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POSITIONS DE PETITES PLANÈTES OBTENUES EN 1976 AU GRAND PRISME OBJECTIF DE 40 CM ($\breve{f} = 4$ M) DE L'OBSERVATOIRE D'ESO À LA SILLA

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OBSERVATIONS OF MINOR PLANETS AT ESO LA SILLA BY MEANS OF THE GPO ($f = 400$ CM, $\varnothing = 40$ CM) IN AUGUST 1976

In August 1976, we have observed Minor Planets at ESO La Silla, most of them indicated as having been observed (signed X, XX or + in the Ephemerides of Minor Planets from ITA or required by the Programme of Leningrad). The instrument GPO ($f = 400$ cm, $\varnothing = 40$ cm) was used. Because of the sky quality, magnitude 17 was easily attained.
Three new asteroids were discovered.
Measures and reductions were performed at Uccle with the Ascorecord measuring machine (0.1 μ) and by means of five reference stars on the Siemens 4004 ORB computer (SAO catalogue registered on magnetic tape by the Strasbourg Observatory, mean least squares method).

Key words: Minor Planets – observations – reference stars – mean least squares

1. INTRODUCTION

Le présent article contient les résultats des observations photographiques des positions d'astéroïdes obtenues à l'instrument dénommé Grand Prisme Objectif ($f = 4$ m, $\varnothing = 40$ cm) de l'Observatoire ESO à La Silla (Chili), en août 1976. L'instrument était évidemment utilisé sans son prisme.

2. MÉTHODE

Toutes les plaques ont été mesurées sur la machine Ascorecord de l'Observatoire royal de Belgique, par H. Debehogne aidé par G. Peeters. Les mesures ont été effectuées au dixième de micron, la dernière décimale étant peu significative en elle-même et aussi dans l'optique du calcul général.

Les étoiles de référence sont prises au millième de seconde de temps en ascension droite et au centième de seconde d'arc en déclinaison (catalogue SAO 1966).

Les éphémérides ont été fournies par Ephemeridi Malik Planets (Leningrad 1977). On remarquera que la quasi-totalité des observations étaient demandées à des titres divers (voir E.M.P. Leningrad).

La méthode de réduction comporte cinq étoiles de référence. Elle est basée sur la méthode des dépendances D_i telles que, si X_i, Y_i, x_i, y_i, sont les coordonnées standard et mesurées des cinq étoiles et X_p, Y_p, x_p, y_p celles de la planète, on ait

$$X_p = \Sigma\, D_i\, X_i$$

avec les D_i définis par

$$Y_p = \Sigma\, D_i\, Y_i$$

$$x_p = \Sigma\, D_i\, x_i$$

$$y_p = \Sigma\, D_i\, y_i$$

$$\Sigma\, D_i = 1$$

que l'on résout au moyen des multiplicateurs de Lagrange et de la condition

$$\Sigma\, D_i^2 = \text{minimum (Debehogne 1977).}$$

On passe aisément des X_p, Y_p aux coordonnées équatoriales de la planète par les formules classiques (Smart 1944). Le programme, élaboré à Uccle, résout également par moindres carrés les équations de condition

$$a\,(x_i - x_o) + b\,(y_i - y_o) = X - X_o$$

$$a'\,(x_i - x_o) + b'\,(y_i - y_o) = Y - Y_o$$

X_o, Y_o, x_o, y_o étant les coordonnées de l'origine que l'on prend au centre de gravité du pentagone formé par les cinq étoiles. Les inconnues a, b, a', b' servent à déterminer X_p, Y_p. Les résultats des deux méthodes diffèrent rarement de $0^s,001$ et $0'',01$.

Signalons que la méthode générale

$$X = \sum_{i,j=1}^{n} a_{ij}\, x^i\, y^j\,,\quad Y = \sum_{i,j=1}^{n} b_{ij}\, x^i\, y^j\,,\quad n \leqslant 7$$

programmée par un des auteurs et utilisée par lui pour des recherches théoriques sur la précision des réductions (Debehogne 1970a), le choix des formules adéquates et du nombre optima d'étoiles de références par introduction des étoiles tests dans la méthode classique (Debehogne 1970b), l'étude des effets des erreurs basée sur la création d'étoiles fictives (Debehogne 1972), n'est pas de mise ici (au contraire des réductions de clichés de satellites) étant donné que chaque plaque contient au maximum deux astéroïdes.

