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Professional paper

POSITIONS AND ORBITS OF FOUR MINOR PLANETS DISCOVERED AT THE ESO – LA SILLA IN 1988

H. Debehogne[1] and V. Protitch-Benishek[2]

[1] *Observatoire Royal de Belgique, Avenue Circulaires 3, 1180 Bruxelles, Belgium*

[2] *Astronomical Observatory, Volgina 7, 11050 Belgrade, Yugoslavia*

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SUMMARY: During the second mission in 1988 at European South Observatory – La Silla, 152 precise astrometric positions of four new-discovered minor planets were obtained with Grand Prism Objective (GPO). On the basic of these positions the elliptic orbits are derived by Gauss-Encke method.

The present paper contains the results of the photographic observations of four new-discovered minor planets during the mission in September 1988 at La Silla Observatory. Their designations are: E 4087 = 1988 RG4, E 4089 = 1988 RV4, E 4101 = 1988 RX4 and E 4107 = 1988 RA5.

Observations were performed with 40 cm GPO using Kodak spectroscopic plates 103a - O. All the plates were measured on the Optronics measuring machine in Garching and on the Ascorecord Zeiss in Uccle.

Amelioration of elliptic orbits, derived by Gauss-Encke method, was done using the method of two distance variation.

The results of observations and minor planets orbital elements are presented in the next four tables.

Table I E 4089 = 1988 RV 4: Observations and residuals

BASIC OBSERVATIONS DATES = 1988 9 3.24336 1988 9 9.37738 1988 9 18.29370
BASIC OBSERVATIONS NUMERALS = 5 17 26

EPOCH = 1988 9 6

MO= 14.82873 NODE= 302 69944 LONG.PER.= 22.60190 INCL.= 1.63176
SEMI-MAJOR AXIS= 2.6566445 EXC.= .1761529 FI= 10.14576
MU DEGREE = .2276166 MU ARC-SEC.= 819.41971

ABSOLUTE MAGN.= 14.366 PERIHELIUM PASSAGE = 1988 7 2.852141
COSIN.DIRECT. OF AXIS= .8220262 −.5267111 −.2164448
.5689453 .7436630 .3510934

DATE			RA(1950.0)			D(1950.0)			RESIDUALS	IN RA	IN D
			h	m	s	°	′	″	s	″	″
1988	9	1.15447	23	22	28.229	−1	51	52.20	−.043	−.64	.01
1988	9	1.16072	23	22	27.928	−1	51	53.91	−.037	−.56	−.23
1988	9	1.16697	23	22	27.630	−1	51	55.44	−.028	−.42	−.29
1988	9	3.23711	23	20	49.531	−2	0	19.74	−.026	−.39	−.27
1988	9	3.24336	23	20	49.241	−2	0	21.02	.000	.00	.00
1988	9	3.24961	23	20	48.950	−2	0	22.53	.025	.37	.04
1988	9	5.35586	23	19	6.278	−2	9	16.70	.002	.03	−.03
1988	9	5.36211	23	19	6.426	−2	9	18.15	.015	.23	.13
1988	9	5.36836	23	19	6.122	−2	9	19.75	.026	.39	.13
1988	9	7.38016	23	17	27.140	−2	18	6.87	−.004	−.06	−.20
1988	9	7.38641	23	17	26.827	−2	18	8.51	−.001	−.01	−.19
1988	9	7.39266	23	17	26.516	−2	18	10.40	.004	.06	−.43
1988	9	8.37461	23	16	37.883	−2	22	31.47	−.006	−.10	.35
1988	9	8.38086	23	16	37.550	−2	22	33.30	−.022	−.33	.18
1988	9	8.38711	23	16	37.217	−2	22	34.98	−.038	−.57	.17
1988	9	9.37113	23	15	48.399	−2	27	.59	−.001	−.01	−.55
1988	9	9.37738	23	15	48.091	−2	27	2.26	.009	.14	−.54
1988	9	9.38363	23	15	47.795	−2	27	3.92	.031	.46	−.52
1988	9	11.37252	23	14	8.897	−2	36	4.07	−.028	−.42	.24
1988	9	11.37877	23	14	8.582	−2	36	5.72	−.026	−.39	.29
1988	9	11.38502	23	14	8.317	−2	36	8.17	.025	.38	−.46
1988	9	14.32217	23	11	43.396	−2	49	33.34	.005	.07	−.40
1988	9	14.32912	23	11	43.045	−2	49	35.21	.005	.08	−.38
1988	9	14.33606	23	11	42.704	−2	49	37.14	.015	.22	−.41
1988	9	18.28815	23	8	32.805	−3	7	31.94	−.005	−.08	.03
1988	9	18.29370	23	8	32.539	−3	7	33.45	.000	.00	.00
1988	9	18.29926	23	8	32.249	−3	7	34.97	−.019	−.28	−.04
1988	9	19.28225	23	7	46.450	−3	11	57.42	−.008	−.12	.41
1988	9	19.28711	23	7	46.223	−3	11	58.84	−.001	−.01	.28
1988	9	19.29197	23	7	45.996	−3	12	.13	.006	.09	.27
1988	9	20.30724	23	6	59.342	−3	16	28.66	−.014	−.21	.37
1988	9	20.31210	23	6	59.119	−3	16	29.98	−.008	−.12	.32
1988	9	20.31697	23	6	58.896	−3	16	31.28	−.003	−.04	.29

