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$N^{\underline{o}}$ 130

STATISTICAL STABILITY OF THE NUMBERED MINOR PLANET SAMPLE

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SUMMARY:

Proceeding from the proven nonrandomness of the numbered minor planet sample with respect to the orbital inclination and angle of eccentricity, variations of principal sample parameters and general aspects of the distributions of these two elements with the increase of the number of minor planets in the sample are investigated. Significant variations of the measures of central tendencies, as well as of the measures of dispersion, symmetry and kurtosis are found, while the shapes of the distributions are classified as more stable sample characteristics.

1. INTRODUCTION

For various kinds of statistical investigations pertaining to minor planets, the numbered minor planet sample is used most frequently as the starting, raw material. Obviously, this sample is strongly biased by the different apparent brightness of objects moving in the different orbits, with the degree of completeness decreasing with the distance from the Sun, or with increasing semi-major axis of the orbits. It is also well known that for inclusion among the numbered minor planets, there has been, under otherwise equal conditions, certain preference for objects with perihelia north of the ecliptic (Kresák, 1967), low inclinations or high eccentricities (Kiang, 1966) and especially recently, for the „interesting" objects with unusual motions (Whipple, 1952). Moreover, the distributions of their osculating and proper elements are characterized by certain groupings, such as a clustering of perihelion longitudes around that of Jupiter, existence of families etc. It is, consequently, quite understandable that, from the statistical point of view, it is reasonable to suppose that the numbered minor planet sample is nonrandom with respect to a number of its features – statistics, parameters and distributions.

The nonrandomness in forming the sample involves some disadvantageous consequences. A nonrandom sample cannot provide, with the reliability required, any accurate information about the real population; an enhancement of a nonrandom sample by new elements may result in significant variations of its statistical properties and of the results of statistical investigations based upon them.

The objective of this work is to examine, just from this standpoint, the situation with the numbered minor planet sample, for the present only from the aspect of basic statistics and general features of the observed distributions of inclinations and angles of eccentricity. First, applying the method of runs the supposition of nonrandomness with respect to inclination and angle of eccentricity should be verified. Then, should this prove correct, the character and extent of the variations appearing with the increase of the sample size should be examined. One can expect that, in this way, a check of the „statistical stability" of the numbered minor planet sample with regard to the selected attributes can be obtained. This, in turn, may prove profitable in considering and assessing the reliability of the results of statistical investigations of minor planets.

The choice of inclination and angle of eccentricity for this check is mainly due to their distribution resemblance, as well as to the dimensions of these elements being the same. This makes possible identical division of the empirical data, rather direct and objective comparison of the results, and considerable reduction of the otherwise very extensive computations.

2. TESTING OF THE RANDOMNESS OF THE NUMBERED MINOR PLANET SAMPLE

The method of runs for testing the sample randomness (Ivković, 1976) is very simple and yields results that are the more reliable, the bigger the tested sample is. In our case, it is necessary to point out that the minor planet population can be considered as practically infinite, and that the numbered minor planet sample is sufficiently large, because this allows an approximation of the number of runs sampling distribution by a normal curve whose mean and standard deviation are:

$$m_u = \frac{n+2}{2} \quad ; \qquad \sigma_u = \sqrt{\frac{n(n-2)}{4(n-1)}} \qquad (1)$$

where n denotes the total number of elements in the sample. This approximation is only applicable for $n \geqslant 25$.

If nothing can be anticipated about the sample under consideration, on the presumption that the null-hypothesis of sample randomness is correct, and with the standard 5% level of significance, the confidence interval for the number of runs assumes the form:

$$m_u - 1.96\,\sigma_u < u < m_u + 1.96\,\sigma_u \qquad (2)$$

where u denotes the total number of runs in the sample.

The list of numbered minor planets published in Ephemerides for 1977 comprises a total of 1942 objects, but only 1915 have been used in our examinations. Two unnumbered minor planets from the list (Adonis, Hermes) have been omitted because the method of runs requires strict preserving of the order in which individual objects were originally included into the list of numbered objects; 25 lost minor planets have also been discarded.

Equations (1) for n = 1915 result in:

$$m_u = 958.5 \qquad \sigma_u = 21.9$$

whence it directly follows that the confidence interval (2) becomes: .

$$915.6 < u < 1001.4$$

The median for the inclination, determined as the 958th value according to its amount, was $M(i) = 8^{\circ}\!.352$, while the total number of runs was u = 868. Consequently, $u < m_u - 1.96\,\sigma_u$ and the numbered minor planet sample with respect to the inclination, at the 5% level of significance, cannot be considered as a random one.

The median value for the angle of eccentricity, determined in the same way, was $M(\varphi) = 8^{\circ}\!.108$ and the number of runs u = 901. Consequently, here again $u < m_u - 1.96\,\sigma_u$, and the numbered minor planet sample with respect to the angle of eccentricity, at the 5% level of significance, cannot be considered as random either.

Thus, the assumption of the numbered minor planet sample being nonrandom with respect to the attributes selected appears to be correct, and it can be expected that some statistical characteristics of the sample connected with the inclination and angle of eccentricity may vary with the increase of sample size.

3. VARIATIONS OF THE PARAMETERS OF THE NUMBERED MINOR PLANET SAMPLE

Proceeding from the value of 1915 of the minor planets that have been taken into account, there have been formed, according to the numbering order, 6 groups of minor planets in such a way, that each group consisted of the preceding one enlarged by one half. An equal relative increase of the size from group to group was thereby obtained, which means that possible variations of the parameters should have the same weight. The smallest group contains the first 252 numbered minor planets, the next one 252 + 252/2 = 278, then 567, 851, 1277 and 1915 minor planets. Groups with less than 252 objects have not been formed in view of too small absolute enhancement of such groups, at which random fluctuations of parameters might well become apparent.

However, with regard to the relatively great number of minor planets included even in the smallest group, the computation of parameters has been carried out with the grouped data, whereby a 1° width of class-intervals was adopted both for the inclination and for the angle of eccentricity.

3.1. Variations of the measures of central tendencies

3.1.1. *Inclination.* – The mean and median inclinations for the groups of minor planets formed in the above described manner, are represented in Table 1 and at the corresponding Fig. 1.

Table 1
Means and medians of the inclination

Group	1	2	3	4	5	6
Mean [°]	8.31	8.38	8.85	9.46	9.58	9.42
Median [°]	6.97	7.14	7.82	8.51	8.63	8.35

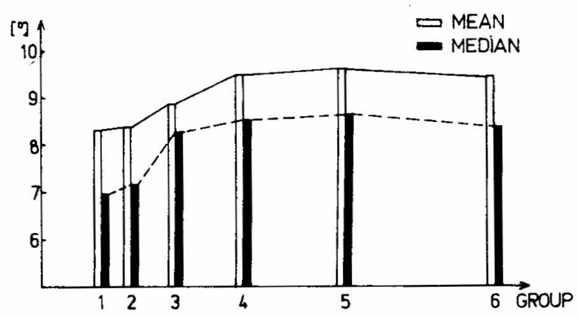

Fig. 1 – Means and medians of the inclination

Two things pertaining to the mean values are at once apparent: first, the interval of variations of mean inclination is $1^{\circ}.27$ wide, and second, the mean value is increasing within the first 5 groups, while in the 6th group, i.e. in the sample containing all minor planets numbered to date, there appears a slight decrease.

The width of the mean inclination variations interval suggests that these variations are considerable. As an illustration of this conclusion we can take the fact that this width amounts to over 13% even of the highest mean inclination obtained ($9^{\circ}.58$, group 5). Although, due to the nonrandomness of the sample theoretical methods for estimating the significance of these variations cannot be applied, from the aspect of the problem under consideration, and particularly in investigations where the mean inclination of the numbered minor planets serves as the starting value or the intermediate result, it is desirable to bear in mind and take into account the wide range covered by the running means.

The analysis of the median values yields similar conclusions. The range of variations is even slightly wider than that of the mean values, $1^{\circ}.66$, which amounts to over 19% of the highest median value ($8^{\circ}.63$, group 5). The run of variations is almost a perfect replica of that of the means, with an average difference of $+1^{\circ}.10$ between the corresponding values. The difference is obviously due to the widely extended tail of the inclination distribution.

The increase of both measures of central tendencies with increasing number of the minor planets included is, from a statistical point of view, a well known consequence of the nonrandomness in forming the sample, but the discontinuity of the trend in the 6th group indicates that the sample structure is not a simple one.

3.1.2. *Angle of eccentricity.* – The mean and median angles of eccentricity for our groups are shown in Table 2 and the corresponding Fig. 2.

Table 2

Means and medians of the angle of eccentricity

Group	1	2	3	4	5	6
Mean [°]	8.65	8.34	8.41	8.36	8.56	8.64
Median [°]	8.32	7.99	8.07	7.94	8.15	8.11

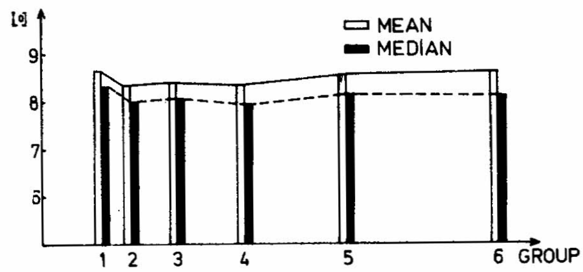

Fig. 2 – Means and medians of the angle of eccentricity

The interval of variations of the mean angle of eccentricity has a $0^{\circ}.31$ width, or only about 3,5% of the highest mean value found ($8^{\circ}.65$, group 1). The corresponding value for the median angle of eccentricity is $0^{\circ}.38$ as the interval width, or about 4,5% of the median value for group 1. The average difference between the means and the medians is $+0^{\circ}.40$. A certain regularity of these variations is again noticeable, though not as clearly as in the case of inclination.

The intervals of the variations of the mean and median angle of eccentricity are practically negligible and these parameters of the numbered minor planet sample can with sufficient confidence be used in statistical investigations. This conclusion is seemingly not in conformity with the previously found nonrandomness of the sample with respect to the angle of eccentricity. But, one should bear in mind that the obtained number of runs in the case of the angle of eccentricity was only a little less than the lower boundary value of the confidence interval (2), i.e. that the deviation of the numbered minor planet sample from randomness was extremelly small. Remaining within the bounds of statistical investigations and with respect to the accuracy of their results usually expected, the above conclusion can be considered as acceptable.

Qualitatively, the variations of the mean and median angle of eccentricity are characterized by slightly greater mean values for groups 1, 5 and 6, and less and almost equal values for the rest. The small average difference between these values is due to the relatively narrow range and relative symmetry of the distribution, but their somewhat greater separation in group 6 reveals a slight widening of the range (these properties of the angle-of-eccentricity distribution will be discussed in more detail in connection with their other consequences, in next chapters).

3.2. Variations of the measures of variation, symmetry and kurtosis

Table 3 contains the standard deviations (s) and measures of symmetry (α_3) and kurtosis (α_4) of the observed distributions of inclination and angle of eccentricity of the numbered minor planets, computed for our groups.

Table 3

The measures of variation, symmetry and kurtosis

Element	i			φ		
Group / Measure	s [°]	α_3	α_4	s [°]	α_3	α_4
1	5.83	1.35	5.16	4.15	0.39	2.91
2	5.78	1.28	4.74	4.13	0.47	2.96
3	5.73	1.11	4.47	4.17	0.48	2.88
4	5.91	0.92	3.87	4.18	0.54	3.03
5	6.07	1.05	4.47	4.40	1.03	6.58
6	6.33	1.23	5.48	4.95	2.01	13.69

It can be stated even without deeper analysis that the variations of standard deviations of both elements are large enough to be kept in mind in statistical investigations and, according to circumstances, to be accounted for. Both distributions are positively skewed, whereby in the first five groups the skewness is more conspicuous for the inclination. The inclination distribution is markedly leptokurtic ($\alpha_4 > 3$), while for the angle of eccentricity we have platykurtic distribution ($\alpha_4 < < 3$) in the first three groups, and leptokurtic in the other three groups. It should be pointed out that the variations of skewness and kurtosis for both elements can also be considered as significant and that they, taken together, reflect the variations of the distribution shapes.

All three statistical characteristics used here, s, α_3 and α_4, are almost systematically greater for inclination, while their variations, on the contrary, are both absolutely and relatively greater, and more irregular, for the angle of eccentricity. It is also interesting to note that, with a single exception, these characteristics reach their highest values in group 6, i.e. in the present numbered minor planet sample. This behaviour of skewness and kurtosis of the inclination distribution can probably be connected with the increased frequency of occurrence of minor planets of low inclinations among the newly numbered objects. The same explanation of the observed phenomenon, however, cannot be accepted for the distribution of the angle of eccentricity, and one can suggest that the behaviour of the statistics under consideration is due, in the first place, to the iwdening of the distribution range (group 4, for example, contains only 3 objects with the angle of eccentricity higher than 21° – the highest being 24°.1; group 5 already contains 10 such objects with the highest value of 41°.0; and group 6 as many as 28 objects, with 55°.8 as the highest value), and to the relative narrowness of the central part of the distribution, leading to its rapid filling up (in all three groups of particular interest, 4, 5 and 6, zone 3°–12° comprises more than 70% of all minor planets).

4. VARIATIONS OF THE DISTRIBUTIONS SHAPES

Examination of the variations of shapes of inclination and angle-of-eccentricity distributions in the sample of numbered minor planets has been carried out for slightly different conditions than those created for the examination of sample parameters variations.

The idea was to compare these distributions for various groups of the numbered minor planets not only graphically, i.e. descriptively, but also by establishing some quantitative measure of the variations of distribution shape. For this purpose, the same theoretical distribution law was applied to approximate the observed distributions of both elements in various groups of minor planets, whereby the agreement of the expected and observed occurence rates was checked. The measure of the accordance of the two sets of frequencies is assumed to represent this quantitative indicator of the variations of the distributions shapes, to be detected.

As it is well known, fitting of a theoretical curve to a set of observed data is most succesfully achieved if the observed frequencies are sufficiently high, in which case the check attains a higher degree of reliability. Accordingly, it was decided to use in this part of work only the three largest groups of minor planets, formed in the previously described manner, namely, groups 4 (851 minor planets), 5 (1277) and 6 (1915).

Of all theoretical distribution laws, which were at our disposal for the application in this examination, the four-parameter Pearson's distribution law of type I (Mitropol'skij, 1961) proved to be the most convenient one,

$$f(x)=\frac{1}{l}\frac{q_1^{q_1}\,q_2^{q_2}}{(s-2)^{s-2}}\frac{\Gamma(s)}{\Gamma(q_1+1)\Gamma(q_2+1)}\left(1+\frac{x}{l_1}\right)^{q_1}\left(1-\frac{x}{l_2}\right)^{q_2} \qquad (3)$$

while for testing the goodness of the fit, the standard χ^2 – criterion with 5% level of significance was applied.

It is quite understandable that for an examination of this kind one should not take into consideration the peripheral parts of the distributions, where the class--intervals are only sporadically filled up. Accordingly, only minor planets with inclinations up to 27^o and angles of eccentricity up to 22^o have been considered. This, however, does not affect the generality or validity of results, inasmuch as the number of minor planets discarded exceeded 1% in only one group under consideration (group 6 for angle of eccentricity).

The step of the distribution argument, i.e. the width of the distribution class-interval was 1^o. Hence, the first interval contained objects with inclination or angle or eccentricity between 0^o and $0^o\!.999$, the second interval those between 1^o and $1^o\!.999$ etc. This choice of the sampling interval provided a sufficient number of degrees of freedom, which is of particular importance for the application of the χ^2 – criterion with the reliability required.

The observed distributions obteined are shown in Figures 3 and 4.

It now becomes evident what the results of Section 3.2. already pointed at. Both distributions, keeping the main features of their shapes, tend to grow more rapidly in their central parts, and become progressively more asymmetric. It is essential, however, that the inclination distribution, in contrast to the angle-of-eccentricity distribution, preserves in all three groups some finer structural peculiarities, such as stable position of the mode in the interval 5^o–$5^o\!.999$, conspicuous peaks in the intervals 10^o–$10^o\!.999$, 18^o–$18^o\!.999$ and 25^o––$25^o\!.999$, and minima in the intervals 7^o–$7^o\!.999$ and 17^o–$17^o\!.999$. The angle-of-eccentricity distribution is characterized by continuous slight variations of its fine structure with the increase of the size of the sample.

However, as already emphasized, main attention in this part of work has been paid to the comparison of Pearson's Law of type I (3) with the observed distributions of inclinations and angles of eccentricity in our groups. On account of the specific nature of the χ^2 – criterion, whose resulting values $P(\chi^2)$, i.e. the probabilities of exceeding the observed χ^2 – values, ought to represent a quantitative measure of distribution shape variations, we shall examine these results in two respects.