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Tableau 1 Positions

No	Objet	Cliché	1976 T.U. Mois	1976 T.U. Jour	α_{1950} h m s	δ_{1950} ° ′ ″	O-C m	O-C ″
1	6 HEBE	117	8	23.342317	0 26 48.149	-11 17 31.80	0.3	2
2	6 HEBE	117	8	23.347165	0 26 48.146	-11 17 36.15	0.3	2
3	6 HEBE	117	8	23.352012	0 26 48.140	-11 17 40.53	0.3	2
4	7 IRIS	065	8	20.154509	19 48 58.380	-13 53 10.80	-0.0	0
5	7 IRIS	065	8	20.168360	19 48 57.774	-13 53 12.52	-0.0	0
6	7 IRIS	065	8	20.184288	19 48 57.060	-13 53 14.20	-0.0	0
7	7 IRIS	093	8	22.018158	19 47 41.331	-13 56 35.01	-0.3	0
8	7 IRIS	093	8	22.025083	19 47 41.037	-13 56 36.50	-0.3	0
9	7 IRIS	093	8	22.032008	19 47 40.766	-13 56 37.58	-0.3	0
10	7 IRIS	108	8	23.115853	19 46 58.324	-13 58 34.71	-0.4	0
11	7 IRIS	108	8	23.123125	19 46 58.026	-13 58 34.97	-0.4	0
12	7 IRIS	108	8	23.128665	19 46 57.824	-13 58 36.24	-0.4	0
13	25 PHOCAEA	062	8	20.030196	18 30 24.030	16 5 44.65	-0.0	0
14	25 PHOCAEA	062	8	20.044047	18 30 24.316	16 5 33.58	-0.0	0
15	25 PHOCAEA	062	8	20.058591	18 30 24.658	16 5 21.80	-0.0	0
16	25 PHOCAEA	091	8	21.975566	18 31 17.110	15 39 37.96	-0.3	1
17	25 PHOCAEA	091	8	21.980414	18 31 17.274	15 39 34.24	-0.3	1
18	25 PHOCAEA	091	8	21.985261	18 31 17.370	15 39 30.13	-0.3	1
19	25 PHOCAEA	105	8	22.974227	18 31 47.519	15 25 59.32	-0.4	2
20	25 PHOCAEA	105	8	22.979075	18 31 47.647	15 25 55.32	-0.4	2
21	25 PHOCAEA	105	8	22.983923	18 31 47.780	15 25 51.52	-0.4	2
22	148 GALLIA	092	8	21.998420	18 22 29.083	-4 31 37.81	-0.2	0
23	148 GALLIA	092	8	22.003268	18 22 29.027	-4 31 41.22	-0.2	0
24	148 GALLIA	092	8	22.008116	18 22 28.992	-4 31 44.62	-0.2	0
25	148 GALLIA	106	8	22.992233	18 22 21.654	-4 42 56.99	-0.3	0
26	148 GALLIA	106	8	22.997081	18 22 21.644	-4 43 0.35	-0.3	0
27	148 GALLIA	106	8	23.001929	18 22 21.597	-4 43 4.02	-0.3	0
28	389 INDUSTRIA	119	8	23.401876	0 59 2.035	18 16 14.30	0.3	2
29	389 INDUSTRIA	119	8	23.413072	0 59 1.857	18 16 15.91	0.3	2
30	389 INDUSTRIA	119	8	23.423714	0 59 1.682	18 16 17.30	0.3	2
31	461 SASKIA	114	8	23.237049	21 4 3.102	-16 5 18.85	-0.3	-1
32	461 SASKIA	114	8	23.248130	21 4 2.635	-16 5 20.97	-0.3	-1
33	461 SASKIA	114	8	23.259211	21 4 2.153	-16 5 23.31	-0.3	-1
34	477 ITALIA	096	8	22.111652	21 30 49.533	-23 4 8.33	-0.4	-3
35	477 ITALIA	096	8	22.124117	21 30 48.807	-23 4 8.33	-0.4	-3
36	477 ITALIA	096	8	22.136583	21 30 48.088	-23 4 8.47	-0.4	-3
37	610 VALESKA	095	8	22.077717	20 36 45.546	-37 30 6.92	-0.2	-2
38	610 VALESKA	095	8	22.090183	20 36 44.916	-37 30 5.38	-0.2	-2
39	610 VALESKA	095	8	22.102648	20 36 44.250	-37 30 3.54	-0.2	-2
40	681 GORGO	071	8	20.299252	23 42 35.422	2 8 12.17	-0.2	0
41	681 GORGO	071	8	20.311718	23 42 35.090	2 8 8.17	-0.2	0
42	681 GORGO	071	8	20.324184	23 42 34.770	2 8 3.65	-0.2	0
43	681 GORGO	116	8	23.308382	23 41 10.194	1 48 43.15	-0.0	2
44	681 GORGO	116	8	23.320155	23 41 9.808	1 48 38.51	-0.0	2
45	681 GORGO	116	8	23.332275	23 41 9.470	1 48 33.82	-0.0	2
46	782 MONTEFIORE	089	8	21.306570	22 0 50.085	-21 24 48.45	-0.1	-1
47	782 MONTEFIORE	089	8	21.315573	22 0 49.512	-21 24 51.34	-0.1	-1
48	935 CLIVIA	085	8	21.190567	20 36 42.095	-22 23 55.31	-0.2	-1
49	935 CLIVIA	085	8	21.201648	20 36 41.494	-22 23 55.67	-0.2	-1
50	971 ALSATIA	087	8	21.273673	21 13 47.074	-33 41 20.92	-0.9	-3
51	974 LIOBA	079	8	21.108154	20 54 46.853	-24 48 37.66	0.4	2
52	974 LIOBA	079	8	21.119235	20 54 46.267	-24 48 40.21	0.4	2