1 AMELIORATION(S), X= .0680615 Y= .0421037 TO ADD AT DELTA1, DELTA 3

Table II E 4087 = 1988 RG 4: Observations and residuals

BASIC OBSERVATIONS DATES= 1988 9 5.17183 1988 9 10.04683 1988 9 17.16558
BASIC OBSERVATIONS NUMERALS= 8 19 34

EPOCH= 1988 9 6

MO=121.82601 NODE= 119.66290 LONG.PER.= 83.22505 INCL.= 6.52302
SEMI-MAJOR AXIS= 2.3945309 EXC.= .0864296 FI= 4.95824
MU DEGREE= .2659950 MU ARC-SEC.= 957.58183

ABSOLUTE MAGN.= 13.766 PERIHELIUM PASSAGE= 1987 6 5.998777
COSIN.DIRECT OF AXIS= −.9156812 −.3987892 −.0499518
.3895938 −.8502213 −.3540346

RESIDUALS

DATE			RA(1950.0)			D(1950.0)			RESIDUALS	IN RA	IN D
			h	m	s	°	′	″	s	″	″
1988	9	1.06350	22	3	31.531	−17	58	39.29	−.002	−.03	−.13
1988	9	1.06974	22	3	31.194	−17	58	41.83	−.002	−.03	−.27
1988	9	1.07599	22	3	30.855	−17	58	44.03	−.004	−.05	−.08
1988	9	3.11940	22	1	45.457	−18	11	23.34	−.017	−.24	.02
1988	9	3.12565	22	1	45.132	−18	11	25.67	−.011	−.15	−.03
1988	9	3.13155	22	1	44.805	−18	11	27.61	−.025	−.35	.18
1988	9	5.16558	22	0	2.881	−18	23	24.95	−.005	−.07	.11
1988	9	5.17183	22	0	2.564	−18	23	27.20	.000	.00	.00
1988	9	5.17808	22	0	2.241	−18	23	29.40	−.001	−.02	−.06
1988	9	7.04127	21	58	32.248	−18	33	51.12	−.005	−.07	−.64
1988	9	7.04752	21	58	31.948	−18	33	53.25	.003	.05	−.71
1988	9	7.05377	21	58	31.640	−18	33	55.23	.004	.06	−.62
1988	9	7.06211	21	58	31.210	−18	33	57.68	−.014	−.20	−.33
1988	9	7.06836	21	58	30.906	−18	33	59.75	−.009	−.13	−.34
1988	9	10.02044	21	56	14.926	−18	49	10.02	−.020	−.28	−.01
1988	9	10.02669	21	56	14.642	−18	49	11.73	−.015	−.22	.15
1988	9	10.03294	21	56	14.326	−18	49	13.50	−.043	−.61	.25
1988	9	10.04058	21	56	14.082	−18	49	16.68	.066	.94	−.65
1988	9	10.04683	21	56	13.785	−18	49	18.59	.059	.83	−.69
1988	9	10.05308	21	56	13.499	−18	49	20.52	.062	.88	−.76
1988	9	11.19336	21	55	23.114	−18	54	45.90	−.045	−.64	.48
1988	9	11.19961	21	55	22.832	−18	54	47.72	−.045	−.63	.39
1988	9	11.20586	21	55	22.553	−18	54	49.51	−.041	−.59	.33
1988	9	13.10238	21	54	3.145	−19	3	20.95	.015	.21	.04
1988	9	13.10863	21	54	2.875	−19	3	22.59	.013	.19	.03
1988	9	13.11488	21	54	2.609	−19	3	24.24	.016	.23	.00
1988	9	14.12252	21	53	22.056	−19	7	39.69	−.034	−.49	−.42
1988	9	14.12877	21	53	21.801	−19	7	41.16	−.029	−.41	−.34
1988	9	14.13502	21	53	21.550	−19	7	42.48	−.020	−.28	−.12
1988	9	16.22252	21	52	1.875	−19	15	53.22	.029	.40	.17
1988	9	16.22912	21	52	1.621	−19	15	54.78	.028	.39	.04
1988	9	16.23572	21	52	1.360	−19	15	56.34	.019	.27	−.08
1988	9	17.15725	21	51	28.287	−19	19	17.42	−.014	−.19	.08
1988	9	17.16558	21	51	27.989	−19	19	19.25	.000	.00	.00
1988	9	17.17322	21	51	27.714	−19	19	20.95	.010	.15	−.10
1988	9	18.03294	21	50	58.110	−19	22	19.32	−.032	−.45	−.12