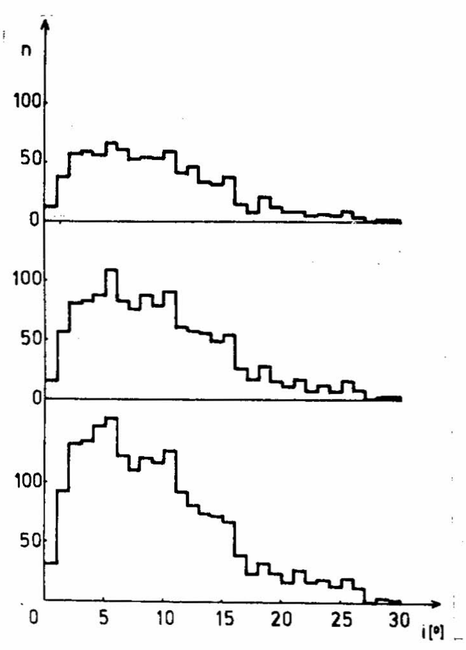

Fig. 3 – Inclination distribution in the groups 4, 5 and 6 (from above)

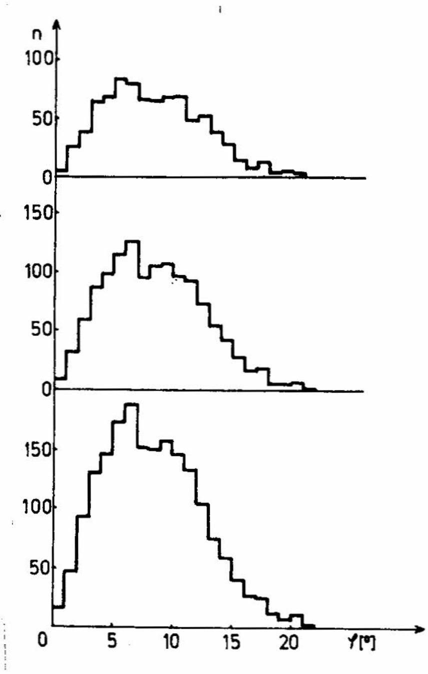

Fig.4 – Angle of eccentricity distribution in the groups 4, 5 and 6 (from above)

For a correct application of the χ^2 – test it is indispensable to fulfil the condition that individual frequencies are not too low. Therefore, in testing the distribution agreement, if necessary, a number of intervals with low frequencies are to be combined into a few wider ones with higher frequencies. This is exactly how it was proceeded in this work, whereby the peripheral intervals on the right-hand side of the inclination and angle-of-eccentricity distributions are combined in the way most appropriate for the given distribution. For a comparison, testing of the agreement of the original distributions, i.e. those without combining of the peripheral intervals, was also performed. Table 4 contains the results of the tests mentioned; the designation DIRECT denotes the probabilities obtained by means of direct testing – without combining of peripheral intervals – and MAXIMUM denotes the probabilities of distributions with intervals combined in the most suitable way.

The tests of agreement of the theoretical and observed inclination distributions by direct application of the χ^2 – criterion showed a clear discordance of the expected and observed data, but the probabilities pertaining to the distributions with combined peripheral intervals indicate a convincing, and in the case of group 4 an excellent agreement. Thus, according to the „direct" probabilities, Pearson's Law of type I does not represent the observed distribution of inclinations, whereas the „maximum" probabilities make the same law a well acceptable approximation. True, this reveals some arbitrariness of the whole procedure, which, however, does not affect our main objectives. It can, therefore, be stated that the variation of probabilities is noticeable, and, although, strictly speaking, it remains within the bounds of random deviations, some evolution of the shape of the inclination distribution with the increase of the numbered minor planet sample can be conjectured.

Table 4

Results of testing the distribution agreement

Group	Element \ Test	DIRECT		MAXIMUM	
		i	φ	i	φ
4		0.03	0.31	0.90	0.64
5		0.00	0.36	0.39	0.66
6		0.00	0.25	0.20	0.58

Regarding the angle of eccentricity, even though the variations of skewness and kurtosis were rather large, according to our previous results, and although small variations of the shape are clearly noticeable, it seems rather paradoxical that the original shape of the distribution has not changed significantly with the increase of the sample size. Direct testing already yielded absolutely satisfying and almost equal probabilities for all three examined groups and, accordingly, the difference of the observed distribution shapes within the margin of random deviations. This means that different intervals of the angle-of-eccentricity distribution have hitherto been relatively uniformly filled up, and that there is no indication of significant changes to be predicted for the future. A similar conclusion can be drawn on the basis of the analysis of the „maximum" probabilities, which differ among themselves even less than those obtained by direct application of the χ^2 – test, and which are systematically higher than the „direct" ones by a factor of about two. Thus, it can be stated that the expression (3) furnishes a very good approximation of the observed distribution of the angle of eccentricity and can be considered, in this case, as a realistic distribution law.

5. CONCLUSIONS

Let us summarize the most important conclusions of this paper.

The nonrandomness of the numbered minor planet sample, as a consequence of various effects of observational selection, affects the statistical stability of the sample, particularly as regards its principal parameters: measures of central tendencies, variation, symmetry and kurtosis. This should be borne in mind and taken into account in statistical investigations.

The shape of the distribution, however, can be considered as a rather stable sample characteristic.

It must be reiterated that the aim of this paper was just to investigate the stability of the principal elements, with the increasing size of the sample of numbered minor planets. Their variations, which were found to be statistically significant, are due to the real features of the minor planet system and selection effects governing both the discovery of new objects and their inclusion into the list of numbered objects. The phenomena and the biases involved will be discussed in a separate paper to follow.

ACKNOWLEDGMENTS

I am grateful to Dr L'. Kresák for stimulating discussions which have been helpful in completing this paper.

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NOTE ON THE RELIABILITY OF COMPUTATION OF THE RELATIVE ORBITAL ELEMENTS OF THE VISUAL BINARIES WITH COMPONENTS OF EQUAL BRIGHTNESS

Đ. J. Zulević

SUMMARY:

An analysis has been made of two, a priori possible, solutions of the orbital elements of 28 visual binaries whose components are of equal and nearly equal brightness. The analysis showed that either solution, for both coordinates, was equally reliable.

Introduction

It is a well known fact in the observational practice that at measuring the positional angle of a visual binary, whose components are of equal or nearly equal brightness, the observer is in a dilemma which of them should be taken for A component, the amount of the position angle, θ or θ+180°, being dependent upon that cohice. For convenience, at the beginning, that position angle is adopted, as was publiched by the pair's first observer, i.e., its discoverer.

This dilemma reappears if, for various reasons, there have been long breaks in the observations or the components have approached each other so closely that their separation escapes the resolving power of the instrument used.

In determining the relative orbital elements in cases where there is uncertainty over the correct quadrant – in consequence of the above mentioned dilemma - one is confronted with the possibility of double solution. The principal characteristics of one of the solutions are: short period and high eccentricity. The second solution is characterized by: nearly doubled period as compared with that of the first solution, high inclination and small eccentricity.

The question arrising is: which of the two solutions is the true one?

Eggen (1955) suggested that the correct solution might be arrived at by comparing the dynamical parallaxes, entailed by the two solutions, with the trigonometric, photometric or some other parallaxes. Having applied this criterion to the binaries ADS 9397 and φ 283, he inferred that in both cases the long period solution was more probable, provided the luminosity was proportional to the mass and both stars belonged to the main sequence. However, notwithstanding the fact that smaller residuals in both cases favoured Eggen's criterion, he pointed out that this was still unsufficient for a definite decision.

W.H. van den Bos (1961) emphasized that Eggen's criterion may be profitable only in cases where radial velocities are known – something rarely found. Accordingly, Eggen's criterion cannot be applied universally.

The problem, therefore, remains open.

Double solution being, under circumstances described, a priori self-imposing, one of which only can be correct, I made an attempt to provide some additional information, little though, if any, this might be, and thus to judge from a possible better position – a posteriori – on this intricate problem. This additional information I expected to acquire by analyzing the mean square error of the residuals, resulting from the one, resp. the other solution, using to this end 28 pairs of double stars, listed in Table 1. Mean square error of the residuals of both coordinates was studied: a/ taking the totality of the residuals of all the 28 pairs, that is, indiscriminately all the observers in consideration, and b) taking into consideration residuals of those observers only, having at least 49 measures.

In addition to the columns of Table 1 giving self-evident data, there is a column „Discoverer", giving the names of authors (in a few cases the same author) of the two variants of the orbits. The column „Last obs." provides information on when the last observation, used in calculation of the orbit, has been made. The last column in Table 1 lists the references and the year of publication of individual orbits.

Mean square error of a single measure of both coordinates resulting from the first and second solution of the orbital elements.

A complete observation of a visual binary comprehends, as is well known, three data: the time of observation, the position angle and the angular separation of the components. I proceeded from the residuals $(0-C)_\theta = \Delta\theta$ and $(0-C)_\rho = \Delta\rho$ where θ and ρ are, as

Table 1

N	ADS	Discoverer		e	P	a	dp	Δm	Sp
1	363	A	431	0.65	54.0	0."36	0."022	0.0	G5
				0.00	108.6	0.39	0.013		
2	−21°57	B	1909	0.60	5.6	0.13	0.034	0.0	G2
				0.00	11.2	0.21	0.034		
3	450	A	111	0.57	10.8	0.17	0.028	0.1	G5
				0.00	21.3	0.19	0.021		
4	673	β	495	0.64	170.6	0.64	0.016	0.0	G0
				0.17	235.0	0.84	0.015		
5	999	β	1100	0.88	75.0	0.40	0.015	0.0	F7
				0.00	150.0	0.58	0.015		
6	1126	A	939	0.82	64.0	0.27	0.005	0.0	F0
				0.25	112.5	0.19	0.008		
7	1371	β	453	0.82	118.6	0.85	0.036	0.2	G5
				0.29	226.6	0.74	0.017		
8	1411	OΣ	34	0.77	165.4	0.35	0.007	0.2	A0
				0.16	395.0	0.64	0.007		
9	1613	A	1813	0.58	12.7	0.12	0.039	0.2	G5
				0.34	25.8	0.19	0.017		
10	2200	β	524	0.76	31.6	0.22	0.013	0.4	F4
				0.00	63.1	0.20	0.007		
11	3041	A	2801	0.76	20.0	0.14	0.015	0.0	G2
				0.00	40.0	0.20	0.013		
12	3520	Hu	555	0.75	59.5	0.28	0.010	0.2	F8
				0.04	101.3	0.22	0.007		
13	3701	A	3010	0.90	1.2	0.18	0.126	0.0	F4
				0.00	2.4	0.10	0.041		
14	3991	A	847	0.75	24.7	0.19	0.015	0.1	F8
				0.00	49.7	0.33	0.017		
15	4929	β	895	0.75	54.0	0.18	0.008	0.0	A3
				0.00	108.0	0.28	0.009		
16	5720	A	2462	0.65	41.9	0.23	0,016	0,0	G0
				0.00	95.0	0.25	0.012		
17	7054	A	1584	0.76	85.0	0.42	0.016	0.0	G2
				0.00	150.0	0.63	0.012		
18	7334	A	1342	0.95	22.3	0.19	0.016	0.0	A2
				0.22	58.9	0.15	0.006		
19	8884	A	2489	0.69	65.6	0.29	0.015	0.0	G5
				0.00	133.8	0.36	0.008		
20	9185	A	1101	0.90	36.0	0.28	0.022	0.5	K0
				0.06	73.0	0.30	0.017		
21	9397	A	2983	0.67	9.9	0.17	0.043	0.0	K2
				0.05	19.8	0.16	0.020		
22	9744	Hu	580	0.80	11.1	0.12	0.013	0.1	A1
				0.00	22.1	0.21	0.015		
23	9831	A	2080	0.84	90.0	0.31	0.011	0.0	F2
				0.14	257.0	0.30	0.005		
24	10360	Hu	1176	0.91	8.0	0.23	0.035	0.0	A5
				0.14	16.1	0.17	0.017		
25	11842	A	2192	0.82	85.4	0.49	0.018	0.0	A5
				0.17	135.0	0.27	0.006		
26	15236	Hu	280	0.73	77.8	0.26	0.010	0.3	A5
				0.29	112.1	0.19	0.005		
27	−58°789	φ	283	0.66	6.3	0.23	0.063	0.1	F0
				0.05	12.6	0.31	0.050		
28	16314	Ho	482	0.81	55.8	0.30	0.010	0.0	A6
				0.10	102.3	0.22	0.006		

Table 1

Author	Last. Obs.	References
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usual, the position angle and separation respectively in order to find out, by way of mean square errors:

$$\epsilon_\theta = \sqrt{\frac{\sum_{k=1}^{n_\theta} \Delta\theta^2}{n_\theta - 1}} \; ; \qquad \epsilon_\rho = \sqrt{\frac{\sum_{k=1}^{n_\rho} \Delta\rho^2}{n_\rho - 1}}$$

how both variants of the orbit fitted in the observations, that is, whether one of them had any advantage over the other.

Gross errors, that is, those exceeding threefold value of the mean value of the square error of the corresponding parameter, were rejected. A presentation of the errors we thus obtained is given in Table 2.

Table 2
Mean square error of a single measure of θ and ρ for both solutions of the orbital elements

ADS	Discoverer		ϵ_{θ_1}	ϵ_{θ_2}	n_{θ_1}	n_{θ_2}	ϵ_{ρ_1}	ϵ_{ρ_2}	n_{ρ_1}	n_{ρ_2}
363	A	431	± 2°.9	± 2°.5	84	84	± 0".024	± 0".038	84	84
−21°.57	B	1909	14.6	8.7	77	77	41	25	77	77
450	A	111	14.7	12.6	104	104	38	19	103	103
673	β	495	11.4	3.1	272	272	44	52	272	272
999	β	1100	4.8	7.4	63	63	48	40	60	60
1126	A	939	3.3	5.4	33	33	55	22	33	33
1371	β	453	4.8	2.4	35	35	56	40	35	35
1411	ΟΣ	34	6.3	5.1	83	83	66	80	73	76
1613	A	1813	4.1	3.7	18	18	0	0	18	18
2200	β	524	10.1	9.8	113	113	38	33	110	106
3041	A	2801	4.3	3.3	38	38	28	21	38	38
3520	Hu	555	1.6	4.8	18	18	32	26	18	18
3701	A	3010	20.8	29.0	13	13	20	29	13	13
3991	A	847	5.7	5.5	61	60	50	54	59	59
4929	β	895	10.1	8.1	157	157	46	39	150	150
5720	A	2462	8.2	9.5	16	16	53	42	16	16
7054	A	1584	1.8	2.2	103	123	69	91	103	123
7334	A	1342	13.9	14.8	104	103	34	29	109	109
8884	A	2489	4.8	6.8	37	37	64	56	37	37
9185	A	1101	4.3	4.2	34	34	51	53	34	34
9397	A	2983	12.1	10.6	52	52	23	28	52	52
9744	HU	580	8.5	8.3	141	140	39	43	142	142
9831	A	2080	5.3	5.8	94	94	39	26	94	94
10360	HU	1176	32.9	29.2	65	65	41	43	65	65
11842	A	2192	4.4	4.5	95	95	32	29	95	95
15236	Hu	280	8.4	10.2	67	67	33	19	67	67
−58°78	φ	283	4.1	4.2	60	60	37	29	60	60
16314	Ho	482	± 2°.5	± 2°.4	58	58	± 0".028	± 0".033	58	58

In Figs. 1 an 2 are represented the frequency distributions of the mean square errors of both coordinates, resulting from both variants of orbits, on the base of the data given in Table 2.

The graphs in Figs. 1 and 2 show that there is almost complete agreement between the mean error distributions for both variants of both parameters. Consequently, both solutions of the orbital elements, in all the cases investigated, possess the same weight.