53	1033 SIMONA	115	8	23.271676	23 29 10.068	3 42 53.24	0.2	2
54	1033 SIMONA	115	8	23.285528	23 29 9.672	3 42 49.01	0.2	2
55	1033 SIMONA	115	8	23.299379	23 29 9.289	3 42 44.97	0.2	2
56	1039 SONNEBERGA	115	8	23.271676	23 33 45.015	3 16 42.99	0.6	4
57	1039 SONNEBERGA	115	8	23.285528	23 33 44.565	3 16 39.84	0.6	4
58	1039 SONNEBERGA	115	8	23.299379	23 33 44.085	3 16 37.12	0.6	4
59	1062 LJUBA	094	8	22.041704	19 48 35.741	-25 52 18.45	-0.2	0
60	1062 LJUBA	094	8	22.054170	19 48 35.291	-25 52 17.94	-0.2	0
61	1062 LJUBA	094	8	22.066636	19 48 34.883	-25 52 17.45	-0.2	0
62	1080 ORCHIS	073	8	20.392053	0 13 8.702	0-56 28.33	0.0	0
63	1080 ORCHIS	073	8	20.419755	0 13 8.165	0-56 28.57	0.0	0
64	1080 ORCHIS	073	8	20.428758	0 13 8.003	0-56 28.45	0.0	0
65	1084 TAMARIWA	076	8	21.044786	20 13 57.529	-14 27 45.96	-0.7	-3
66	1084 TAMARIWA	076	8	21.058637	20 13 57.054	-14 27 49.73	-0.7	-3
67	1106 CYDONIA	075	8	21.023663	20 0 20.401	-27 40 16.14	-0.1	-1
68	1106 CYDONIA	075	8	21.036129	20 0 19.853	-27 40 13.07	-0.1	-1
69	1178 IRMELA	065	8	20.154509	19 53 28.846	-13 56 44.61	-0.0	0
70	1178 IRMELA	065	8	20.168360	19 53 28.392	-13 56 48.02	-0.0	0
71	1178 IRMELA	065	8	20.184288	19 53 27.810	-13 56 52.82	-0.0	0
72	1178 IRMELA	093	8	22.018158	19 52 26.986	-14 4 55.28	-0.2	0
73	1178 IRMELA	093	8	22.025083	19 52 26.750	-14 4 57.50	-0.2	0
74	1178 IRMELA	093	8	22.032008	19 52 26.533	-14 4 59.89	-0.2	0
75	1178 IRMELA	108	8	23.115853	19 51 52.174	-14 9 41.03	-0.3	-1
76	1178 IRMELA	108	8	23.123125	19 51 51.968	-14 9 43.19	-0.3	-1
77	1178 IRMELA	108	8	23.128665	19 51 51.769	-14 9 44.75	-0.3	-1
78	1220 CROCUS	090	8	21.327692	22 5 56.452	-21 38 10.98	0.1	0
79	1220 CROCUS	090	8	21.340158	22 5 55.884	-21 38 16.19	0.1	0
80	1269 ROLLANDIA	086	8	21.239392	21 13 8.820	-16 22 27.61	0.3	0
81	971 ALSATIA	087	8	21.263285	21 13 47.682	-33 41 18.29	-0.9	-3
82	1313 BERNA	074	8	21.000809	19 43 55.003	-18 9 55.97	0.5	3
83	1313 BERNA	074	8	21.014660	19 43 54.453	-18 9 54.19	0.5	3
84	1345 POTOMAC	072	8	20.351885	0 6 18.586	-8 9 29.79	-0.0	-1
85	1345 POTOMAC	072	8	20.364351	0 6 18.271	-8 9 33.42	-0.0	-1
86	1345 POTOMAC	072	8	20.376817	0 6 17.956	-8 9 37.35	-0.0	-1
87	1465 AUTONOMA	078	8	21.086685	20 44 31.817	-10 4 42.17	-0.6	-5
88	1465 AUTONOMA	078	8	21.099151	20 44 31.267	-10 4 44.30	-0.6	-5
89	1447 UTRA	096	8	22.111652	21 33 2.916	-22 24 51.87	-0.0	0
90	1447 UTRA	096	8	22.124117	21 33 2.192	-22 24 54.16	-0.0	0
91	1447 UTRA	096	8	22.136583	21 33 1.381	-22 24 56.96	-0.0	0
92	1757 1939 FC	103	8	22.249469	21 54 50.161	-19 22 58.03	-0.3	-2
93	1757 1939 FC	103	8	22.263689	21 54 49.273	-19 23 2.04	-0.3	-2
94	1757 1939 FC	103	8	22.277171	21 54 48.448	-19 23 5.22	-0.3	-2
95	1778 ALFVEN	104	8	22.286867	21 9 48.904	-18 22 47.06	-0.1	0
96	1778 ALFVEN	104	8	22.299333	21 9 48.395	-18 22 49.63	-0.1	0
97	1778 ALFVEN	104	8	22.311798	21 9 47.839	-18 22 52.43	-0.1	0
98	1781 VAN BIESBROECK	088	8	21.286832	21 32 7.566	-28 0 29.48	3.8	-10
99	1781 VAN BIESBROECK	088	8	21.297913	21 32 6.992	-28 0 30.41	3.8	-10
100	NOUVEAU	078	8	21.086685	20 46 45.044	-10 36 54.86		
101	NOUVEAU	078	8	21.099151	20 46 44.335	-10 36 56.09		
102	NOUVEAU	090	8	21.327692	22 8 27.729	-22 37 32.27		
103	NOUVEAU	090	8	21.340158	22 8 27.141	-22 37 36.86		
104	NOUVEAU	103	8	22.249469	21 56 3.072	-19 34 7.12		
105	NOUVEAU	103	8	22.263689	21 56 2.225	-19 34 12.70		
106	NOUVEAU	103	8	22.277171	21 56 1.511	-19 34 17.11		

