027	.35	-.70
1986 9 11.28642	22 36 48.820	-15 11 4.44	.156	2.26	-1.04	.006	.09	-.72
1986 9 11.29128	22 36 48.559	-15 11 5.53	.155	2.25	-.56	.004	.07	-.51
1986 9 11.29614	22 36 48.319	-15 11 6.21	.153	2.22	-.68	.002	.03	-.55
1986 9 14.35864	22 34 23.973	-15 21 48.98	.254	3.68	-1.13	-.047	-.68	-.32
1986 9 14.36351	22 34 23.759	-15 21 49.67	.261	3.78	-.96	-.040	-.58	-.15
1986 9 14.36837	22 34 23.520	-15 21 50.49	.249	3.67	-1.12	-.051	-.75	-.31