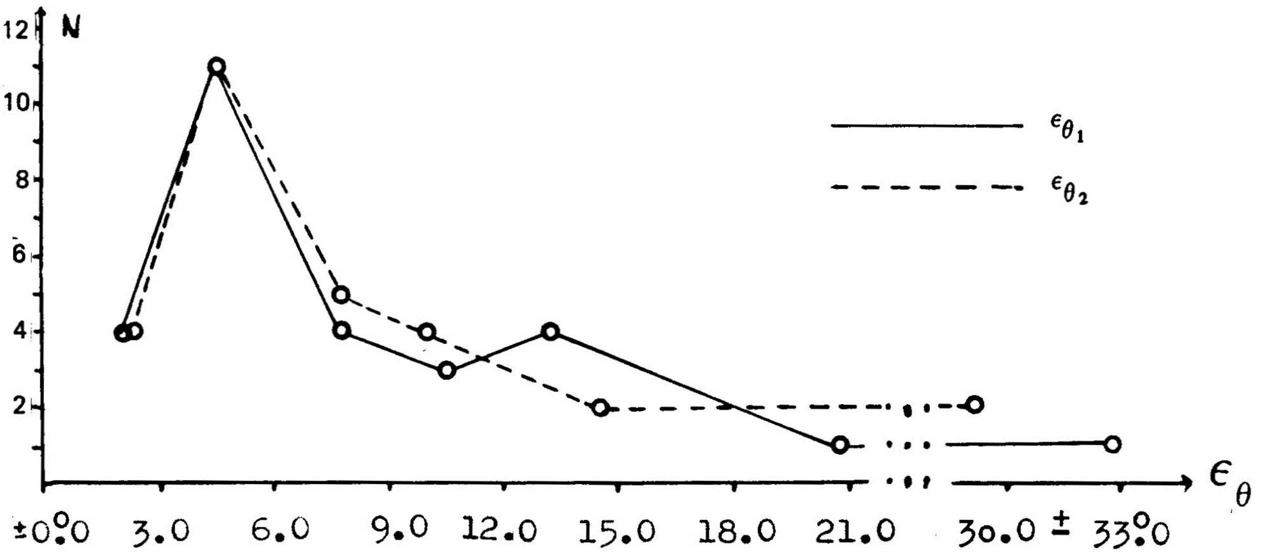

Fig. 1
Frequency distribution of the mean square errors ϵ_{θ_1} and ϵ_{θ_2}
Horizontal scale: magnitude of errors; Vertical scale: number of occurrence of errors

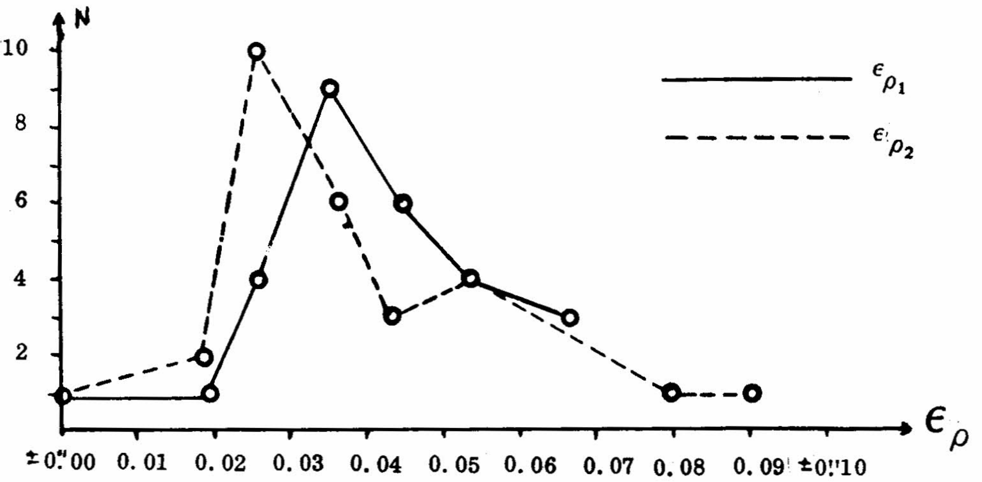

Fig. 2
Frequency distribution of the mean square errors ϵ_{ρ_1} and ϵ_{ρ_2}
Horizontal scale: magnitude of errors; Vertical scale: number of occurrence of errors

Mean square error of a single measure by five observers: VBS, A, BOS, C and M

In order to assess whether the measures of the following observers: G. Biesbroeck, R. G. Aitken, W. H. van den Bos, P. Couteau and P. Muller, somehow favoured the one or the other solution, I summerized the mean square error of all their observations of the pairs, comprehended in Table 1. These mean square errors are listed in Table 3.

Table 3

Mean square error of a single measure of θ and ρ of the observers: VBs, A, Bos, C and M

Author	ϵ_{θ_1}	ϵ_{θ_2}	n_{θ_1}	n_{θ_2}	ϵ_{ρ_1}	ϵ_{ρ_2}	n_{ρ_1}	n_{ρ_2}
VBs	± 6°.3	± 7°.0	380	381	± 0''.046	± 0''.038	388	382
A	5.4	6.7	244	244	25	27	244	244
Bos	11.1	10.7	227	229	39	27	238	238
C	26.4	5.8	50	50	47	25	50	50
M	± 10°.4	± 12°.0	49	49	± 37	± 47	49	49

The differences between the first and the second figures is still within the possible errors, although one would say that the second solution displayed some advantage over the first. Accordingly, even this analysis does not indicate anything definite concerning the question we treated here: what is the correct solution of the two possible.

Conclusion

The analysis carried out in the way described here showed that both solution are as yet of equal reliability. I, therefore, propose that, in cases where both components are equally bright, and there has been a long break in observations, due to the pair not having been observed for a long time or because of separation of the stars has been below the resolving power of the instrument, both solution of the orbital elements be obligatory given.

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ORBITS OF TWO VISUAL BINARIES

D. J. Zulević

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SUMMARY:

Orbits and dynamical parallaxes are presented of two visual binary systems: ADS 6582 and ADS 7758. Calculated positions are compared with observations and ephemerides are given for each system.

Orbits for two visual binaries have been computed using the methods of Thiele-Innes. Precessional corrections for the year 1950 were applied to the position angles of all the observations. Dynamical parallaxes were computed by the method of Baize and Romani (1946) with magnitudes and spectral types taken from the Lick Index Catalogue of Visual Double Stars, 1961. (1963). The relevant information is given in Table I.

Table I
Campbell and Thiele-Innes elements

ADS	6582		7758	
IDS	08010S0029		10195N2468	
Disc.	A 1971		STF 1429	
Vis. mag.	9.1–9.2		9.0–9.0	
Sp. type	G 5		G 5	
P (years)	151.83	A = −0″.4700	1174.55	A = −0″.7150
n	2°.3710	B = −0″.190	0°.3065	B = +1″.8000
T (years)	1896.72	F = −0″.1620	2139.21	F = +0″.5620
a	0″.51	G = +0″.395	1″.94	G = +0″.2200
e	0.61	C = ±0″.0039	0.32	C = ±0″.0032
i	147°.4	H = ∓0″.2747	108°.2	H = ±1″.8399
ω	179°.2		0°.1	
Ω	21°.3		111°.7	
π dyn.	0″.014		0″.013	
Σ Mass	2.10 ⊙		2.40 ⊙	
a	36.43 U.A.		149.0 U.A.	

Table II
Ephemerides

	ADS 6582		ADS 7758			ADS 6582		ADS 7758	
T	P	ρ	P	ρ	T	P	ρ	P	ρ
1978.0	18°.7	0″.81	184°.2	0″.55	1985.0	14°.4	0″.80	176°.5	0″.57
1979.0	18.1	0.81	183.0	0.55	1986.0	13.7	0.80	175.4	0.57
1980.0	17.5	0.81	181.9	0.55	1987.0	13.1	0.79	174.4	0.57
1981.0	16.9	0.81	180.8	0.56	1988.0	12.4	0.79	173.4	0.58
1982.0	16.2	0.80	179.7	0.56	1989.0	11.7	0.78	172.4	0.58
1983.0	15.6	0.80	178.6	0.56	1990.0	11.1	0.78	171.4	0.58
1984.0	15.0	0.80	177.6	0.56					

Table III
Observations and residuals

T	P	ρ	mag	n	Obs.	(0–C)P	(0–C)ρ
				ADS 6582			
1908.97	104°.6	0″.35	$9^{m}.0-9^{m}.1$	3	A	+1°.7	+0″.06
1919.92	71.4	0.51		2	A	+1.6	+0.05
1936.47	46.3	0.53		5	VBs	–1.4	–0.12
1942.40	40.0	0.55		3	VBs	–2.4	–0.15
1951.02	33.0	0.70		2	VBs	–2.9	–0.06
1955.65	31.5	0.77		6	Worley	–1.2	0.00
1958.05	26.5	0.82		2	Bos	–4.6	+0.03
1960.48	29.7	0.82		4	Worley	+0.2	+0.02
1961.24	26.	0.93		3	VBs	–3.1	+0.13
1965.17	29.6	0.76		1	Worley	+3.0	–0.05
1969.96	24.2	0.87		4	Worley	+0.6	+0.05
1976.14	20.9	0.79		2	DZ	+1.0	–0.02
				ADS 7758			
1829.28	270°.6	1″.52	$8^{m}.7-8^{m}.7$	3	STF	+0°.5	+0″.08
1890.65	255.4	0.99		8	Sp	+0.3	+0.03
1902.4	253.7	0.93		18	GrO	+3.5	+0.07
1909.07	246.3	0.76		16	Frm 1, Wz 2, A 1, GrO 8, Doo 3, Lau 1	–0.7	–0.05
1913.86	244.4	0.72		12	Fox 3, Dob 4, Rabe 2, VBs 3	0.0	–0.06
1921.50	237.1	0.70		10	A 1, VBs 2, Fur 3, B 4	–2.7	–0.02
1922.31	244.5	1.20		2	Gcb	+5.2	+0.48
1925.37	239.3	0.37e		2	Dob	+2.1	–0.33
1926.27	236.1	0.65		5	Fatou	–0.5	–0.05
1927.362	234.7	0.65		2	Hintze	–1.1	–0.04

T	P	ρ	mag	n	Obs.	(0–C)P	(0–C)ρ
				ADS	7758		
1928.214	234°.5	0".70		2	Hintze	–0°.7	+0".02
1934.21	228.1	0.64		3	VBs	–2.5	0.00
1944.02	215.7	0.61		2	VBs	–6.2	+0.01
1949.276	215.1	0.56		7	Rabe	–1.6	–0.01
1950.18	213.0	0.68		1	Domm.	–2.7	+0.11
1951.02	211.6	0.61		4	VBs	–3.2	+0.04
1951.22	215.0	0.58		2	Domm.	+0.4	+0.01
1951.312	215.5	0.52		6	Rabe	+1.0	–0.05
1952.30	217.5*	0.57		1	Domm.	+3.0	+0.01
1953.16	212.5*	0.60		2/1	Domm.	–0.1	+0.04
1953.314	211.6	0.54		6	Rabe	–0.8	–0.02
1954.334	211.7	0.50		5	Rabe	+0.4	–0.06
1955.19	209.2	0.65		4	Worley	–1.2	+0.09
1955.312	208.4	0.53		6	Rabe	–1.8	–0.03
1956.22	208.7	0.54		3	P. Conteau	–0.5	–0.01
1956.328	209.8	0.50		6	Rabe	+0.7	–0.05
1958.	305.	0.60		.	....	–2.	+0.05
1958.041	209.6	0.67	9.0–9.1	1	Bos	+2.4	+0.12
1958.26	208.1	0.66	8.7–8.7	3	P. Couteau	–0.5	+0.11
1958.309	206.4	0.45	9.0–9.2	1	Bos	–0.5	–0.10
1958.52	204.6	0.66		2	Worley	–2.1	+0.11
1960.26	206.2*	0.58		6	W. D. Heintz	+1.5	+0.03
1961.15	202.9	0.62		3	VBs	–0.8	+0.08
1961.25	204.7	0.56	8.8–8.8	3	Dj	+1.1	+0.02
1962.138	204.7	0.52	9.1–9.1	3	Bos	+2.2	–0.02
1962.33	204.8	0.58		4	F. Holden	+2.5	–0.04
1963.144	204.1	0.51		4	Worley	+2.7	–0.03
1964.30	197.9*	0.66		5	W. D. Heintz	–2.1	+0.12
1964.57	201.5	0.54	8.6–8.6	3	P. Couteau	+1.8	0.00
1966.34	199.5	·0.64		3	P. Baize	+1.8	+0.10
1969.26	191.1*	0.58		4	W. D. Heintz	–3.1	+0.04
1972.232	191.8	0.55		1	OLE	+0.8	+0.01
1976.139	191°.4	0".67		1	DZ	+5°.1	+0".12

* Qudrant reversed.

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ORBITE NOUVELLE DE L'ETOILE DOUBLE VISUELLE ADS 4020 = A 848

V. Erceg

(Reçu le 10 décembre 1978)

SOMMAIRE:

On donne les éléments d'orbite, les masses, les magnitudes absolues et la parallaxe dynamique de ADS 4020 = A 848, les éléments étant déterminés et utilisant la méthode de Thiele-Innes Van den Bos.

Orbite de ADS 4020 = A 848
α, δ (1950): $05^h23^m\!.0$, $-\ 0°35'$

Mgns.: 6.7–7.3; Type sp. B9

Tableau I
Eléments orbitaux, les quantités astrophysiques et les constantes

P = 194.28 ans		
n = 1°.8530		
T = 1986.96	A = –0".1564	π dyn = 0".002
e = 0.24	B = –0.0560	$M_A = -1^m\!.5$
a = 0".169	F = +0,0438	$M_B = -0^m\!.9$
i = 23°.30	G = –0.1512	$\mathfrak{M}_A$ = 6.56 ⊙
Ω = 42°.45	C = ±0.0277	$\mathfrak{M}_B$ = 5.28 ⊙
ω = 155°.52	H = ∓0.0608	a = 73.5 UA
$T_{\Omega\mho}$ = 1910.36; 1994.91		

Tableau II
Ephémérides

t	θ°	ρ"	t	θ°	ρ"
1978.0	172.8	0.12	1983.0	187.9	0.12
1979.0	175,8	0.12	1984.0	190.9	0.12
1980.0	178.8	0.12	1985.0	193.9	0.12
1981.0	181.9	0.12	1986.0	196.9	0.12
1982.0	184.9	0.12	1987.0	199.8	0.13

Tableau III
Observations et les résidus

t	θ^{o}	ρ"	Obs.	n	Références	$(0-C)_{\theta^o}$	$(0-C)_{\rho}$"
1904.88	35.6	0.22	A	3	ADS	–0.7	+0.01
1910.09	43.2	0.26	Bry	1	"	+1.1	+ 6
1917.76	45.8	0.22	A	2	"	–5.3	+ 2
1924.06	47.2	0.15	A	1	"	–11.7	– 4
1931.16	57.5	0.19	A	2	Lick Obs. Bull. N. 451.	–10.9	+ 1
1935.864	84.*	0.16	Vou	4	Ann. Bosscha Len. 1934, N. VI	+9.	– 2
1935.864	86.*	0.15	B	4	U.O.C. 96, 1936.	+11.	– 3
1937.137	70.	0.2	φ	1	U.O.C. 112, 1951.	–7.	0
1937.787	77.8*	0.17	Vou	4	Ann. Bosscha Len. 1934, N. VI	–0.4	0
1938.785	72.6*	0.17	Vou	4	"	–7.2	0
1944.81	92.1	0.16	Vou	4	J.O.Vol. XXXVIII, N. 6, 1955.	+2.1	0
1944.85	75.2	0.16	VBs	2	Pub. Yerkes Obs., Vol. VIII, Part VI.	–14.8	0
1953.11	119.1	0.140	φ	4	U.O.C. 113, 1953,	+12.9	– 1
1954.14	118.4	0.144	φ	2	U.O.C. 114, 1954	+10.0	– 1
1954.79	129.2	0.12	VBs	4	Pub. Yerkes Obs., Vol. IX, Part II.	+19.4	– 2
1956.17	98.	0.14	Mull	2	J.O.Vol. XXXIX, N. 7, 1956.	–15.	0
1958.027	122.7	0.12	B	1	Pub. Yerkes Obs., Vol. IX, Part I.	+5.4	– 2
1958.088	122.0	0.12	B	1	"	+4.6	– 2
1958.194	128.7	0.14	B	1	"	+11.0	0
1960.16	122.4	0.132	φ	4	U.O.C. 119, 1960.	0.0	0
1960.19	138.4	0.16	VBs	2	Kitt Peak N. Obs. Contr. N. 180.	+15.9	+ 2
1961.859	simple		Cou	1	J.O. Vol. 45, N. 9, 1962.	–	–
1961.899	128.3	0.13	B	4	Astr. J. Vol. 67, N. 8, 1962, N. 1303.	+1.5	0
1964.820	141.3	0.12	Wor	1	P.U.S.N.O. XXII, Part II.	+6.8	– 1
1966.880	131.2	0.11	Wor	2	Pub. Naval Obs., Sec. ser. Vol. XXII, Part IV.	–8.9	– 2
1971.836	153.0	0.19	VBs	1	Ap. J. Supp. 270, N. 28, 1974.	–1.3	+0.06

* Quadrant changé.