L'astéroïde des positions 100 et 101 est à 1,6 min. et −37′ de 1465 Autonoma mais les vitesses ne concordent pas.

Tableau 2 Dépendances

No	Etoiles repères	Positions utilisées s	Positions utilisées "	Dépendances
1	147305	56.053	34.77	0.382108
	147297	15.901	11.55	0.321983
	147280	29.831	49.09	-0.108643
	147292	1.006	48.62	0.113486
	147300	40.218	7.99	0.291066
2	147305	56.053	34.77	0.381662
	147297	15.901	11.55	0.318414
	147280	29.831	49.09	-0.108960
	147292	1.006	48.62	0.116660
	147300	40.218	7.99	0.292224
3	147305	56.053	34.77	0.381172
	147297	15.901	11.55	0.314826
	147280	29.831	49.09	-0.109256
	147292	1.006	48.62	0.119817
	147300	40.218	7.99	0.293442
4	163069	38.839	8.91	0.224232
	163073	53.195	35.29	0.218634
	163055	57.359	41.86	0.179413
	163033	44.199	16.90	0.171733
	163038	18.547	50.36	0.205989
5	163069	38.839	8.91	0.220645
	163073	53.195	35.29	0.215708
	163055	57.359	41.86	0.182158
	163033	44.199	16.90	0.176038
	163038	18.547	50.36	0.205452
6	163069	38.839	8.91	0.216411
	163073	53.195	35.29	0.212259
	163055	57.359	41.86	0.185455
	163033	44.199	16.90	0.181126
	163038	18.547	50.36	0.204749
7	163030	37.932	4.35	0.399181
	163032	43.394	46.29	0.440978
	163033	44.199	16.90	0.266728
	163038	18.547	50.36	-0.152225
	163069	38.839	8.91	0.045337
8	163030	37.932	4.35	0.400460
	163032	43.394	46.29	0.441630
	163033	44.199	16.90	0.267381
	163038	18.547	50.36	-0.152350
	163069	38.839	8.91	0.042879
9	163030	37.932	4.35	0.401562
	163032	43.394	46.29	0.442321
	163033	44.199	16.90	0.268045
	163038	18.547	50.36	-0.152580
	163069	38.839	8.91	0.040652
10	163033	44.199	16.90	0.184491
	163030	37.932	4.35	0.220348
	163032	43.394	46.29	0.244237
	163001	26.994	32.99	0.262321
	163009	10.975	44.66	0.088603
11	163033	44.199	16.90	0.183779
	163030	37.932	4.35	0.219453
	163032	43.394	46.29	0.243155
	163001	26.994	32.99	0.263549
	163009	10.975	44.66	0.090063
12	163033	44.199	16.90	0.183313
	163030	37.932	4.35	0.218894
	163032	43.394	46.29	0.242243
	163001	26.994	32.99	0.264135
	163009	10.975	44.66	0.091415
13	103845	18.239	4.85	0.257955
	103852	32.237	35.35	0.284529
	103822	1.091	42.42	0.220401
	103784	44.699	34.35	0.099161
	103801	53.399	7.12	0.137853
14	103845	18.239	4.85	0.261655
	103852	32.237	35.35	0.283924
	103822	1.091	42.42	0.216201
	103784	44.699	34.35	0.097025
	103801	53.399	7.12	0.141195
15	103845	18.239	4.85	0.265720
	103852	32.237	35.35	0.283249
	103822	1.091	42.42	0.211673
	103784	44.699	34.35	0.094594
	103801	53.399	7.12	0.144764
16	103855	45.591	14.48	0.302143
	103845	18.239	4.85	0.367582
	103801	53.399	7.12	0.063834
	103843	14.041	38.99	0.122539
	103849	20.801	39.37	0.143901
17	103855	45.591	14.48	0.302209
	103845	18.239	4.85	0.366539
	103801	53.399	7.12	0.062700
	103843	14.041	38.99	0.123614
	103849	20.801	39.37	0.144937
18	103855	45.591	14.48	0.302048
	103845	18.239	4.85	0.365228
	103801	53.399	7.12	0.061992
	103843	14.041	38.99	0.124773
	103849	20.801	39.37	0.145960
19	103881	18.827	29.82	0.128317
	103855	45.591	14.48	0.292128
	103849	20.801	39.37	0.237608
	103843	14.041	38.99	0.239614
	103866	19.119	19.60	0.102332