DATE			RA(1950.0)			D(1950.0)			RESIDUALS	IN RA	IN D
			h	m	s	o	′	″	s	″	″
1988	9	18.03815	21	50	57.939	−19	22	20.39	−.015	−.22	−.11
1988	9	18.04335	21	50	57.676	−19	22	21.39	.000	.00	−.03
1988	9	19.03572	21	50	24.664	−19	25	37.02	−.018	−.26	−.39
1988	9	19.04961	21	50	24.206	−19	25	39.79	.003	.05	−.45
1988	9	19.06350	21	50	23.705	−19	25	42.57	−.018	−.25	−.53

3 AMELIORATION(S), X= .0532690 Y= .1393020 TO ADD AT DELTA1, DELTA3

Table III E 4101 = 1988 RX 4: Observations and residuals

BASIC OBSERVATIONS DATES = 1988 9 5.17183 1988 9 11.19961 1988 9 17.16558
BASIC OBSERVATIONS NUMERALS = 8 17 29

EPOCH = 1988 9 6

MO= -9.49301 NODE= 103.12599 LONG.PER.= 245.95840 INCL.= 3.54759
SEMI-MAJOR AXIS= 2.4182604 EXC.= .2154737 FI= 12.44332
MU DEGREE= .2620894 MU ARC-SEC.= 943.52186

ABSOLUTE MAGN.= 14.860 PERIHELIUM PASSAGE= 1988 10 12.220491
COSIN DIRECT. OF AXIS= .9802028 −.1516204 −.1273328
.1886028 .9107377 .3674042

RESIDUALS

DATE			RA(1950.0)			D(1950.0)			RESIDUALS	IN RA	IN D
			h	m	s	o	′	″	s	″	″
1988	9	2.04336	21	56	28.325	−18	30	14.30	.055	.78	−.08
1988	9	2.04961	21	56	28.062	−18	30	16.36	.077	1.09	−.19
1988	9	2.05586	21	56	27.802	−18	30	18.33	.102	1.45	−.22
1988	9	4.14197	21	55	00.200	−18	40	18.52	.009	.13	.30
1988	9	4.14822	21	54	59.943	−18	40	20.33	.030	.42	.22
1988	9	4.15447	21	54	59.675	−18	40	22.13	.039	.56	.14
1988	9	5.16558	21	54	18.972	−18	44	54.05	−.020	−.28	−.01
1988	9	5.17183	21	54	18.722	−18	44	55.67	.000	.00	.00
1988	9	5.17808	21	54	18.474	−18	44	57.25	.022	.31	.04
1988	9	7.04127	21	53	07.351	−18	52	43.59	−.002	−.02	−.27
1988	9	7.04752	21	53	07.098	−18	52	45.15	−.004	−.06	−.28
1988	9	7.05377	21	53	06.865	−18	52	46.63	.014	.20	−.21
1988	9	9.05238	21	51	55.287	−19	00	16.08	.019	.27	−.44
1988	9	9.05863	21	51	55.081	−19	00	17.38	.048	.67	−.37
1988	9	9.06488	21	51	54.839	−19	00	18.95	.040	.57	−.57
1988	9	11.19336	21	50	44.675	−19	07	16.03	−.009	−.13	.16
1988	9	11.19961	21	50	44.473	−19	07	17.25	.003	.05	.03
1988	9	11.20586	21	50	44.259	−19	07	18.26	.004	.05	.11
1988	9	13.10238	21	49	48.768	−19	12	36.59	−.022	−.31	−.15
1988	9	13.10863	21	49	48.585	−19	12	37.60	−.009	−.12	−.18
1988	9	13.11488	21	49	48.400	−19	12	38.58	.002	.03	−.19
1988	9	14.12252	21	49	21.252	−19	15	05.92	−.011	−.15	.12
1988	9	14.12877	21	49	21.093	−19	15	06.81	.015	.21	.10
1988	9	14.13502	21	49	20.922	−19	15	07.78	.029	.40	−.01
1988	9	16.22251	21	48	30.395	−19	19	25.66	.009	.12	−.08