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Bull. Obs. Astron. Belgrade, N° 130

TRAJECTOIRE APPARENTE RECTILIGNE DE ADS 3880 = A 2639

V. Erceg

(Reçu le 10 décembre 1978)

ADS 3880 = A 2639

α, δ (1950): $05^h15^m.4$, $+03^\circ38'$

Formules linéaires de la trajéctoire

$$\rho \cos(\theta - 348.^\circ6) = 0.''350$$
$$\rho \sin(\theta - 348.^\circ6) = 0.''0108\,(t - 1923.26)$$

Tableau I
Observations et les résidus

t	θ°	ρ''	n	Obs.	Références	$(0-C)^\circ_\theta$	$(0-C)''_\rho$
1913.79	7.6	0.35	2	A	ADS	+2.7	–0.01
1920.76	348.6	0.36	2	A	ADS	–4.4	+ 1
1930.99	329.6	0.35	1	A	Lick Obs. Bull. 451.	–5.7	– 1
1938.558	320.6	0.40	4	B	U.O.C.107, 1948.	–2.8	+ 1
1940.71	324.5	0.42	3	VBs	Pub. Yerkes Obs. Vol. VIII, Part VI.	+4.1	+ 2
1942.83	318.3	0.37	3	Vou	J.O.Vol. XXXVIII, N. 6, 1955.	+0.7	– 4
1953.03	309.3	0.48	4	VBs	Pub. Yerkes Obs. Vol. IX, Part II.	+3.1	+ 1
1958.041	301.3	0.48	1	B	Pub. Yerkes Obs. Vol. IX, Part I.	–0.4	– 3
1958.074	300.1	0.53	1	B	"	–1.6	+ 2
1958.74	304.0	0.42	3	Cou	J. O. Vol. 42.	+2.8	– 10
1961.939	302.8	0.61	3	Wor	Pub. Naval Obs., Vol. XVIII, Part VI.	+4.1	+0.07

Tableau II
Ephémérides

t	θ°	ρ''
1978.0	300.6	0.68
1979.0	300.2	0.70
1980.0	299.7	0.71
1981.0	299.3	0.72
1982.0	298.9	0.72
1983.0	298.5	0.73
1984.0	298.1	0.74
1985.0	297.7	0.75
1986.0	297.3	0.76
1987.0	297.0	0.77

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MICROMETER MEASURES OF DOUBLE STARS

(Series 29)

D. J. Zulević

(Received December 15, 1978)

SUMMARY:

Presented here are 233 measures of 84 Double Stars made with 65/1055 cm refractor of Belgrade Observatory.

The present list is a continuation of the published series of measures of double stars in Belgrade, made in the period 1976.86–1978.80.

In the Table I of measures the columns give: ADS number, double star designation, multiple, position for 1900 (IDS), epoch omitting the century, position angle, separation, estimated magnitudes, number of nights and notes. An asterisk in the second column indicates that there is a note at the end of Table I.

In the present work the distribution of 233 measures of distances is as follows:

Distances	measures	%
to 0″.50	13	5.6
0″.51 to 1″.00	99	42.5
1″.01 to 1″.50	81	34.8
1″.51 to 2″.00	21	9.0
2″.01 or greater	19	8.2
	233	100%

Table I
Micrometer measures of double stars

ADS	Disc. IDS	Mult.	Epoch 1900+	P	ρ	Est. Mag.	n	Notes
61	STF 3062		77.80	281°.0	1″.25	6.4–7.5	1	
	00010N5753		78.77	283.2	1.30		1	
			78.78	285.5	1.28		1	
			78.79	283.9	1.26		1	
			78.80	286.6	1.23		1	
			78.58	284.0	1.26		5	Baize, 1958: –0°.2; –0″.16
221	STT 4		78.78	175.5	0.49	8.2–8.9	1	
	00115N3556		78.78	176.0	0.50		1	
			78.78	175.7	0.49		2	Muller, 1959: +2°.3; –0″.06
283	HJ 1018		78.77	83.8	1.26	8.6–9.2	1	
	00154N6707		78.79	84.5	1.38		1	
			78.78	84.1	1.32		2	Muller, 1956: –2°.1; –0″.10
684	BU 232	AB	78.77	239.2	0.78	8.5–9.0	1	
	00448N5005		78.79	235.5	0.75		1	
			78.78	237.3	0.77		2	Baize, 1963: +1°.6; –0″.04

ADS	Disc. IDS	Mult.	Epoch 1900+	P	ρ	Est. Mag.	n	Notes
1254	STF 138	AB	76.99	51°3	1″57	7.7–7.7	1	
	01308N0708		77.67	50.0	1.70		1	
			77.74	50.8	1.65		1	
			77.82	53.7	1.54		1	
			77.55	51.4	1.61		4	Changed 31° since 1830.
1371	BU 453		77.81	62.4	0.49	10.1–10.4	1	
	01384N5637		78.77	54.3	0.47		1	Florsch, 1955: Orbite questionable.
			78.29	58.4	0.48		2	Baize, 1973:
1737	STF 234	AB	77.81	237.4	0.76	8.5–9.4	1	
	02100N6053		78.77	238.0	0.74		1	
			78.29	237.7	0.75		2	Baize, 1954: –2°3; –0″14
2034	STT 43		77.04	12.6	0.97	8.3–9.9	1	
	02349N2612		77.74	10.4	0.97		1	
			77.75	13.5	1.03		1	
			77.76	11.2	1.03		1	
			77.80	11.6	0.97		1	
			77.80	8.2	0.97		1	
			77.65	11.2	0.99		6	Heintz, 1961: +1°6; –0″04
2122	STF 305	AB	76.86	310.0	3.45	7.4–8.3	1	
	02418N1857		77.74	309.0	3.51		1	
			77.75	311.0	3.40		1	
			77.76	309.1	3.43		1	
			77.53	309.8	3.45		4	Rabe, 1961: +0°5; –0″19
2446	STT 53		77.80	263.8	0.86	7.7–8.5	1	
	03113N3816		77.81	264.7	0.76		1	
			77.82	264.4	0.77		1	
			78.78	263.2	0.82		1	
			78.05	264.0	0.80		4	Rabe, 1948: –2°5; –0″06
2995	STT 531	AB	77.76	13.4	1.32		1	
	04009N3749							Rabe, 1956: +8°0; –0″07
3082	STT 77	AB	77.03	268.6	0.79	8.2–8.3	1	
	04096N3127		77.04	272.4	0.74		1	
			77.74	273.4	0.81		1	
			77.76	271.1	0.78		1	
			77.39	271.4	0.78		4	Muller, 1957: +2°6; +0″00
3169	STT 82		77.02	2.1	1.25	7.3–9.3	1	
	04171N1449		77.80	1.2	1.25		1	
			77.41	1.6	1.25		2	Heintz, 1969: +0°7; –0″15
3390	STF 577		77.02	24.8	1.15	8.6–8.6	1	
	04355N3719		77.80	21.5	0.98		1	
			77.82	24.7	1.06		1	Popović, 1964: +0°2; –0″16
			77.55	23.7	1.06		3	Hock, 1968: –0°1; –0″07
3956	STF 677		77.18	158.7	0.92	7.9–8.2	1	
	05153N6317		77.82	159.5	0.92		1	
			77.50	159.1	0.92		2	Heintz, 1963: –2°9; –0″10

ADS	Disc. IDS	Mult.	Epoch 1900+	P	ρ	Est. mag.	n	Notes
4208	STF 749 05309N2652	AB	78.01	326°.7	0″.98	7.1–7.1	1	Changed 56° since 1829.
5400	STF 948 06374N5933	AB	77.18	262.3	1.62	5.3–6.2	1	
			77.19	261.6	1.66		1	
			77.19	262.0	1.64		2	Brosche, 1956: +1°.9; –0″.05.
5400	STF 948 06374N5933	BC	77.18	308.7	8.57	8.3–9.5	1	
			77.19	309.2	8.52		1	
			77.19	309.0	8.55		2	Changed 1″.8 since 1903.
5871	STF 1037 07066N2724	AB	78.17	321.1	1.20	7.2–7.2	1	Karmel, 1940: –0°.3; –0″.13
5999	STF 1070 07148N3413	AB	77.24	324.5	1.51	8.4–8.4	1	Changed 0″.4 since 1830.
6019	HJ 757 07162N3425		77.24	109.1	5.41	9.9–10.0	1	No change since 1903.
6650	STF 1196 08065N1757	AB	78.25	289.5	0.97	5.6–6.3	1	Gasteyer, 1954:
7613	STT 210 09563N4651		77.17	261.4	1.06		1	No change since 1845.
7704	STT 215 10108N1774		77.26	184.3	1.29	7.3–7.5	1	Zaera, 1957: +2°.4; –0″.08.
7802	STF 1439 10246N2079		77.19	91.4	1.46	8.9–9.4	1	Slow change since 1829.
8032	A 1590 10576N5464		77.34	348.5	1.08	9.2–9.7	1	
			77.36	346.6	1.23		1	
			77.35	347.5	1.15		2	Heintz, 1963: +2°.9; –0″.07.
8082	HJ 2562 11053N3142		77.34	259.9	1.12	9.8–11.3	1	
			77.36	267.3	1.02		1	
			77.35	263.6	1.07		2	Changed 66° since 1831.
8539	STF 1639 12194N2568	AB	77.34	326.7	1.30	6.6–7.8	1	
			77.36	327.2	1.41		1	
			77.44	326.4	1.38		1	
			77.38	326.8	1.36		3	Aller, 1951: +0°.6; –0″.06.
8540	STF 250 12195N4339		77.32	344.0	0.41	8.4–8.7	1	Slow change since 1845.
8553	STF 1643 12222N2735		77.34	15.6	2.38	9.2–9.5	1	
			77.36	15.2	2.41		1	
			77.35	15.4	2.40		2	Hopmann, 1959: +2°.3; +0″.11.
8606	STF 1661 12310N1157		77.33	252.5	2.22	9.1–9.1	1	
			77.34	248.4	2.24		1	
			77.36	248.1	2.18		1	
			77.34	249.7	2.21		3	Changed 22° since 1828.
8680	HU 640 12458N2065		77.36	143.4	0.71	10.1–10.1	1	
			77.44	139.5	0.58		1	
			77.44	170.8	0.59		1	
			77.41	141.2	0.63		3	Baize, 1956: –2°.3; +0″.12

ADS	Disc. IDS	Mult.	Epoch 1900+	P	ρ	Est. mag.	n	Notes
8887	HO 260		77.44	69°6	1″05	9.6–9.8	1	
	13189N2945		77.44	70.3	0.97		1	
			78.47	67.7	0.97		1	
			78.48	68.4	0.97		1	
			77.96	69.0	0.99		4	Baize, 1967: −1°6; −0″02.
9071	A 1614		77.44	135.4	1.12	9.4–9.5	1	
	13539N5229		77.44	134.6	1.12		1	
			77.44	134.9	1.03		1	
			78.47	135.6	1.12		1	
			77.70	135.1	1.10		4	Mourao, 1963: 0°0; −0″13
9182	STF 1819		77.36	251.1	0.78	7.7–7.8	1	
	14103N0336		77.44	246.7	0.84		1	
			78.48	245.8	0.87		1	
			78.53	243.7	0.82		1	
			78.54	244.4	0.78		1	
			78.07	246.3	0.82		5	Hopmann, 1945: −9°0; −0″24
9229	STF 1834		78.47	102.0	1.13	7.9–8.0	1	
	14166N4818		78.56	102.7	1.09		1	
			78.52	102.3	1.11		2	Van Den Bos, 1938: −1°4; −0″11
9324	A 347		77.44	276.1	0.52	8.5–8.7	1	Guntzel–Lingner, 1955:
	14334N4839							−3°6; −0″10.
9352	HU 575		77.32	8.6	0.45	10.1–10.6	1	Muller, 1952: −1°2; −0″11.
	14380N1955							
9418	STT 287		78.53	348.4	0.97	8.5–8.6	1	
	14478N4480		78.54	346.6	0.87		1	
			78.56	346.7	0.88		1	
			78.54	347.2	0.91		3	Heintz, 1962: +1°8; −0″19.
9578	STF 1932		77.42	243.2	1.12	7.1–7.6	1	
	15140N2672		77.42	247.7	1.16		1	
			77.44	247.4	1.25		1	
			78.47	247.5	1.17		1	
			78.48	248.9	1.18		1	
			77.84	246.9	1.18		5	Heintz, 1964: −2°3; −0″18.
9617	STF 1937	AB	77.32	249.0	0.63	5.6–6.1	1	Danjon, 1938: −7°2; +0″25.
	15191N3029		78.54	284.0	0.56		1	
			78.57	285.3	0.55		1	
			78.55	284.6	0.55		2	Danjon, 1938: +1°1; +0″23.
9626	STF 1938	BC	78.54	15.2	1.87	7.0–7.6	1	
	15207N3742		78.56	17.5	1.84		1	
			78.55	16.3	1.85		2	Baize, 1951: −0°4; −0″31.
9716	STT 298	AB	77.32	207.9	0.80	7.4–7.7	1	
	15325N3968		77.44	207.1	0.88		1	
			77.44	206.3	0.87		1	
			78.47	212.3	0.97		1	
			78.47	211.1	0.83		1	
			77.83	208.9	0.87		5	Couteau, 1965: +1°3; +0″04.

ADS	Disc. IDS	Mult.	Epoch 1900+	P	ρ	Est. mag.	n	Notes
10075	STF 2052	AB	77.44	140°.2	1″.25	7.8–7.8	1	
	16245N1837		77.44	135.5	1.24		1	
			77.66	136.6	1.26		1	
			78.47	138.4	1.22		1	
			78.54	136.4	1.17		1	
			78.57	136.2	1.19		1	
			78.02	137.2	1.22		6	siegrist, 1952: +0°.6; –0″.14.
10188	D 15		78.47	145.6	0.97	9.1–9.1	1	
	16408N4340		78.55	144.8	1.15		1	
			78.57	144.4	1.06		1	
			78.54	144.9	1.06		3	Wierzbinski, 1955: +1°.9; –0″.13.
10235	STF 2107	AB	77.32	89.2	1.17	6.7–8.2	1	
	16479N2850		78.47	86.6	1.19		1	
			78.47	90.7	1.06		1	
			78.47	88.1	1.16		1	
			78.48	87.4	1.16		1	
			78.54	90.4	1.11		1	
			78.28	88.7	1.14		6	Rabe, 1927: +1°.7; –0″.22.
10279	STF 2118		77.65	69.1	1.10	6.9–7.4	1	
	16559N6511		77.68	69.7	1.13		1	
			78.56	69.5	1.01		1	
			77.97	69.4	1.06		3	Giannuzzi, 1956: +0°.5; –0″.19.
10312	STF 2114		77.48	187.0	1.03	7.5–8.5	1	
	16572N0836		78.53	186.4	1.14		1	
			78.54	188.2	1.13		1	
			78.19	187.2	1.10		3	Changed 52° since 1830.
10345	STF 213		77.65	48.5	2.12	5.8–5.8	1	
	17033N5436		78.54	47.5	2.06		1	
			78.10	48.0	2.09		2	Heintz, 1965: +2°.7; +0″.17
10786	AC 7	BC	77.32	16.0	0.60	10.2–10.7	1	
	17425N2747		77.44	18.4	0.64		1	
			77.44	16.9	0.69		1	
			77.40	17.1	0.64		3	Couteau, 1958: +0°.6; –0″.14.
11010	BU 1127		77.32	80.3	0.92	7.4–9.3	1	
	17596N4414		77.68	81.7	0.88		1	
			78.53	85.2	0.98		1	
			78.56	82.9	0.82		1	
			78.02	82.5	0.90		4	Popović, 1970: +1°.8; –0″.24.
11324	AC 11		77.44	358.1	0.68	6.8–7.0	1	
	18198S0138		78.57	357.8	0.77		1	
			78.00	358.0	0.72		2	Heintz, 1958: +1°.6; –0″.06.
11331	HO 84		78.54	318.8	4.11	10.0–12.0	1	Slow change since 1885.
	18208N2721							
11334	STF 2315		77.69	133.3	0.59	6.6–7.6	1	
	18210N2720		78.54	136.7	0.73		1	
			78.55	134.2	0.59		1	
			78.57	133.5	0.57		1	
			78.34	134.4	0.62		4	Heintz, 1959: +3°.3; +0″.06.

ADS	Disc. IDS	Mult.	Epoch 1900+	P	ρ	Est. mag.	n	Notes
11483	STT 358	AB	77.66	162°0	1″65	6.8–7.2	1	
	18314N1654		77.75	165.0	1.58		1	
			77.70	163.5	1.61		2	Heintz, 1954: +1°5; +0″00.
12040	STF 2454	AB	77.69	281.1	0.92	8.5–9.7	1	
	19023N3017		77.80	282.9	1.01		1	
			78.53	278.7	0.98		1	
			78.54	280.0	0.97		1	
			78.14	280.7	0.97		4	Olević, 1977: =2°2; –0″13.
12123	A 150		77.69	115.0	0.53	9.5–9.6	1	
	19060N2020		78.55	115.6	0.50		1	
			78.57	114.3	0.48		1	
			78.27	115.0	0.50		3	Changed 15° since 1900.
12487	ES 1664		77.68	90.3	1.91	9.8–10.2	1	
	19244N4041		77.75	86.1	1.91		1	
			78.47	87.5	1.93		1	
			78.54	86.8	1.94		1	
			78.11	87.7	1.92		4	Changed 12° since 1917.
12592	A 714		77.65	348.2	1.44	8.9–9.2	1	
	19296N4550		77.66	348.5	1.47		1	
			77.67	348.6	1.45		1	
			77.68	347.2	1.45		1	
			78.56	347.7	1.46		1	
			77.84	348.0	1.45		5	Changed 20° since 1904.
12667	STT 377	AB	77.68	36.8	0.83	9.3–9.4	1	
	19326N3526		77.75	37.3	0.81		1	
			77.80	36.5	0.91		1	
			78.53	35.5	0.89		1	
			78.56	36.8	0.81		1	
			78.06	36.6	0.85		5	Changed 15° since 1842.
12889	STF 2576	AB	77.67	357.0	1.63	9.2–9.2	1	
	19418N3322		77.68	360.3	1.74		1	
			78.56	360.8	1.78		1	
			77.97	359.6	1.72		3	Rabe, 1948: +0°8; –0″24.
12972	STT 387		77.68	170.4	0.64	6.9–7.9	1	
	19450N3504		78.47	170.5	0.72		1	
			78.53	169.4	0.80		1	
			78.54	170.7	0.80		1	
			78.55	171.8	0.63		1	
			78.57	173.8	0.62		1	
			78.39	171.1	0.70		6	Baize, 1961: +1°1; +0″10.
13649	BU 984		78.57	246.5	0.70	7.9–8.2	1	Changed 42° since 1880.
	20134N2604							
13665	A 1205		78.55	288.9	0.49	9.2–10.0	1	
	20141N2854		78.57	283.9	0.49		1	
			78.57	289.6	0.49		1	
			78.56	287.5	0.49		3	Changed 60° since 1905.