20	103881	18.827	29.82	0.128619
	103855	45.591	14.48	0.289533
	103849	20.801	39.37	0.237343
	103843	14.041	38.99	0.239503
	103866	19.119	19.60	0.105002
21	103881	18.827	29.82	0.128996
	103855	45.591	14.48	0.286995
	103849	20.801	39.37	0.237100
	103843	14.041	38.99	0.239337
	103866	19.119	19.60	0.107572
22	142328	59.608	5.24	0.206406
	142277	38.808	59.47	0.229178
	142272	19.318	19.99	0.198203
	142283	51.409	21.17	0.182749
	142297	35.282	28.29	0.183463
23	142328	59.608	5.24	0.205992
	142277	38.808	59.47	0.228508
	142272	19.318	19.99	0.198361
	142283	51.409	21.17	0.183258
	142297	35.282	28.29	0.183881
24	142328	59.608	5.24	0.205670
	142277	38.808	59.47	0.227739
	142272	19.318	19.99	0.198478
	142283	51.409	21.17	0.183774
	142297	35.282	28.29	0.184338
25	142277	38.808	59.47	0.367291
	142257	58.513	39.18	-0.159742
	142272	19.318	19.99	0.111047
	142283	51.409	21.17	0.216453
	142297	35.282	28.29	0.464941
26	142277	38.808	59.47	0.366129
	142257	58.513	39.18	-0.159725
	142272	19.318	19.99	0.111606
	142283	51.409	21.17	0.217147
	142297	35.282	28.29	0.464843
27	142277	38.808	59.47	0.364605
	142257	58.513	39.18	-0.159372
	142272	19.318	19.99	0.112184
	142283	51.409	21.17	0.217936
	142297	35.282	28.29	0.464648
28	92223	51.024	20.81	0.246558
	92221	43.343	6.79	0.152691
	92211	32.171	2.36	0.057975
	92196	50.122	20.50	0.180277
	92194	36.431	49.17	0.362499
29	92223	51.024	20.81	0.245462
	92221	43.343	6.79	0.152305
	92211	32.171	2.36	0.058798
	92196	50.122	20.50	0.181154
	92194	36.431	49.17	0.362280
30	92223	51.024	20.81	0.244441
	92221	43.343	6.79	0.151899
	92211	32.171	2.36	0.059557
	92196	50.122	20.50	0.181988
	92194	36.431	49.17	0.362115
31	164142	6.607	46.25	0.806821
	164158	11.595	34.29	0.183167
	164141	1.500	25.94	-0.082977
	164117	44.968	1.57	-0.158400
	164116	34.279	25.24	0.251388
32	164142	6.607	46.25	0.807588
	164158	11.595	34.29	0.181498
	164141	1.500	25.94	-0.084517
	164117	44.968	1.57	-0.157753
	164116	34.279	25.24	0.253185
33	164142	6.607	46.25	0.808536
	164158	11.595	34.29	0.179597
	164141	1.500	25.94	-0.086010
	164117	44.968	1.57	-0.157185
	164116	34.279	25.24	0.255063
34	190447	11.859	1.92	0.545288
	190445	6.471	49.62	0.265862
	190420	32.027	2.01	-0.014858
	190417	13.793	42.33	0.030665
	190418	23.314	58.24	0.173044
35	190447	11.859	1.92	0.540644
	190445	6.471	49.62	0.263745
	190420	32.027	2.01	-0.012163
	190417	13.793	42.33	0.033468
	190418	23.314	58.24	0.174305
36	190447	11.859	1.92	0.536056
	190445	6.471	49.62	0.261623
	190420	32.027	2.01	-0.009517
	190417	13.793	42.33	0.036169
	190418	23.314	58.24	0.175668
37	212353	42.327	45.54	0.260698
	212324	52.944	13.70	0.150760
	212309	37.924	1.68	0.055056
	212280	41.363	41.12	0.179025
	212327	59.904	34.18	0.354461
38	212353	42.327	45.54	0.258956
	212324	52.944	13.70	0.150669
	212309	37.924	1.68	0.056234
	212280	41.363	41.12	0.180815
	212327	59.904	34.18	0.353326
39	212353	42.327	45.54	0.257104
	212324	52.944	13.70	0.150633
	212309	37.924	1.68	0.057535
	212280	41.363	41.12	0.182674
	212327	59.904	34.18	0.352054
40	128369	15.964	8.82	0.347968