DATE			RA(1950.0)			D(1950.0)			RESIDUALS	IN RA	IN D
			h	m	s	°	′	″	s	″	″
1988	9	16.22912	21	48	30.234	−19	19	26.43	.011	.16	−.20
1988	9	16.23572	21	48	30.071	−19	19	27.33	.012	.16	−.46
1988	9	17.15725	21	48	10.749	−19	21	01.25	−.017	−.24	−.24
1988	9	17.16558	21	48	10.569	−19	21	01.76	.000	.00	.00
1988	9	17.17322	21	48	10.428	−19	21	02.55	.039	.55	−.11
1988	9	18.03294	21	47	54.148	−19	22	18.64	−.003	−.04	−.53
1988	9	18.03815	21	47	54.053	−19	22	19.00	−.015	−.22	−.43
1988	9	18.04335	21	47	53.939	−19	22	19.38	.014	.20	−.34
1988	9	19.03572	21	47	36.479	−19	23	33.36	−.012	−.17	−.58
1988	9	19.04961	21	47	36.231	−19	23	34.41	.015	.21	.53
1988	9	19.06350	21	47	35.984	−19	23	35.45	.043	.61	−.57

Table IV E4107 = 1988RA5: Observations and residuals

ORBIT ELEMENTS (ALL ANGLES IN DEGREES)

BASIC OBSERVATIONS DATES = 1988 9 3.12565 1988 9 9.05863 1988 9 16.22912
BASIC OBSERVATIONS NUMERALS = 5 17 32

EPOCH = 1988 9 6

MO= -1.85444 NODE= 93.50643 LONG.PER.= 243.09057 INCL.= 3.61096
SEMI-MAJOR AXIS= 2.4718127 EXC.= .1749523 FI= 10.07588
MU DEGREE=.2536184 MU ARC-SEC.= 913.02618

ABSOLUTE MAGN.= 14.044 PERIHELIUM PASSAGE = 1988 9 13.311945
COSIN.DIRECT. OF AXIS= .9159668 −.3421743 −.2095749
.3962992 .8532836 .3389013

RESIDUALS

DATE			RA(1950.0)			D(1950.0)			RESIDUALS	IN RA	IN D
			h	m	s	°	′	″	s	″	″
1988	9	2.04336	22	0	47.731	−18	35	13.78	.003	.04	.19
1988	9	2.04961	22	0	47.395	−18	35	15.24	−.032	−.45	.50
1988	9	2.05586	22	0	47.118	−18	35	16.91	−.007	−.10	.59
1988	9	3.11940	21	59	58.688	−18	40	1.09	−.006	−.09	.02
1988	9	3.12565	21	59	58.394	−18	40	2.76	.000	.00	.00
1988	9	3.13155	21	59	58.128	−18	40	4.52	.018	.25	−.21
1988	9	4.14197	21	59	13.203	−18	44	21.61	.018	.25	−.04
1988	9	4.14822	21	59	12.906	−18	44	23.20	.015	.22	−.06
1988	9	4.15447	21	59	12.590	−18	44	24.43	−.006	−.09	.27
1988	9	5.16558	21	58	28.626	−18	48	30.51	−.025	−.36	−.26
1988	9	5.17183	21	58	28.354	−18	48	32.01	−.009	−.13	−.29
1988	9	5.17808	21	58	28.069	−18	48	33.78	−.006	−.09	−.59
1988	9	7.04127	21	57	10.506	−18	55	33.25	.003	.04	−.02
1988	9	7.04752	21	57	10.223	−18	55	33.91	−.010	−.14	.71
1988	9	7.05377	21	57	9.955	−18	55	35.35	−.007	−.09	.66
1988	9	9.05238	21	55	50.941	−19	2	20.03	−.064	−.91	−.54
1988	9	9.05863	21	55	50.692	−19	2	21.31	−.057	−.81	−.59
1988	9	9.06488	21	55	50.451	−19	2	22.62	−.042	−.60	−.67