ADS	Disc. IDS	Mult.	Epoch 1900+	P	ρ	Est. mag.	n	Notes
13750	STF 2672		77.65	324.2	0.79	8.7–8.8	1	
	20173N2327		77.76	327.5	0.66		1	
			78.54	329.8	0.73		1	
			78.55	325.6	0.70		1	
			78.57	328.6	0.62		1	
			78.22	327.1	0.70		5	Changed 52° since 1831.
14499	STF 2737	AD	77.64	285.5	0.97	5.8–6.3	1	
	20541N0355		77.69	289.3	0.90		1	
			78.55	287.7	0.88		1	
			77.96	287.5	0.92		3	Van deñ Bos, 1933: +1°.9: –0".15
14573	STF 2744	AB	77.67	129.1	1.25	7.0–7.5	1	
	20580N0108		77.68	130.0	1.18		1	
			77.69	130.0	1.25		1	
			78.56	130.1	1.28		1	
			77.90	129.8	1.24		4	Popović, 1964: +3°.2; –0".03.
14766	A 884		78.55	129.7	0.32	9.3–9.4	1	Changed 59° since 1904.
	21098N4630							
15076	STF 2804	AB	77.66	350.2	3.49	7.6–8.5	1	
	21284N2016		78.54	350.5	3.32		1	
			78.10	350.3	3.40		2	Changed 35° since 1828.
15270	STF 2822	AB	77.67	292.8	1.72	4.9–6.2	1	
	21397N2817		77.75	296.5	1.89		1	
			77.80	296.2	1.69		1	
			77.74	295.2	1.77		3	Heintz, 1965: –1°.0; –0".06.
15673	STF 2868		77.67	357.0	1.03	8.3–8.8	1	
	22047N2203		77.68	355.9	1.22		1	
			77.68	351.6	1.20		1	
			78.53	355.8	1.08		1	
			78.56	354.7	1.16		1	
			78.57	355.7	0.99		1	
			78.74	354.1	1.02		1	
			78.20	355.0	1.10		7	
15769	STF 2881		77.74	83.9	1.16	8.5–9.0	1	Changed 27° since 1830.
	22100N2905							
15988	STF 2912		76.91	119.8	0.77	5.8–7.2	1	
	22249N0355		78.57	119.3	0.76		1	
			77.74	119.5	0.77		2	Knipe, 1959: +1°.9; –0".28.
16131	HO 479		78.53	127.2	0.52	8.2–9.7	1	
	22334N0147		78.73	120.0	0.53		1	
			78.63	123.6	0.53		2	
16185	STF 2934		77.68	70.9	0.92	8.7–9.7	1	
	22370N2054		77.80	77.3	0.88		1	
			77.74	74.1	0.90		2	Heintz, 1960: +1°.0; +0".02.
16239	ES 848		77.67	61.5	2.18	9.3–9.5	1	
	22407N5003		77.80	63.3	2.11		1	
			77.73	62.4	2.15		2	Changed 31° since 1909.

ADS	Disc. IDS	Mult.	Epoch 1900+	P	p	Est. mag.	n	Notes
16428	STT 483		76.91	293°8	0"68	6.0–7.5	1	
	22542N1112		78.57	295.9	0.66		1	
			78.73	292.9	0.65		1	
			78.07	294.2	0.66		3	Guntzel-Lingner, 1956: –4°0; –0"02.
16951	A 1242		77.68	325.7	0.80	9.6–9.6	1	Zulević, 1977: +2°0; +0"05.
	23380N1117							
17020	STT 507	AB	77.68	304.1	0.76	6.9–7.5	1	Zulević, 1977: +1°1; +0"02.
	23438N6420							
17149	STF 3050	AB	77.67	303.1	1.45	6.6–6.6	1	
	23544N3310		77.68	305.7	1.44		1	
			78.80	307.7	1.47		1	
			78.05	305.5	1.45		3	Franz, 1955: –2°2; –0"22.
17178	HLD 60		77.68	183.8	0.88	9.1–9.4	1	
	23563N3905		77.75	183.2	0.87		1	
			77.76	183.4	0.92		1	
			78.80	180.7	0.96		1	
			78.00	182.8	0.91		4	Heintz, 1963: –0°7; –0"11.
39	A 203		77.67	344.5	1.46	8.4–8.8	1	
	23597N4325		77.74	343.1	1.52		1	
			77.75	345.1	1.44		1	
			77.76	344.9	1.47		1	
			77.73	344.4	1.47		4	Changed 9° since 1900.
–	GP 35		77.76	304.6	0.60	9.0–9.7	1	
	00143N3511*							
–	GP 140		77.81	162.4	0.36	8.5–8.7	1	
	05073N3648*							

* There is not IDS number.

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MICROMETER MEASURES OF DOUBLE STARS
(30th series)

G. M. Popović

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Presented are 193 measures of 111 pairs made with ZEISS 65/1055 cm refractor of the Belgrade Observatory.

This is the 30th Belgrade series of the double stars measures and, at the same time, a continuation of my measures published as Series 26 (G. M. Popović, 1977). The structure of the measured pairs according to ρ is given in Table 1. Compared with my previous series some improvement may be stated.

Table I

$\rho < 0''.50$	$0''.50 \leqslant \rho < 1''.00$	$1''.00 \leqslant \rho < 2''.00$	$\rho \geqslant 2''.00$	Σ
7 m	55 m	78 m	53 m	193
3.6 %	28.5 %	40.4 %	27.6 %	100 %

Table II lists the measurements in the form identical to that of my previous series (G. M. Popović, 1977).

Table II
Micrometer measures of double stars

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
102	Σ 2	76.777	25°2	0″63	0.0	2+2	Van Biesbroeck, 1954: −0°6, −0″01
00038–091N7910–43							
6.8–7.1							
221	OΣ 4	76.771	177.6	0.54	8.0–8.7	3+3	Muller, 1959: +1°8, – 0″02
00115–167N3556–89							
8.2–8.9							
224	Es 1481	77.680	67.5	6.97	9.0–10.0	1+2	The angle decreased by 12° since 1916,
00116–168N4354–67		77.768	69.2	7.00	9.0–10.0	2+2	with decrease ~0″7 in distance
9.9–10.4		**77.730**	**68.5**	**6.99**	**9.0–10.0**	**2n**	
–	GP 35	77.762	292.0	0.60	10.0–10.3	1+2	GP 35 = BD + 34°33 (9ᵐ4)
00143–195N3511–44							
9.5–10.8 (5n)							
–	GP 52	76.861	320.7	7.52	10.0–11.0	1+2	The position of the pair related to
00288–340N3512–46							BD+34°75 (9ᵐ5): Δα = 0ˢ, Δδ = +3′.
10.0–11.0 (2n)							
616	OΣ 52	78.792	8.6	1.26	8.0–9.0	2+2	
00386–442N4541–74							
7.9–8.9							

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
755	Σ 73	78.792	250°.3	0″.56	0.2	2+2	Baize, 1946: −7°.7, −0″.10
00496–550N2305–38							Muller, 1956:−4.2, −0.04
6.1–6.7	AB						
940	OΣ 515	78.814	139.4	0.56	2.0	2+2	Baize, 1958: −1°.4, +0″.10
01037–093N4643–75							
4.5–6.1							
1410	A 1523	76.771	60.8	0.46	0.2	3+3	
01412–472N4142–72		76.777	61.2	0.48	0.0	3+3	
9.6–9.6		**76.774**	**61.0**	**0.47**	**0.1**	**2n**	
1603	A 1527	78.009	237.6	4.24	–	1+1	$\theta_{AC} = 112^\circ$; $\rho_{AC} \sim 70''$, estimate.
01552–614N4311–40							
8.7–12.0	AB						
1630	OΣ 38	76.777	106.0	0.58	0.8	2+2	Muller, 1957: −1°.9, +0″.07
01578–635N4151–83		77.814	107.6	0.65	1.0	2+2	
5.1–8.3	BC	**77.296**	**106.8**	**0.62**	**0.9**	**2n**	
1799	OΣ 40	77.814	48.3	0.73	0.5	2+2	The angle decreased by 8° since 1850.
02156–217N3803–30							
8.4–9.2							
2257	Σ 333	77.987	204.8	1.50	–	1+1	IDS: Orbital!
02535–592N2056–80							
5.2–5.5	AB						
–	GP 11	76.861	328.6	10.09	0.3	1+1	The position of the pair related to
02579–641N3445–69							BD+34°565 ($9^m.3$): $\Delta\alpha=-4^s$, $\Delta\delta=-6'$
12.0–12.5 (3n)	AB						
2477	A 1705	78.006	8.7	2.88	10.0–9.5	1+2	
03144–211N4300–22							
10.3–10.3							
3038	β 546	76.777	42.4	1.00	0.0	3+3	The angle increased by 18° since 1878.
04046–114N4136–52							
8.8–8.8							
4166	β 1267	76.772	195.8	0.53	−0.2	3+3	The angle decreased by 22° since 1892.
05287–351N3052–56							
8.8–8.8							
4169	A 2354	76.772	131.6	0.51	−0.1	3+3	
05291–349N1834–38							
9.8–9.8							
4172	β 13	76.772	145.0	0.79	8.0–10.0	2+2	The angle increased by 16° since 1876.
05296–345S0433–29							
8.2–10.2							
4836	J 683	77.097	8.2	1.32	8.0–9.0	2+2	
06088–146N1727–25		77.122	10.8	1.05	8.3–9.0	1+1	
9.0–9.7		77.168	7.3	1.25	8.0–8.7	2+2	
		77.179	5.3	1.21	8.0–8.7	1+2	
		77.190	9.0	1.17	0.7	1+2	
		77.151	**7.9**	**1.22**	**0.8**	**5n**	
–	GP 84	77.168	189.8	1.73	9.5–9.8	2+1	GP 84 = BD+35°1573 ($9^m.5$)
07060–127N3522–13		77.236	188.7	1.88	0.0	1+1	
9.5–9.8		**77.195**	**189.4**	**1.79**	**0.2**	**2n**	

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
5871	Σ 1037	77.097	322°.4	1″.19	7.5–7.5	1+2	Karmel, 1940: +1°.6, –0″.15
07066–128N2724–14		77.168	324.3	1.18	0.0	1+2	
7.2–7.2	AB	**77.132**	**323.4**	**1.18**	**0.0**	**2n**	
5999	Σ 1070	77.236	321.8	1.74	1.0	1+1	
07148–213N3413–02							
8.4–9.4	AB						
6019	h 757	77.201	106.6	4.83	8.0–8.7	2+2	
07162–227N3425–14		77.234	107.0	5.20	9.0–9.5	3+2	
9.9–10.0		**77.219**	**106.8**	**5.04**	**8.6–9.2**	**2n**	
–	GP 74	77.190	147.7	8.80	9.5–10.5	1+1	The position of the pair related to
07174–240N3439–28		77.201	145.0	8.80	10.0–11.5	1+2	BD+34°1592 ($9^m.2$): $\Delta\alpha=+70^s$, $\Delta\delta=+2'$
9.6–11.1 (8n)		77.233	148.0	9.29	9.5–11.0	2+2	
		77.213	**146.9**	**9.02**	**9.6–11.0**	**3n**	
–	GP 75	77.201	211.6	5.86	8.5–11.0	2+2	GP 75 = BD+34°1624 ($9^m.4$)
07250–315N3407–46		77.234	211.1	6.26	9.5–11.5	2+1	Possible A double.
9.2–11.8 (9n)		**77.215**	**211.4**	**6.03**	**9.0–11.2**	**2n**	
6267	Hu 457	77.168	144.4	2.09	8.0–10.5	2+2	The distance is closing in.
07348–408N2329–42		78.165	146.1	1.70	8.0–10.0	2+1	
8.2–12.0		**77.595**	**145.1**	**1.92**	**8.0–10.2**	**2n**	
6277	AG 142	77.168	20.4	1.56	9.5–10.2	2+2	
07354–414N2326–12		77.179	18.6	1.59	8.5–10.0	1+1	
9.4–10.6		**77.172**	**19.8**	**1.57**	**9.2–10.1**	**2n**	
7102	A 2968	77.168	313.2	1.08	0.0	3+2	
08517–571N1068–45		78.165	316.8	1.14	9.1–9.0	2+2	
9.2–9.2		**77.611**	**314.4**	**1.11**	**0.0**	**2n**	
7186	Brt 102	78.165	57.8	–	–	1+1	Further observations of the pair are as follows:
09013–079N4362–38		78.170	54.6	3.57	0.2	1+2	
10.5–10.7		**78.168**	**55.9**	**3.57**	**0.2**	**2/1n**	1893.29 126°.8 3″.6 Brt 1
							1974.33 56.9 3.98 GP 2
							1975.98 56.0 3.58 GP 4
–	GP 106	77.234	65.7	1.30	9.5–10.0	2+1	The position of the pair related to
09158–219N3338–13							BD+33°1845 ($9^m.2$): $\Delta\alpha=+47^s$, $\Delta\delta=-3'$
9.6–10.2 (3n)							
7613	OΣ 210	77.168	256.7	0.98	0.7	1+2	
09563–626N4651–22		77.182	262.8	1.08	0.5	1+2	
8.6–9.4		77.267	260.1	1.16	0.5	1+2	
		77.206	**259.9**	**1.07**	**0.6**	**3n**	
7802	Σ 1439	78.244	87.2	1.46	8.9–9.4	1+1	The angle decreased by 44° since 1829.
10246–294N2079–49							
8.9–9.4							
8433	A 1998	77.234	356.0	0.34	8.5–9.2	2+2	The angle decreased by 28° since 1909.
12029–080N4315–42							
9.5–9.6							
8539	Σ 1639	78.171	329.8	1.45	1.2	1+1	Aller, 1951: +3°.6, +0″.07
12194–244N2568–35		78.242	327.7	1.55	7.0–8.2	1+2	
6.6–7.8	AB	78.342	331.5	1.59	–	1+2	
		78.262	**329.6**	**1.54**	**1.2**	**3n**	

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
8540	OΣ 250	77.319	344°.8	0".40	0.3	2+2	The angle increased by 14° since 1845.
12195–244N4339–06							
8.4–8.7							
–	GP 57	77.182	351.7	8.33	9.5–11.5	1+1	GP 57 = BD+35°2339 ($9^m.5$)
12229–279N3458–24							The first measure:
9.5–11.2 (5n)							1971.37 352°.2 9".29 4n GP
8575	Σ 1647	78.242	238.6	1.29	8.5–9.0	1+2	The angle increased by 38° since 1830.
12255–306N0976–43		78.400	241.2	1.22	0.3	2+2	
8.5–8.8		**78.332**	**240.1**	**1.25**	**0.4**	**2n**	
8708	OΣ 256	78.242	92.0	1.02	7.0–7.3	1+1	
12513–564S0025–57		78.395	89.8	–	–	1+1	
7.2–7.6		78.400	94.7	0.92	–0.1	1+2	
		78.353	**92.5**	**0.96**	**0.1**	**3n**	
–	GP 119	77.234	15.9	0.64	9.8–10.0	2+2	GP 119 = BD+41°2389 ($9^m.1$)
13187–232N4061–30							The first measure:
9.4–9.7 (2n)							1976.382 11°.9 0".53 1n GP
8946	A 1792	77.234	310.1	0.57	8.5–9.3	2+2	The angle decreased by 36° since 1908.
13290-340N0878–47							
8.8–9.3							
8974	A 1768	78.242	104.1	1.78	2.5	1+1	Jackson, 1921: +2°.5, +0".02
13330–375N3648–17		78.373	104.6	1.69	1.5	1+2	
5.1–7.0		78.395	103.8	1.75	1.5	1+2	
		78.348	**104.2**	**1.74**	**1.8**	**3n**	
9182	Σ 1819	77.363	247.4	0.85	0.7	1+2	Hopmann, 1945: –10°.1, –0".18
14103–153N0336–08		78.242	243.0	0.89	0.1	1+2	
7.7–7.8		78.373	245.2	0.90	0.0	2+2	
		78.031	**245.2**	**0.88**	**0.3**	**3n**	
9254	Σ 1837	78.400	281.7	1.18	1.5	1+1	The angle decreased by 45° since 1829.
14193–247S1113–40							
6.7–8.3							
9269	Ho 542	77.234	224.5	0.86	11.0–11.0	2+2	The angle decreased by 49° since 1896.
14230–277N2[illegible]–37		77.505	224.3	0.78	–0.2	3+2	
10.7–10.7		**77.384**	**224.4**	**0.82**	**–0.1**	**2n**	
9418	OΣ 287	78.242	347.1	1.11	0.2	1+2	Heintz, 1962: +1°.8, –0".05.
14478–514N4480–55		78.373	346.8	1.00	0.2	3+2	
8.5–8.6		78.477	347.5	1.08	0.4	1+2	
		78.366	**347.1**	**1.05**	**0.2**	**3n**	
	GP 118	77.363	344.6	2.49	0.1	1+2	The position of the pair related to
15122–158N4215–52		77.369	345.4	2.61	0.0	1+2	BD+42°2580 ($9^m.4$): $\Delta\alpha=+32^s$, $\Delta\delta=+3'$
9.5–9.6 (1n)		77.412	346.8	2.45	0.0	1+2	
		77.381	**345.6**	**2.52**	**0.0**	**3n**	
9573	Σ 1934	78.529	16.7	8.79	0.1	2+2	Probable optical!
15139–174N4370–48							
9.4–9.4							
9589	A 1630	77.363	250.4	0.59	9.5–10.0	1+2	The angle decreased by 13° since 1907.
15157–192N4351–29							
9.4–9.8							