Tableau 2 *(suite)*

No	Etoiles repères	Positions utilisées s	Positions utilisées n	Dépendances
	128348	17.993	28.00	0.075992
	128339	7.110	22.31	-0.051736
	128353	35.879	6.21	0.234980
	128361	30.588	48.33	0.392796
41	128369	15.964	8.82	0.346041
	128348	17.993	28.00	0.075924
	128339	7.110	22.31	-0.050190
	128353	35.879	6.21	0.235488
	128361	30.588	48.33	0.392736
42	128369	15.964	8.82	0.343995
	128348	17.993	28.00	0.075854
	128339	7.110	22.31	-0.048828
	128353	35.879	6.21	0.236168
	128361	30.588	48.33	0.392812
43	128361	30.588	48.33	0.403226
	128369	15.964	8.82	-0.185428
	128348	17.993	28.00	0.054324
	128339	7.110	22.31	0.318053
	128353	35.879	6.21	0.409825
44	128361	30.588	48.33	0.403091
	128369	15.964	8.82	-0.187716
	128348	17.993	28.00	0.054366
	128339	7.110	22.31	0.319734
	128353	35.879	6.21	0.410524
45	128361	30.588	48.33	0.403173
	128369	15.964	8.82	-0.189855
	128348	17.993	28.00	0.054290
	128339	7.110	22.31	0.321194
	128353	35.879	6.21	0.411198
46	190878	43.641	22.71	0.125811
	190869	1.508	3.44	0.254674
	190834	52.333	11.46	0.303205
	190854	40.944	38.23	0.168201
	190860	23.088	21.97	0.148109
47	190878	43.641	22.71	0.124482
	190869	1.508	3.44	0.251923
	190834	52.333	11.46	0.305176
	190854	40.944	38.23	0.169684
	190860	23.088	21.97	0.148735
48	189588	8.246	57.56	0.102633
	189584	46.166	53.45	0.231513
	189517	31.588	6.52	0.446155
	189522	52.959	44.04	0.284014
	189528	14.843	10.62	-0.064315
49	189588	8.246	57.56	0.100932
	189584	46.166	53.45	0.229911
	189517	31.588	6.52	0.447128
	189522	52.959	44.04	0.285030
	189528	14.843	10.62	-0.063001
50	212883	21.298	+ 0.21	0.294737
	212859	58.426	53.89	0.431655
	212830	1.814	21.15	0.308635
	212845	47.232	49.54	0.005402
	212856	43.525	41.52	-0.040430
51	189884	18.849	19.68	0.205656
	189880	58.552	30.90	0.266581
	189874	44.141	59.50	0.261857
	189857	49.685	10.11	0.155183
	189876	46.020	46.24	0.110723
52	189884	18.849	19.68	0.202639
	189880	58.552	30.90	0.260271
	189874	44.141	59.50	0.256917
	189857	49.685	10.11	0.162573
	189876	46.020	46.24	0.117600
53	128240	21.190	19.74	-0.482477
	128242	31.443	14.14	-0.249732
	128244	37.869	57.50	0.159379
	128233	51.322	16.71	0.789541
	128229	20.409	16.10	0.783289
54	128240	21.190	19.74	-0.484825
	128242	31.443	14.14	-0.252183
	128244	37.869	57.50	0.157453
	128233	51.322	16.71	0.791815
	128229	20.409	16.10	0.787740
55	128240	21.190	19.74	-0.487153
	128242	31.443	14.14	-0.254381
	128244	37.869	57.50	0.155368
	128233	51.322	16.71	0.794257
	128229	20.409	16.10	0.791910
56	128271	3.196	45.52	0.548091
	128253	29.790	48.44	-0.074393
	128263	55.017	4.98	-0.247796
	128274	19.307	5.94	0.353469
	128277	32.381	28.81	0.420628
57	128271	3.196	45.52	0.544857
	128253	29.790	48.44	-0.072899
	128263	55.017	4.98	-0.243982
	128274	19.307	5.94	0.352669
	128277	32.381	28.81	0.419356
58	128271	3.196	45.52	0.541551
	128253	29.790	48.44	-0.071239
	128263	55.017	4.98	-0.240016
	128274	19.307	5.94	0.351666
	128277	32.381	28.81	0.418039
59	188672	4.568	40.93	0.414592
	188624	55.433	23.74	0.334929