DATE			RA(1950.0)			D(1950.0)			RESIDUALS	IN RA	IN D
			h	m	s	o	′	″	s	″	″
1988	9	10.04058	21	55	13.953	−19	5	19.53	.002	.03	.72
1988	9	10.04683	21	55	13.709	−19	5	20.67	.004	.06	.74
1988	9	10.05308	21	55	13.467	−19	5	22.84	.009	.13	−.28
1988	9	11.19336	21	54	31.976	−19	8	35.14	.000	.00	.45
1988	9	11.19961	21	54	31.754	−19	8	36.18	.016	.23	.39
1988	9	11.20586	21	54	31.507	−19	8	37.37	.007	.10	.17
1988	9	13.10238	21	53	27.934	−19	13	20.61	.039	.55	−.19
1988	9	13.10863	21	53	27.727	−19	13	21.52	.053	.75	−.23
1988	9	13.11488	21	53	27.509	−19	13	22.73	.056	.79	−.58
1988	9	14.12252	21	52	55.800	−19	15	33.13	.002	.02	−.30
1988	9	14.12877	21	52	55.554	−19	15	33.60	−.034	−.48	.00
1988	9	14.13502	21	52	55.361	−19	15	34.51	−.016	−.23	−.15
1988	9	16.22252	21	51	55.028	−19	19	21.21	.000	.00	−.21
1988	9	16.22912	21	51	54.834	−19	19	21.57	.000	.00	.00
1988	9	16.23572	21	51	54.637	−19	19	22.29	−.003	−.05	−.16
1988	9	17.15725	21	51	30.699	−19	20	43.92	−.040	−.57	.18
1988	9	17.16558	21	51	30.469	−19	20	44.65	−.035	−.49	.10
1988	9	17.17322	21	51	30.271	−19	20	45.00	−.017	−.24	.34
1988	9	18.03924	21	51	9.568	−19	21	50.83	−.026	−.37	−.14
1988	9	18.03815	21	51	9.452	−19	21	51.49	−.005	−.07	−.40
1988	9	18.04335	21	51	9.342	−19	21	51.67	.023	.33	−.18
1988	9	19.03572	21	50	46.671	−19	22	54.29	.011	.15	.31
1988	9	19.04961	21	50	46.337	−19	22	54.97	.020	.28	.50
1988	9	19.06350	21	50	45.950	−19	22	56.19	−.023	−.33	.14

1 AMELIORATION(S), X= .0585613 Y= .0213901 TO ADD AT DELTA1, DELTA3.

ПОЛОЖАЈИ И ОРБИТЕ ЧЕТИРИ МАЛЕ ПЛАНЕТЕ ОТКРИВЕНЕ СА ESO – LA SILLA 1988. ГОДИНЕ

H. Debehogne[1] и В. Протић-Бенишек[2]

[1] *Краљевска опсерваторија, Брисел, Белгија*

[2] *Астрономска опсерваторија, Волгина 7, 11050 Београд, Југославија*

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Стручни рад

У току друге мисије 1988. године на Европској јужној опсерваторији у La Silla (Чиле) H. Debehogne је открио четири нове мале планете: E 4087, E 4089, E 4101 и E 4107. Све оне добиле су и своје привремене ознаке. У раду су дати њихови прецизни астрографски положаји и орбитални елемент изведени методом Gauss-Encke.