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
9603	A 573	78.529	167°.7	0".59	9.0–10.0	2+2	No change since 1903.
15173–209N4264–43							
8.9–10.4							
9607	Es 625	78.529	252.4	1.53	9.6–10.2	2+1	
15177–212N4441–20							
10.8–11.8							
9639	OΣ 296	78.400	282.9	1.79	8.0–10.0	3+2	The angle decreased by 45° since 1845.
15230–265N4421–00		78.529	282.2	1.81	8.0– 9.0	2+2	
7.6–9.2	AB	**78.457**	**282.6**	**1.80**	**8.0– 9.6**	**2n**	
9687	A 2075	77.505	108.5	0.49	8.5– 9.5	3+3	The angle decreased by 23° since 1909.
15273–319N1643–23							
9.3–10.1							
9742	A 2076	77.505	180.8	0.78	–0.2	3+3	The angle decreased by 35° since 1909.
15360–405N1860–41		78.373	182.6	0.65	–	2+2	
8.4–8.4		**77.852**	**181.5**	**0.73**	**–0.2**	**2n**	
9880	OΣ 303	77.480	170.2	1.19	0.2	1+2	The angle increased by 58° since 1846.
15562–609N1333–15		78.373	168.1	1.26	0.3	2+2	
7.5–8.0		**77.990**	**169.0**	**1.23**	**0.3**	**2n**	
9952	A 1799	77.505	128.7	0.56	–0.1	3+3	The angle decreased by 42° since 1908.
16069–115N1523–08							
9.2–9.3							
10188	D 15	78.469	144.1	1.35	0.1	2+2	Wierzbinski, 1955: +1°.1, +0".15
16408–439N4340–29							
9.1–9.1							
10312	Σ 2114	77.480	187.9	1.26	0.8	1+1	The angle increased by 50° since 1830.
16572–619N0836–27		78.373	185.7	1.20	1.0	1+2	
6.5–7.7		78.540	185.1	1.23	0.8	1+2	
		78.570	186.6	1.18	1.0	1+2	
		78.310	**186.2**	**1.21**	**0.9**	**4n**	
–	GP 76	77.562	112.0	1.65	11.5–12.5	1+1	The position of the pair related to BD+34°2928 (7^m.0): $\Delta\alpha=-53^s$, $\Delta\delta=+6'$
17111–148N3455–48							
11.7–12.5 (5n)							
–	GP 77	77.562	319.9	4.00	9.5–12.0	1+2	The position of the pair related to BD+34°2930 (9^m.2): $\Delta\alpha=+9^s$, $\Delta\delta=+1'$
17129–165N3455–48		77.565	320.7	4.54	9.5–13.0	1+1	
9.8–13.0 (5n)		**77.563**	**320.2**	**4.22**	**9.5–12.5**	**2n**	
10540	β 1250	78.540	97.9	1.75	0.3	1+2	The angle increased by 42° since 1877.
17210–249N3049–43		78.570	103.1	1.41	0.2	1+1	
9.3–9.8		**78.552**	**100.0**	**1.61**	**0.2**	**2n**	
10544	A 2089	77.574	335.3	0.60	0.2	2+2	
17222–250N4707–01		78.469	329.1	0.60	0.3	1+2	
9.4–9.8		**77.958**	**332.6**	**0.60**	**0.2**	**2n**	
10669	β 1121	77.505	207.0	0.53	0.5	2+2	The angle decreased by 32° since 1889.
17328–374N1237–33		78.469	209.8	0.45	0.7	1+2	
9.1–9.6		**77.918**	**208.2**	**0.50**	**0.6**	**2n**	
10699	Σ 2199	77.412	64.7	1.77	7.5–8.5	1+2	The angle decreased by 52° since 1830.
17368–386N5549–46		78.540	64.0	1.78	8.5–8.9	1+3	
7.8–8.4		78.570	62.9	1.80	0.3	2+2	
		78.243	**63.8**	**1.78**	**0.5**	**3n**	

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
10722	Σ 2203	77.412	302°.7	0".58	0.2	1+2	The angle decreased by 31° since 1830.
17381–412N4142–40		78.469	301.3	0.69	0.5	1+2	
7.6–7.9		**77.940**	**302.0**	**0.63**	**0.4**	**2n**	
10795	Σ 2215	78.696	270.9	0.58	7.5–8.2	1+2	The angle deceased by 40° since 1831.
17427–472N1744–42							
5.8–7.8							
10850	OΣ 338	77.412	353.3	0.64	0.1	1+2	The angle decreased by 48° since 1843.
17475–520N1521–20		78.474	356.8	0.77	0.2	1+1	
6.8–7.1	AB	**77.837**	**354.7**	**0.69**	**0.2**	**2n**	
–	GP 10	78.529	214.0	1.67	0.1	1+1	
17537–573N3542–41		78.540	214.8	1.74	11.0–11.2	1+2	
10.8–10.9 (4n)	AB	**78.536**	**214.5**	**1.71**	**0.2**	**2n**	
11010	β 1127	77.363	78.5	0.77	–	1+2	Popović, 1970: –2°.1, –0".23
17596–626N4414–13		77.505	80.4	0.85	–	2+2	
7.4–9.3		77.508	77.2	0.85	2.0	1+2	
		77.463	**78.9**	**0.83**	**2.0**	**3n**	
11287	β 641	78.696	345.3	0.67	1.7	1+1	Changes in both coordinates questionable.
18176–219N2128–31							
6.8–8.7							
11432	OΣ 354	77.508	194.8	0.77	0.5	1+2	
18272–321N0643–47		77.683	193.4	0.68	8.5–9.0	2+2	
7.7–8.5		**77.608**	**194.0**	**0.72**	**0.5**	**2n**	
–	GP 43	77.508	275.5	3.14	13.0–14.0	1+2	The position of the pair related to BD+34°3323 (8^m.0): Δα=–17^s, Δδ=+5'
18447–484N3425–32							Further observations:
12.5–13.4 (4n)							1970.769 261°.8 2".77 1n GP
							1974.670 268.7 3.05 2n GP
–	GP 29	77.412	170.3	2.27	10.0–10.8	1+2	The position of the pair related to
18539–575N3446–54		77.571	175.2	2.34	0.8	1+1	BD+34°3370 (9^m.2): Δα=–19^s, Δδ=–1'
10.1–11.3		**77.476**	**172.3**	**2.30**	**0.8**	**2n**	
12040	Σ 2454	78.570	276.9	1.04	1.5	1+2	Baize, 1975 (ellip-traject.): -1°.3, –0".19
19023–062N3017–26							Olević, 1977 (rectil.traject.): -1.8, -0,06
8.5–9.7	AB						
–	GP 34	77.562	57.8	2.64	9.5–13.0	1+2	GP 34 = BD+34°3568 (9^m.5)
19252–289N3503–25		77.571	58.5	2.62	9.5–12.5	1+2	Motion evident:
9.5–13.0 (9n)	AB	77.574	61.9	2.67	9.5–13.5	2+2	Carte du Ciel: 1925 θ ~ 135°
		77.677	62.0	2.95	10.0–14.0	1+2	Mt. Palomar Surv: 1952 θ ~ 100
		77.683	58.6	2.74	9.5–12.5	1+2	Beograd: 1969 θ = 79
		77.611	**59.9**	**2.72**	**9.6–13.2**	**5n**	
	AC	77.571	3.7	33.4	9.5–11.0	1+2	
		77.677	3.8	33.8	10.0–12.0	2+2	
		77.632	**3.8**	**33.6**	**9.8–11.6**	**2n**	Retrograde motion.
–	DJU 3	77.562	243.3	0.80	3.5	1+2	DJU3 = BD+23°3820
19492–534N2349–65		77.571	244.1	0.88	–	1+2	
4.6–7.8		**77.566**	**243.7**	**0.84**	**3.5**	**2n**	
13277	OΣ 395	78.570	117.5	0.97	0.3	1+2	The angle increased by 38° since 1844.
19578–618N2439–56							
5.9–6.3							

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
13178	AC 12	78.570	303°5	1"31	0.5	1+2	Probably optical!
19532–584S0230–14							
7.4–8.2							
13328	h 1478	78.737	34.6	2.24	9.0–9.2	1+2	ADS 13328 = BD+43°3471 ($9^m.4$)
20005–038N4343–60							Given coordinates those from IDS.
10.3–10.9							
13331	Es 1437	78.737	258.4	3.58	9.0–14.0	1+1	Slow decrease in both angle and
20006–039N4304–21							distance.
10.4–12.9							
13468	Roe 41	78.737	336.1	5.34	9.2–9.6	1+1	Distances discordant:
20071–105N4258–76							1910 ρ = 4"44 3 Roe
10.9–11.3							1915 ρ = 5.92 3 Es
13521	Es 501	77.762	128.5	1.22	9.5–11.0	2+2	
20090–112N4518–36							
10.1-11.2							
13543	Σ 2653	77.683	270.0	2.37	3.5	1+1	The angle increased by 15° since 1831.
20094–136N2356–74		78.474	270.0	2.24	3.5	1+1	
6.6–9.7		78.791	271.8	2.55	7.5–10.0	1+2	
		78.384	**270.8**	**2.41**	**3.2**	**3n**	
13649	β 984	78.570	242.2	0.56	0.2	2+2	The angle increased by 38° since 1880.
20134–176N2604–22							
9.0–9.3							
13830	β 432	77.519	199.8	1.31	8.5–9.5	1+2	
20210–248N3526–45		77.743	198.9	1.20	1.0	1+2	
9.0–10.3		**77.631**	**199.4**	**1.25**	**1.0**	**2n**	
14233	Σ 2723	78.475	124.8	1.02	1.7	1+2	The angle increased by 38° since 1831.
20402–450N1157–79		78.696	124.6	1.06	1.0	1+1	
6.9–8.7	AB	78.704	122.2	0.99	1.5	1+1	
		78.604	**124.0**	**1.02**	**1.4**	**3n**	
–	GP 28	77.677	5.2	2.23	12.5–12.7	1+2	The position of the pair related to
20553–593N3407–30							BD+33°4112 ($8^m.0$): Δα=+13ˢ,Δδ=+1'
12.5–12.8 (2n)							
14558	Σ 2746	78.704	314.3	0.97	8.0–9.0	1+1	The angle increased by 36° since 1830.
20580–619N3852–76		78.712	307.2	1.17	0.7	2+2	
8.0–8.6		**78.709**	**309.6**	**1.10**	**0.8**	**2n**	
14573	Σ 2744	77.680	129.2	1.29	8.3–8.5	1+2	Popović, 1964: +1°0, 0"00
20580–631N0108–32		77.743	126.2	1.28	0.5	1+2	
7.0–7.5	AB	77.757	128.4	1.34	0.3	1+1	
		78.778	127.1	1.22	0.6	1+1	
		78.780	126.4	1.23	0.4	1+2	
		78.129	**127.4**	**1.27**	**0.4**	**5n**	
14829	Ho 153	78.778	120.5	0.77	0.8	2+2	The change uncertain.
21135–176N3320–45		78.780	118.2	0.94	1.0	2+2	
8.1–9.1		**78.779**	**119.4**	**0.86**	**0.9**	**2n**	
–	GP 49	77.574	209.8	6.06	11.0–11.2	1+2	The position of the pair related to
21220–261N3503–29		77.743	207.2	5.82	12.0–12.2	1+2	BD+34°4413 ($9^m.1$): Δα=–26ˢ,Δδ=+9'
11.5–11.6		**77.658**	**208.5**	**5.94**	**11.5–11.7**	**2n**	

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
15007	Σ 2799	78.704	269°.6	1″.55	0.0	1+2	The angle decreased by 63° since 1831.
21240–289N1039–65		78.712	271.2	1.63	0.0	1+2	
7.5–7.5		**78.708**	**270.4**	**1.59**	**0.0**	**2n**	
15091	β 273	77.677	89.4	5.58	8.0–12.0	2+1	
21295–344N1100–27							
8.1–12.0							
15295	Ho 168	78.712	232.3	0.85	–0.3	2+2	With little change in distance the angle decreased by 17° since 1885.
21415–454N4328–56							
9.4–9.4	AB						
15313	Σ 2825	78.712	137.1	0.71	0.3	2+2	The angle increased by 37° since 1827 with a slow reduction in distance.
21418–469N0023–51							
8.4–8.6							
15407	Σ 2843	76.785	145.4	1.57	8.0–8.3	1+2	The angle increased by 12° since 1831 and the distance closes in.
21491–516N6517–45		77.574	144.3	1.53	0.2	1+2	
7.1–7.3		77.743	147.3	1.50	0.2	1+2	
		77.388	**145.5**	**1.53**	**0.2**	**3n**	
15464	OΣ 453	78.712	261.4	0.65	0.5	2+2	
21515–565N0646–74							
9.1–9.6	AB						
15539	A 777	77.820	85.1	1.65	9.3–9.8	1+1	
21562–602N4516–45		78.775	80.0	1.90	10.0–11.0	2+2	
9.7–11.2		**78.457**	**81.7**	**1.82**	9.8–10.6	**2n**	
15556	A 780	77.820	146.0	1.37	9.0–9.2	3+3	
21573–613N4446–75							
9.4–9.7							
15633	A 183	77.819	244.9	0.72	9.5–10.0	3+3	
22018–059N4453–82							
8.8–9.8							
15769	Σ 2881	77.743	79.0	1.23	–	1+2	The angle decreased by 33° since 1830.
22100–145N2905–35		77.757	76.9	1.48	–	1+1	
7.6–8.1		**77.749**	**78.2**	**1.33**	–	**2n**	
–	SMA –	77.669	355.3	9.00	10.0–10.2	1+2	Further observations:
22267–310N4224–55		77.680	359.4	9.36	10.0–10.5	1+1	AB: 1922 358° 9″.5 } IDS
10.3–11.1	AB	77.762	350.8	9.32	9.5–9.7	1+2	AC: 1922 341 9.1 } IDS
		77.803	353.5	9.46	9.5–9.7	2+2	
		77.739	**354.2**	**9.29**	**9.7–10.0**	**4n**	
11.1–11.1	BC	77.669	72.0	1.89	10.2–10.5	1+2	
		77.680	65.9	2.19	10.3–10.5	1+1	
		77.762	67.2	2.14	9.7–9.9	1+2	
		77.803	69.1	2.16	9.7–9.8	3+3	
		77.748	**68.9**	**2.10**	**9.9–10.0**	**4n**	μ_C ~ 0″.08 in 69°.
16185	Σ 2934	77.768	75.7	0.90	0.5	1+2	Heintz, 1960: +3°.0, +0″.03
22370–418N2054–85		78.775	75.1	0.91	0.7	2+2	
8.7–9.7	AB	**78.343**	**75.4**	**0.91**	**0.6**	**2n**	
16270	Σ 2944	78.704	281.7	2.22	0.5	1+2	The angle increased by 35° since 1833 and the distance has closed in.
22427–479S0445–13							
7.3–7.8	AB						

ADS α,δ m	Disc. 1900–2000 Mult.	Epoch 1900+	θ	ρ	m	W	Notes
16607 23085–136N0140–73 10.5–11.0	A 2299 BC	77,574	65°.4	0".78	–	1+1	
– 23146–193N4310–43 10.7–11.4	SMA –	78.955	32.9	5.51	9.5–10.0	1+1	
16777 23234–285N0301–34 10.0–10.1	β 1222	78.704	41.8	1.18	–0.1	1+2	
– 23341–390N2940–73 11.2–12.0 (4n)	GP 4	78.816	70.6	4.75	13.0–13.7	1+1	The position the pair related to BD+29°4974 ($8^m.5$):Δα=+10^s, Δδ=+10',
16904 23344–392N4510–43 8.5–8.6	A 643	77.803	176.9	0.30	8.5–8.0	3+2	Heintz, 1967: +5°.3, +0".07

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Bull. Obs. Astron. Belgrade, N° 130

MESURES MICROMETRIQUES DES ETOILES DOUBLES
(Série 31)

V. Erceg

(Reçu le 10 décembre 1978)

SOMMAIRE:

On présente 63 mesures de 30 étoiles doubles visuelles.