	188614	21.076	17.95	0.225873
	188620	38.606	54.55	0.066169
	188662	43.340	26.62	-0.041563
60	188672	4.568	40.93	0.413537
	188624	55.433	23.74	0.336199
	188614	21.076	17.95	0.227417
	188620	38.606	54.55	0.066741
	188662	43.340	26.62	-0.043894
61	188672	4.568	40.93	0.412583
	188624	55.433	23.74	0.337397
	188614	21.076	17.95	0.228755
	188620	38.606	54.55	0.067298
	188662	43.340	26.62	-0.046033
62	128651	40.666	49.07	0.148866
	128659	19.924	45.80	0.211012
	128658	16.408	50.98	0.152640
	128671	44.507	1.20	0.185621
	128676	30.641	42.64	0.301861
63	128651	40.666	49.07	0.150879
	128659	19.924	45.80	0.212138
	128658	16.408	50.98	0.153553
	128671	44.507	1.20	0.183999
	128676	30.641	42.64	0.299432
64	128651	40.666	49.07	0.151469
	128659	19.924	45.80	0.212453
	128658	16.408	50.98	0.153869
	128671	44.507	1.20	0.183536
	128676	30.641	42.64	0.298674
65	163440	14.386	52.45	0.150116
	163411	2.893	8.17	0.249971
	163400	15.759	28.01	0.261724
	163393	53.575	35.63	0.271592
	163430	34.090	18.12	0.066597
66	163440	14.386	52.45	0.146585
	163411	2.893	8.17	0.249084
	163400	15.759	28.01	0.262730
	163393	53.575	35.63	0.273298
	163430	34.090	18.12	0.068303
67	188814	49.952	17.43	0.186129
	188844	35.261	1.11	0.170319
	188843	26.220	17.57	0.136636
	188875	21.534	20.80	0.215209
	188890	3.060	53.83	0.291707
68	188814	49.952	17.43	0.188480
	188844	35.261	1.11	0.170478
	188843	26.220	17.57	0.136516
	188875	21.534	20.80	0.213935
	188890	3.060	53.83	0.290591
69	163149	37.161	49.90	0.267110
	163108	44.863	45.07	0.187910
	163103	7.907	58.48	0.169854
	163104	16.923	57.40	0.171253
	163119	29.378	17.44	0.203873
70	163149	37.161	49.90	0.263797
	163108	44.863	45.07	0.185222
	163103	7.907	58.48	0.168930
	163104	16.923	57.40	0.174378
	163119	29.378	17.44	0.207674
71	163149	37.161	49.90	0.259476
	163108	44.863	45.07	0.181583
	163103	7.907	58.48	0.167618
	163104	16.923	57.40	0.178507
	163119	29.378	17.44	0.212816
72	163119	29.378	17.44	0.305725
	163104	16.923	57.40	0.233555
	163100	52.585	22.95	0.185471
	163090	13.851	1.66	0.122997
	163105	18.204	7.78	0.152252
73	163119	29.378	17.44	0.303616
	163104	16.923	57.40	0.232230
	163100	52.585	22.95	0.185409
	163090	13.851	1.66	0.124373
	163105	18.204	7.78	0.154372
74	163119	29.378	17.44	0.301628
	163104	16.923	57.40	0.230899
	163100	52.585	22.95	0.185294
	163090	13.851	1.66	0.125627
	163105	18.204	7.78	0.156551
75	163119	29.378	17.44	-0.003320
	163104	16.923	57.40	0.053901
	163100	52.585	22.95	0.183941
	163090	13.851	1.66	0.326217
	163105	18.204	7.78	0.439261
76	163119	29.378	17.44	-0.005180
	163104	16.923	57.40	0.052631
	163100	52.585	22.95	0.183927
	163090	13.851	1.66	0.327377
	163105	18.204	7.78	0.441245
77	163119	29.378	17.44	-0.006893
	163104	16.923	57.40	0.051544
	163100	52.585	22.95	0.183936
	163090	13.851	1.66	0.328602
	163105	18.204	7.78	0.442812
78	190899	31.391	30.49	0.151272
	190902	52.386	13.51	0.130952
	190907	4.656	16.95	0.171713
	190912	55.441	4.04	0.230704
	190938	32.411	24.26	0.315359
79	190899	31.391	30.49	0.152857
	190902	52.386	13.51	0.132341