La série est la continuation des séries des mesures micrometriques effectuées au réfracteur Zeiss 65/1055 cm de l'observatoire de Belgrade. Dans les colonnes de Tableau I sont presentés: les nombres du Catalogue ADS, les abréviations des découvreurs d'après le Catalogue IDS et les coordonées pour l'anné 1900, les époques d'observations, les angles de position, les distances, la différence des magnitudes visuelles, les nombres des observations, et les remarques soit sur les changements des angles de position, soit les résidus d'après les éphémérides calculées.

Tableau I
Mesures micrométriques des étoiles doubles

ADS	Decouv. Coord	Comp.	Epoque 1900+	θ^o	ρ''	Δm	n	Remarques
61	STF 3062		77.812	284.8	1.26	0.8	1	
	00010N5753		77.815	282.7	1.20	0.8	1	
			77.814	283.8	1.23	0.8	2	Baize, 1958: +0°8; –0".19.
1538	STF 186		77.897	52.7	1.42	0.1	1	Cid, 1952: 0°0; +0".17.
	01507N0121							
7724	STF 1424	AB	77.320	122.7	4.30	1.2	1	
	10145N1981		77.322	121.6	4.42	–	1	
			77.321	122.2	4.36	1.2	2	Gün.–Lin., 1956: –0°5; –0".07
								Rabe, 1958: –1°0; +0".07
8119	STF 1523		77.322	108.1	3.01	0.2	1	
	11128N3166		77.328	109.1	3.02	0.2	1	
			77.325	108.6	3.02	0.2	2	Heintz, 1966: –1°7; +0".01.
8238	STF 1558	AB	77.330	168.0	1.34	0.5	1	
	11315N2161		77.339	164.4	1.54	0.5	1	
			77.334	166.2	1.44	0.5	2	
8263	STF 1566		77.330	354.6	2.25	–	1	
	11354N2135		77.339	353.7	2.03	1.3	1	
			77.334	354.2	2.14	1.3	2	
8539	STF 1639		78.375	327.9	1.54	1.2	1	Aller, 1951: +1°8; +0".07.
	12194N2568							

ADS	Decouv. Coord.	Comp.	Epoque 1900+ –	θ°	ρ"	Δm	n	Remarques
8575	STF 1647		77.331	247.1	1.51	0.3	1	
	12255N0976		77.339	239.2	1.77	0.2	1	
			77.335	243.2	1.64	0.2	2	En 147 ans θ augmenté de 41°.
8862	HU 644		77.410	266.5	1.24	1.2	1	Baize, 1969: –6°.5; –0".04.
	13154N4778							Heintz, 1969: –5°.8; –0".06.
8949	STF 1757	AB	77.339	112.7	2.09	1.2	1	
	13292N0012		77.410	112.7	2.21	1.0	1	
			78.367	110.7	2.30	1.0	1	
			77.705	112.0	2.20	1.1	3	Heintz, 1955: –1°.2; –0".03
9182	STF 1819		77.339	253.6	1.24	0.1	1	
	14103N0336		77.410	255.6	1.20	0.1	1	
			77.374	254.6	1.22	0.1	2	Hopmann, 1945: –2°.3; +0".17.
9343	STF 1865	AB	77.410	306.9	1.02	0.1	1	
	14364N1369		77.421	302.3	0.83	0.0	1	
			77.416	304.6	0.92	0.0	2	Van den Bos, 1937: –1°.6; –0".20.
9425	STT 288		77.410	177.7	1.23	0.5	1	
	14487N1567		77.421	176.2	1.13	0.7	1	
			77.416	177.0	1.18	0.6	2	Heintz, 1955: +4°.4; –0".12.
9626	STF 1938	BC	77.490	17.6	2.00	1.0	1	Baize, 1951: +1°.1; –0".15.
	15207N3742							
9716	STT 298	AB	77.424	204.3	0.91	0.0	1	
	15325N3968		77.500	206.8	0.94	0.2	1	
			77.462	205.6	0.92	0.1	2	Couteau, 1965: –0°.4; +0".04.
10070	STF 2049		77.424	194.8	1.01	0.6	1	
	16238N2572		77.492	196.0	1.15	0.8	1	
			77.501	198.4	0.96	0.8	1	
			77.472	196.4	1.04	0.7	3	
10184	STF 2094	AB	77.424	78.7	1.18	0.2	1	
	16400N2342		77.490	77.6	1.17	0.2	1	
			77.492	81.5	1.16	0.2	1	
			77.469	79.3	1.17	0.2	3	
10285	STF 3107	AB	77.424	86.9	1.18	0.0	1	
	16539N0367		77.490	85.6	1.21	0.0	1	
			77.493	87.0	1.30	0.0	1	
			77.469	86.5	1.23	0.0	3	En 146 ans θ diminué de 26°.
11046	STF 2272	AB	77.501	350.7	1.73	2.0	1	
	18004N0232		77.504	352.6	1.72	2.0	1	Strand, 1952: +8°.0; –0".28.
			77.502	351.6	1.72	2.0	2	
12447	STF 2525		77.589	291.6	1.78	0.0	1	
	19225N2707		77.660	290.6	1.75	0.2	1	
			77.624	291.1	1.76	0.1	2	Finzen, 1937: –0°.6; +0".10.
12972	STT 387		77.589	169.8	0.72	1.0	1	Baize, 1961: –0°.9; +0".12.
	19450N3504							
14296	STT 413	AB	77.589	15.8	0.83	1.7	1	Rabe, 1948: –0°.7; –0".01.
	20435N3607							
14499	STF 2737	AB	77.589	287.5	0.98	0.2	1	
	20541N0355		77.660	287.0	1.01	0.2	1	
			77.624	287.2	1.00	0.2	2	Van den Bos, 1933: +1°.6; –0".07.

ADS	Decouv. Coord.	Comp.	Epoque 1900+	θ^o_o	ρ"	Δm	n	Remarques
14573	STF 2744	AB	77.799	129.7	1.51	0.2	1	
	20580N0108		77.816	–	1.45	0.4	1	
			78.772	–	1.32	0.5	1	
			78.781	122.4	1.49	–	1	
			78.789	127.3	1.36	0.5	1	
			78.391	126.5	1.43	0.4	5	Popović, 1964: 0°.0; +0".16.
14715	STF 2765	AB	78.772	81.4	2.63	0.0	1	
	21061N0908		78.797	79.6	2.73	0.0	1	
			78.784	80.5	2.68	0.0	2	
14829	HO 153		78.778	118.8	0.95	0.8	1	
	21135N3320		78.797	125.1	1.20	1.0	1	
			78.788	122.0	1.08	0.9	2	
15007	STF 2799	AB	78.772	269.3	1.72	0.0	1	
	21240N1039		78.778	272.2	1.57	0.0	1	
			78.775	270.8	1.64	0.0	2	En 147 ans θ diminué de 62°.
15769	STF 2881		78.781	83.0	1.20	0.4	1	
	22100N2905		78.789	84.9	1.46	0.4	1	
			78.797	83.5	1.42	0.5	1	
			78.789	83.8	1.36	0.4	3	En 148 ans θ diminué de 27°.
15988	STF 2912		77.660	–	0.78	1.5	1	
	22249N0355		77.799	–	0.75	–	1	
			77.815	120.4	0.80	1.3	1	
			77.758	120.4	0.78	1.4	3	Knipe, 1959: +2°.8; –0".27.
17149	STF 3050	AB	77.799	305.0	1.46	0.1	1	
	23544N3310		77.813	304.3	1.52	0.1	1	
			77.806	304.6	1.49	0.1	2	Franz, 1955: –2°.8; –0".18.

Bull. Obs. Astron. Belgrade N° 130

OBSERVATIONS PHOTOGRAPHIQUES DES PETITES PLANÈTES EN 1978

V. Protitch-Benichek

(Reçu le 10 Avril, 1979)

SOMMAIRE:

On présente les résultats des observations photographiques de 77 petites planètes et des objets 1978 CA et 1978 DA, faites à l'Observatoire Astronomique de Belgrade en 1978.

1. Introduction

Ci-après nous présentons les résultats des observations photographiques des petites planètes, faites à l'Observatoire de Belgrade au cours de 1978, avec l'astrographe Askania de 125/1000 mm.

Notre programme d'observations comprend (depuis plusieurs anées déjà) principalement les petites planètes brillantes de la liste de l'Institute de l'Astronomie théorique de Leningrade, constitué en vue de la détermination des corrections de l'orientation du système fondamental de référence (Orelskaya, 1974).

Mais, il s'etend aussi aux petites planètes dont les observations sont recherchées, soit en vue de la correction de leurs élements orbitaux ou bien par suite de la manque des observations plus récentes et les écarts (0–C) notables.

Le programme d'observations ainsi conçu à été réalisé au cours de 1978 en utilisant généralement les plaques OR-WO Zu 2 Spezial et, parfois, les plaques Kodak IIa-0.

Les mesures des clichés ont été faites par l'observateur lui-même, à la machine Zeiss, dont la précision garantie en deux coordonnées est ±0,5 μ.

En ce qui concerne les reductions dès positions précises il faut dire qu'elles étaient accomplies dans le plupart des cas au burreau de calculs avec la calculatrice „Wang 2200", d'après un programme à trois étoiles de repères. Quant aux étoiles de repères, leurs positions sont empruntées aux catalogues AGK 3 et SAO, à l'exception des reductions sous les numéros 5,6 (Yale 17) et 22,30 (AGK 2). Pour les étoiles BD +13°659 (positon N° 16) et BD +12°557 (position N° 22) on a appliqué les mouvements propres deduits de la comparaison des positions données dans les catalogues avec celles tirées de Carte du Ciel. Les positions des étoiles BD –4°224 (position N° 30), BD +19°796 (position N°19), BD +24°1148 (position N° 40), BD +20°857 et d'une étoile anonyme sont reduites d'après nos propres mesures.

2. Les résultats

Les résultats d'observations et des reductions sont recueillis dans les Tables I–IV comme suit:

Table I. – Dans les colonnes 1–4, au dessous de la désignation de la planète observée: le numéro de la position, la date et la temps TU (en fraction du jour) d'observation, les coordonnées α et δ topocentriques observées pour l'équinoxe 1950.0, les écarts (0–C) (à 0^m1 et l'prés) se rapportent aux Ephémérides des petites planètes pour 1978 Leningrade, tandis que les (0–C) plus précis (à 0^s01 et $0''1$ prés) sont déduits d'après les éphémérides de Dr V.I. Orelskaya (Soobshchenie o geocentricheskikh ezhednevnykh ehfemeridakh izabrannykh malykh planet), en tenant compte de la parallaxe et de la correction ΔT provisoire.

A titre de comparaison pour les petites planètes 2 Pallas et 3 Juno on à donné également les (0–C) d'après l'Astronomical Ephemeris pour l'an 1978. Les remarques (x) et (xx) indiquent respectivement, l'image de l'objet floue et l'objet éloigné du centre de la plaque.

Table II contient le numéro correspodant à chaque observation donnée dans la table précédente, les étoiles de repères, utilisées dans la réductions, d'après la désignation de BD et, enfin, les dépendances calculées d'après les mesures effectuées.

Table III contient le numéro et les facteurs de parallaxe en α et δ correspondant à l'Observatoire de Belgrade et calculés d'après les relations suivantes:

$$P_\alpha = -0\overset{s}{.}4147 \sin\tau \sec\delta$$

$$P_\delta = +6''.166 \sin(\gamma-\delta) \operatorname{cosec}\gamma$$

avec $\tau = (\theta - \alpha)$, $\operatorname{tg}\gamma = 0.9865 \sec\tau$

θ – étant le temps sidéral local.

Table IV renferme les positions précises astrographiques de quelques étoiles de repères, rapportées à l'équinoxe 1950.0 et à l'époque indiquée dans la colonne T.

Tableau I

Positions précises des petites planètes

N°	Date TU		Equin. 1950.0		(0 - C)	
			h m s	° ' "	s	"
			2 Pallas			
1	Jun	22.893111	16 56 58.290	+25 36 57.27	–0.041	+0.26
					(+0,019	–0,24)
2		23.874702	16 56 13.396	+25 33 20.23	–0.132	–0.62
					(–0.082	–1.12)
3		24.926444	16 55 26.158	+25 29 12.28	–0.056	+1.35
					(–0.006	+0.95)
4	Jul	04.890332	16 48 45.795	+24 34 57.85	–0.114	+0.70
					(–0.064	+0.20)
			3 Juno			
5	Jul	12.906975	20 09 53.759	–04 06 55.09	+0.035	+0.38
					(+0.106	–0.98)
6		13.900024	20 09 05.352	–04 10 11.69	+0.126	–0.32
					(+0.196	–0.82
			6 Hebe			
7	Mar	01.885440	10 43 34.902	+16 24 34.88	+0.031	–1.05
8		04.810041	10 40 58.364	+16 52 20.11	+0.074	–0.91
9		28.812555	10 23 10.803	+19 41 25.60	+0.036	–0.81
10		29.865969	10 22 38.490	+19 46 06.52	+0.057	+1.12
			7 Iris			
11	Mar	01.863913	09 38 38.823	+04 53 01.08	+0.025	+0.68
12		03.919468	09 36 53.981	+05 03 52.67	–0.131	+0.26
13		28.787509	09 24 22.194	+06 54 02.66	–0.104	+0.25
14		29.839599	09 24 13.595	+06 57 23.02	–0.027	+1.50
15	Avr	02.844476	09 23 58.173	+07 08 46.64	+0.028	+0.40
			11 Parthenope			
16	Nov	24.847955	04 11 52.365	+14 14 09.45	–0.020	+0.09
17		26.104205	04 10 33.301	+14 11 53.84	–0.033	–0.92
18	Dec	15.703497	03 51 51.063	+13 52 42.78	–0.089	–0.78

Tableau I (suite)

N°	Date TU		Equin. 1950.0 h m s	Equin. 1950.0 ° ' "	(0–C) s	(0–C) "	
			14 Irene				
19	Dec	20.880591	04 49 06.363	+20 32 42.62	–0^{m}.0	+0'	
20		21.794480	04 48 10.356	+20 34 26.32	–0.1	+0	
			15 Eunomia				
21	Feb	22.755574	07 39 24.536	+16 56 51.39	0.0	–0	(x)
			17 Thetis				
22	Nov	24.847955	04 05 43.122	+12 59 50.95	+0.2	+1	
23		26.104205	04 04 20.048	+12 56 03.94	+0.1	–0	
			19 Fortuna				
24	Sep	01.891685	23 05 15.265	–03 28 51.04	+0.2	–0	
25		02.906963	23 04 24.379	–03 34 43.14	+0.1	–0	
			29 Amphitrite				
26	Sep	01.911141	00 05 35.944	–00 06 48.39	–0.1	–0	
27		02.927113	00 04 50.192	–00 08 53.16	–0.1	–1	(x)
28		03.912524	00 04 04.717	–00 11 03.84	–0.1	–1	
			30 Urania				
29	Sep	03.931975	00 14 59.566	+04 38 25.07	–0.1	–0	
			39 Laetitia				
30	Dec	15.681088	01 31 19.432	–03 38 05.52	+0^{s}.294	+0''.49	
			40 Harmonia				
31	Jan	02.929185	04 12 21.130	+19 27 36.96	+0.154	–0.66	
32		14.711129	04 08 53.111	+19 48 47.85	–0.045	–1.79	
			51 Nemausa				
33	Mar	29.909730	10 26 17.675	+07 52 21.89	0^{m}.0	0'	
34		30.799325	10 25 58.003	+07 59 54.79	+0.1	–0	
			52 Europa				
35	Mar	12.929189	11 12 03.316	+12 40 26.05	0.0	+0	
36		30.850714	11 00 21.550	+14 09 32.73	0.0	+0	
			59 Elpis				
37	Jan	06.781269	07 10 40.481	+10 11 20.43	–0.3	+1	(x)
38		11.786117	07 05 59.605	+10 27 58.57	–0.3	+1	
			64 Angelina				
39	Dec	26.895868	06 07 14.707	+24 46 14.45	0.0	–0.2	
40		27.877118	06 06 13.442	+24 45 49.70	0.0	–0.2	

Tableau I (suite)