Tableau 2 *(suite)*

No	Etoiles repères	Positions utilisées		Dépendances
		s	"	
	190907	4.656	16.95	0.172508
	190912	55.441	4.04	0.230099
	190938	32.411	24.26	0.312196
80	164285	5.298	4.91	-0.074948
	164252	25.483	54.31	-0.384269
	164255	39.199	30.95	0.423743
	164262	48.352	58.79	0.777286
	164278	28.266	6.92	0.258188
81	212883	21.298	+ 0.21	0.297685
	212859	58.426	53.89	0.432931
	212830	1.814	21.15	0.306648
	212845	47.232	49.54	0.003642
	212856	43.525	41.52	-0.040907
82	162941	52.834	48.72	-0.041530
	162944	7.486	17.74	0.066414
	162947	21.426	43.32	0.216392
	162993	59.862	44.21	0.611439
	162942	58.742	21.97	0.147285
83	162941	52.834	48.72	-0.039882
	162944	7.486	17.74	0.067339
	162947	21.426	43.32	0.216415
	162993	59.862	44.21	0.608400
	162942	58.742	21.97	0.147727
84	128600	26.824	24.08	0.299136
	128594	6.704	59.57	0.234398
	128601	27.658	23.17	0.122456
	128611	28.545	26.17	0.153282
	128636	32.722	49.03	0.190728
85	128600	26.824	24.08	0.298863
	128594	6.704	59.57	0.234751
	128601	27.658	23.17	0.123413
	128611	28.545	26.17	0.153570
	128636	32.722	49.03	0.189403
86	128600	26.824	24.08	0.298521
	128594	6.704	59.57	0.235072
	128601	27.658	23.17	0.124429
	128611	28.545	26.17	0.153926
	128636	32.722	49.03	0.188052
87	144787	39.046	49.82	0.260045
	163872	56.353	44.92	0.235089
	163881	53.434	8.60	0.169515
	144816	25.779	2.33	0.190069
	163890	27.875	38.79	0.145283
88	144787	39.046	49.82	0.262594
	163872	56.353	44.92	0.237718
	163881	53.434	8.60	0.170770
	144816	25.779	2.33	0.184758
	163890	27.875	38.79	0.144159
89	190485	46.683	26.62	0.439450
	190467	23.171	3.21	0.452031
	190451	20.684	7.78	0.110023
	190445	6.471	49.62	-0.105397
	190474	41.281	39.42	0.103893
90	190485	46.683	26.62	0.435600
	190467	23.171	3.21	0.450908
	190451	20.684	7.78	0.112060
	190445	6.471	49.62	-0.101928
	190474	41.281	39.42	0.103360
91	190485	46.683	26.62	0.431304
	190467	23.171	3.21	0.449435
	190451	20.684	7.78	0.111449
	190445	6.471	49.62	-0.098077
	190474	41.281	39.42	0.102889
92	164751	40.888	21.64	0.090989
	164759	18.706	41.93	0.232648
	164764	32.323	6.07	0.392454
	164776	39.192	26.87	0.125323
	164786	21.593	42.62	0.158585
93	164751	40.888	21.64	0.096782

No	Etoiles repères	Positions utilisées		Dépendances
		s	"	
	164759	18.706	41.93	0.234225
	164764	32.323	6.07	0.390869
	164776	39.192	26.87	0.123867
	164786	21.593	42.62	0.154257
94	164751	40.888	21.64	0.101968
	164759	18.706	41.93	0.235686
	164764	32.323	6.07	0.389692
	164776	39.192	26.87	0.122482
	164786	21.593	42.62	0.150172
95	164192	43.620	6.62	0.299197
	164202	40.878	30.40	0.088989
	164210	15.066	34.88	0.247938
	164241	43.254	46.15	0.088290
	164250	20.494	43.07	0.275586
96	164192	43.620	6.62	0.300798
	164202	40.878	30.40	0.088988
	164210	15.066	34.88	0.248591
	164241	43.254	46.15	0.086813
	164250	20.494	43.07	0.274809
97	164192	43.620	6.62	0.302565
	164202	40.878	30.40	0.088983
	164210	15.066	34.88	0.249277
	164241	43.254	46.15	0.085226
	164250	20.494	43.07	0.273950
98	190465	10.078	9.43	0.433739
	190456	44.971	18.64	-0.195262
	190437	35.525	44.36	-0.277574
	190449	14.011	25.89	0.367384
	190457	50.619	32.66	0.671713
99	190465	10.078	9.43	0.430170
	190456	44.971	18.64	-0.191839
	190437	35.525	44.36	-0.270606
	190449	14.011	25.89	0.366357
	190457	50.619	32.66	0.665918
100	163935	36.905	36.52	0.477578
	163923	56.177	12.63	0.171251
	163890	27.875	38.79	-0.067744
	163874	1.683	12.95	0.087263
	163871	54.178	50.16	0.331652
101	163935	36.905	36.52	0.475473
	163923	56.177	12.63	0.170345
	163890	27.875	38.79	-0.066711
	163874	1.683	12.95	0.088540
	163871	54.178	50.16	0.332353
102	190948	24.552	40.68	0.443534
	190952	36.004	20.98	0.368649
	190935	28.815	35.70	0.209067
	190899	31.391	30.49	-0.153053
	190910	13.526	34.30	0.131803
103	190948	24.552	40.68	0.443383
	190952	36.004	20.98	0.366929
	190935	28.815	35.70	0.207594
	190899	31.391	30.49	-0.152757
	190910	13.526	34.30	0.134850
104	164751	40.888	21.64	-0.039062
	164759	18.706	41.93	0.042015
	164764	32.323	6.07	0.019493
	164776	39.192	26.87	0.412653
	164786	21.593	42.62	0.564990
105	164751	40.888	21.64	-0.032961
	164759	18.706	41.93	0.043440
	164764	32.323	6.07	0.017093
	164776	39.192	26.87	0.411586
	164786	21.593	42.62	0.560841
106	164751	40.888	21.64	-0.027896
	164759	18.706	41.93	0.044647
	164764	32.323	6.07	0.015223
	164776	39.192	26.87	0.410569
	164786	21.593	42.62	0.557457