		Date TU	Equin. 1950.0 h m s	° ' "	(0–C) s	"
			71 Niobe			
41	Jan	06.756952	06 39 51.326	+43 51 45.77	–0.1	–0.4
42		11.753490	06 33 14.939	+43 24 02.18	0.0	–0.5(x)
			80 Sappho			
43	Mar	29.887520	10 25 02.118	–00 42 26.95	–0.1	–1 (xx)
44		30.824314	10 24 31.960	–00 34 23.37	0.0	0 (x)
			XX 85 Io			
45	Dec	26.916007	05 37 39.750	+07 02 38.82	–0.3	+0
46		27.899340	05 36 46.154	+07 02 14.75	–0.3	+0
			89 Julia			
47	Jan	02.946547	07 22 27.633	+33 39 23.26	0.0	0
48		03.804868	07 21 21.023	+33 36 52.56	0.0	0
49		14.736823	07 07 19.755	+32 55 14.48	+0.1	+0
			98 Ianthe			
50	Mar	01.885440	10 39 41.484	+17 15 09.02	0.0	0
51		04.810041	10 36 14.753	+17 04 18.71	+0.1	+0
			106 Dione			
52	Mar	12.929189	11 14 15.685	+11 41 14.29	–0.1	+0
			XX 115 Thyra			
53	Nov	24.875727	04 29 42.873	+42 21 54.43	+1.4	+2
54		26.080247	04 28 16.200	+42 15 43.20	+1.3	+2
			182 Elsa			
55	Dec	20.880591	04 56 21.131	+20 57 40.97	+0.0	–0
56		21.794480	04 55 25.034	+20 57 58.47	–0.1	–0
			266 Aline			
57	Dec	26.934757	06 04 25.914	+10 28 44.82	–0.1	+0
			354 Eleonora			
58	Mai	12.915245	14 50 39.511	+13 15 13.76	0.0	–0
			389 Industria			
59	Jan	14.767 379	07 54 02.416	+17 37 27.97	+0.0	+0
			441 Bathilde			
60	Dec	20.880591	05 01 47.470	+21 06 29.92	+0.1	–1
61		21.794480	05 00 57.895	+21 02 28.47	+0.1	–1

Tableau I (suite)

Date TU			Equin. 1950.0 h m s	o ' "	(0–C) s	"
			532 Herculina			
62	Mai	12.940448	15 16 16.812	+06 58 20.18	+0ˢ.031	+0".82 (x)
63	Jun	23.836167	14 51 41.424	+02 12 19.04	+0.021	–0.09
64		23.857000	14 51 41.201	+02 12 06.99	–0.038	+0.91
65		24.886167	14 51 35.488	+02 01 18.85	+0.044	+0.58
66		24.904222	14 51 35.254	+02 01 06.40	–0.080	–0.45
			554 Peraga			
67	Jan	03.773630	05 21 19.663	+25 22 33.59	–0ᵐ.1	+0'
68		03.820864	05 21 17.547	+25 22 23.17	0.0	0
			695 Bella			
69	Dec	26.895868	06 04 18.461	+24 47 50.72	0.0	–0
70		27.877118	06 03 11.590	+24 42 17.81	0.0	–0
			xx 737 Arequipa			
71	Jul	09.853508	19 23 30.557	+01 47 17.09	0.0	0
72		12.886841	19 21 13.091	+01 39 40.60	–0.1	–0
73		13.877802	12 20 32.465	+01 37 10.91	–0.1	+0
			1554 Yugoslavia			
74	Aou	23.829881	21 47 36.122	+09 01 39.85	–0.1	–0 (x)
75		29.972252	21 43 16.027	+08 12 43.00	–0.1	–0 (x)
			1978 CA			
76	Mar	03.893773	10 05 12.354	+12 47 14.83	0.00	–0.4
			1978 DA			
77	Mar	14.977441	14 20 44.127	+08 58 58.73	–0.26	0.0(x)

Tableau II

N°	Étoiles de repères (BD)			Dépendances		
1	+26°2921	+25°3175	+25°3178	0.296093	0.342932	0.360975
2	+25 3156	+25 3175	+25 3178	0.353921	0.294680	0.351399
3	+25 3156	+26 2921	+25 3175	0.270539	0.219186	0.510275
4	+25 3058	+23 3006	+25 3150	0.266154	0.316529	0.417316
5	– 4 5037	– 3 4818	– 4 5059	0.325921	0.387516	0.286563
6	– 4 5037	– 3 4804	– 4 5059	0.266709	0.422709	0.310581
7	+17 2263	+16 2165	+17 2280	0.371162	0.270129	0.358709
8	+17 2264	+17 2265	+17 2269	0.290001	0.811082	0.398917
9	+19 2335	21 2193	13 2346	0.320217	0.331860	0.347922
10	+19 2335	21 2193	+20 2487	0.356662	0.254970	0.388367

Tableau II (suite)

N°	Étoiles de repères (BD)			Dépendances		
11	+ 5°2211	+ 4°2229	+ 5°2225	0.300516	0.315091	0.384393
12	+ 5 2205	+ 5 2215	+ 5 2222	0.376465	0.268423	0.355112
13	+ 6 2173	+ 7 2130	+ 7 2132	0.376738	0.308263	0.314999
14	+ 6 2169	+ 7 2130	+ 7 2132	0.323228	0.322181	0.354591
15	+ 6 2169	+ 8 2220	+ 7 2132	0.262010	0.391035	0.346955
16	+13 0653	+14 0670	+13 0659	0.352418	0.376842	0.270740
17	+13 0651	+14 0670	+13 0655	0.384605	0.340040	0.275355
18	+13 0613	+13 0614	+13 0618	0.380583	0.348026	0.271390
19	+20 0823	+19 0796	+20 0841	0.301816	0.319872	0.378311
20	+20 0823	+19 0796	+20 0841	0.334185	0.348479	0.317335
21	+17 1634	+17 1646	+16 1547	0.459936	0.241684	0.298380
22	+12 0550	+13 0649	+12 0557	0.340068	0.351562	0.308370
23	+12 0548	+11 0571	+13 0649	0.407910	0.257615	0.334476
24	− 4 5815	− 3 5576	− 4 5833	0.314688	0.400921	0.284390
25	− 4 5815	− 4 5822	− 3 5575	0.323998	0.273581	0.402420
26	− 1 4525	− 0 0006	− 0 0008	0.240962	0.372606	0.386432
27	− 1 4525	− 0 0003	− 0 0008	0.341842	0.354037	0.304121
28	− 1 4525	− 0 4619	− 0 0006	0.333089	0.351012	0.315898
29	+ 4 0023	+ 3 0028	+ 3 0034	0.339655	0.271849	0.388496
30	− 4 0224	− 3 0218	− 4 0249	0.361617	0.334588	0.303794
31	+19 0674	+18 0606	+19 0687	0.292010	0.354406	0.353584
32	+19 0672	+20 0715	+19 0679	0.366681	0.300244	0.333075
33	+ 8 2359	+ 8 2369	+ 7 2314	0.316118	0.252516	0.431366
34	+ 8 2359	+ 8 2369	+ 7 2314	0.381672	0.315384	0.302944
35	+13 2370	+13 2376	+13 2377	0.357195	0.352782	0.290023
36	+14 2330	+13 2345	+15 2282	0.317103	0.261984	0.413713
37	+10 1453	+10 1458	+09 1571	0.309485	0.334480	0.356035
38	+10 1416	+11 1457	+10 1448	0.381275	0.315173	0.303552
39	+24 1109	+24 1123	+24 1159	0.269748	0.286260	0.443992
40	+24 1109	+24 1120	+24 1148	0.375500	0.307502	0.316998
41	43 1576	+44 1525	+43 1600	0.422725	0.262448	0.314827
42	+43 1562	+43 1565	+43 1576	0.288009	0.246696	0.465295
43	− 0 2341	− 0 2657	− 0 2346	0.410166	0.186924	0.402909
44	− 0 2337	− 0 2657	− 0 2346	0.322394	0.333721	0.343885
45	+ 7 0952	+ 6 0990	+ 7 0983	0.342732	0.344507	0.312762
46	+ 7 0952	+ 7 0966	+ 6 0990	0.273052	0.367466	0.359482
47	+33 1512	+34 1607	+33 1534	0.325727	0.397363	0.276910
48	+33 1515	+33 1523	+33 1527	0.338863	0.408626	0.252511
49	+32 1486	+32 1497	+33 1486	0.275927	0.262225	0.461848
50	+18 2388	+17 2259	+17 2269	0.275473	0.396606	0.327921
51	+17 2246	+17 2253	+17 2259	0.369530	0.247708	0.382761
52	+11 2339	+12 2312	+12 2322	0.254908	0.402466	0.342626
53	+41 0884	+42 0989	+42 1005	0.438746	0.304266	0.256988
54	+42 0979	+41 0884	+41 0895	0.350226	0.260214	0.389560

Tableau II (suite)

N°	Étoiles de repères (BD)			Dépendances		
55	+21°0733	+20°0858	+21°0745	0.256037	0.347333	0.396630
56	+21 0733	+20 0855	+21 0745	0.350304	0.329921	0.319775
57	+ 9 1087	+10 1015	+11 1032	0.252081	0.452411	0.295508
58	+12 2753	+14 2796	+13 2865	0.303507	0.365989	0.330504
59	+18 1769	+18 1795	+17 1720	0.262062	0.353360	0.384578
60	+20 0863	+21 0754	+20 0883	0.313535	0.316214	0.370250
61	+20 0863	+21 0754	+20 0877	0.331406	0.380486	0.288108
62	+ 7 2926	+ 8 3005	+ 6 3030	0.355870	0.330454	0.313676
63	+ 2 2881	+ 2 2882	+ 2 2887	0.348292	0.357482	0.294226
64	+ 2 2881	+ 2 2882	+ 2 2887	0.342176	0.366275	0.291549
65	+ 2 2876	+ 1 2999	+ 3 2955	0.254423	0.381009	0.364568
66	+ 2 2876	+ 1 2999	+ 3 2955	0.255629	0.383290	0.361081
67	+25 0818	+25 0828	+25 0830	0.319675	0.359896	0.320429
68	+25 0818	+25 0828	+25 0830	0.325764	0.355306	0.318929
69	+24 1086	+25 1125	+24 1120	0.307708	0.374827	0.317465
70	+25 1105	+24 1086	+24 1120	0.386716	0.264920	0.348364
71	+ 2 3874	+ 1 3992	+ 1 4001	0.312730	0.382795	0.304475
72	+ 0 4188	+ 2 3864	+ 1 3993	0.372618	0.307102	0.320279
73	+ 2 3858	+ 0 4188	+ 1 3993	0.358884	0.314940	0.326176
74	+ 9 4202	+ 7 4753	+ 8 4751	0.472408	0.247111	0.280480
75	+ 8 4720	+ 7 4745	+ 7 4749	0.319117	0.336813	0.344070
76	+13 2199	+12 2147	+13 2217	0.314074	0.385320	0.300606
77	+ 9 2878	+ 9 2881	+ 9 2890	0.381144	0.322226	0.296630

Tableau III

N°	fact. par.		N°	fact. par.		N°	fact. par.	
1	−0ˢ.012	+2″.86	14	+0ˢ.063	+5″.37	27	−0ˢ.178	+6″.18
2	−0.056	+2.89	15	+0.104	+5.36	28	−0.204	+6.18
3	+0.103	+2.94	16	−0.239	+4.70	29	−0.177	+5.69
4	+0.090	+3.06	17	+0.372	+5.21	30	−0.115	+3.38
5	−0.177	+6.56	18	−0.235	+3.30	31	+0.248	+4.09
6	−0.185	+6.56	19	−0.046	+3.59	32	−0.345	+4.00
7	−0.164	+4.28	20	−0.259	+3.99	33	+0.133	+5.30
8	−0.323	+4.68	21	−0.225	+4.34	34	−0.147	+5.29
9	−0.129	+3.79	22	−0.228	+4.82	35	−0.021	+4.64
10	+0.027	+3.69	23	+0.376	+5.35	36	−0.078	+4.48
11	−0.100	+5.63	24	−0.171	+6.50	37	−0.366	+5.51
12	+0.063	+5.60	25	−0.125	+6.53	38	−0.334	+5.36
13	−0.082	+5.38	26	−0.222	+6.18	39	−0.109	+3.06

Tableau III (suite)

N°	fact. par.		N°	fact. par.		N°	fact. par.	
40	$-0\overset{s}{.}151$	$+3\overset{''}{.}13$	52	$-0\overset{s}{.}025$	$+4\overset{''}{.}77$	64	$+0\overset{s}{.}127$	$+5\overset{''}{.}93$
41	−0.529	+2.70	53	−0.266	+0.84	65	+0.204	+5.97
42	−0.473	+2.05	54	+0.411	+1.69	66	+0.244	+5.98
43	+0.077	+6.24	55	−0.058	+3.54	67	−0.286	+3.47
44	−0.080	+6.23	56	−0.271	+3.98	68	−0.167	+3.07
45	+0.006	+5.35	57	+0.007	+4.93	69	−0.104	+3.04
46	−0.029	+5.34	58	−0.018	+4.57	70	−0.146	+3.12
47	−0.062	+1.69	59	−0.405	+5.16	71	−0.243	+6.00
48	−0.420	+3.25	60	−0.067	+3.53	72	−0.143	+5.99
49	−0.456	+3.93	61	−0.279	+4.00	73	−0.158	+6.00
50	−0.159	+4.16	62	+0.002	+5.36	74	−0.247	+5.29
51	−0.307	+4.59	63	+0.074	+5.92	75	+0.161	+5.29

Positions précises de quelques étoiles de repéres, déduites d'aprés nos mesures et appliquées lors des réductions précedentes (ou dans des cas analogues):

Tableau IV

N°	Étoile	Date TU	Équin. 1950.0		Époque
1	BD −4°224	Dec.15.681088	$1^h28^m41\overset{s}{.}748$	$-\ 3°53'\ 05\overset{''}{.}74$	1978.95
2	BD+19°796	Dec.20.880591	4 48 57.067	+19 43 01.63	1978.97
3	BD+24°1148	Dec.27.877118	6 08 00.355	+24 53 38.56	1978.99
4	BD+20°857	Dec.20.880591	4 56 27.649	+20 58 39.47	1978.97
5	Anonyme	Dec.26.895868	6 04 21.236	+24 47 50.69	1978.98

Bull. Obs. Astron. Belgrade, N° 130

DETERMINATION ASTRONOMIQUE DE L'HEURE

M. Jovanović, L. Đurović

Observateurs: J – M. Jovanović
Đ – L. Đurović

1 9 7 7

Date		Date Julienne 2440000	TU	TUO–TUC	t_i
I	5	3149.17	$16^h.1$	7077	$-0^s.9$
	5	3149.20	16.9	6948	–1.8
	14	3158.18	16.3	6619	+4.0
	14	3158.22	17.2	6342	+3.4
	19	3163.16	16.0	6720	–1.5
	23	3167.36	20.8	5987	+3.0
	25	3169.24	17.7	6056	+4.3
	25	3169.27	18.5	6184	+4.2
	28	3172.18	16.3	6007	+7.2
	28	3172.21	17.1	6060	+7.1
II	11	3186.27	18.4	5453	+8.7
	11	3186.31	19.4	5606	+8.6
III	6	3209.22	17.2	5039	+9.1
	6	3209.26	18.1	5166	+9.1
	7	3210.22	17.2	5070	+9.6
	7	3210.25	18.1	5088	+8.5
	8	3211.21	17.1	4939	+9.7
	8	3211.25	18.0	4874	+9.0
	9	3212.25	18.1	5273	+11.2
	10	3213.24	17.9	5147	+11.7
	10	3213.28	18.8	5139	+10.4
	11	3214.24	17.8	4847	+10.5
	11	3214.28	18.7	4905	–
	14	3217.27	18.5	4470	+8.9
	14	3217.31	19.4	4390	+8.7
	16	3219.23	17.5	4421	+10.5
	16	3219.26	18.4	4687	+9.3
	17	3220.26	18.3	4702	+11.7
	17	3220.30	19.2	4673	+10.2
	18	3221.22	17.4	4346	+11.2
	18	3221.26	18.3	4936	+9.5

Date		Date Julienne 2440000	TU	TUO– TUC	t_i	Obs
III	19	3222.26	18.2	4000	+11.0	J
	19	3222.29	19.0	4443	+10.3	J
	21	3224.32	19.8	4499	+11.9	J
	21	3224.36	20.6	4311	+11.6	J
	22	3225.32	19.7	4416	+15.4	Đ
	22	3225.36	20.7	4301	+15.8	Đ
	23	3226.28	18.8	4523	+18.3	Đ
	23	3226.32	19.6	4618	+18.2	Đ
	24	3227.35	20.5	4316	+18.6	J
	24	3227.39	21.3	4314	+18.0	J
	25	3228.24	17.8	4338	+16.6	Đ
	25	3228.28	18.7	4642	+15.1	Đ
	26	3229.24	17.7	4287	+17.2	J
	26	3229.27	18.6	4812	+16.4	J
	27	3230.24	17.6	4133	+18.1	J
	27	3230.27	18.5	4512	+16.1	J
IV	7	3241.35	20.5	3820	+13.3	J
	7	3241.39	21.3	3621	+13.2	J
	11	3245.34	20.3	3896	+ 9.0	J
	11	3245.38	21.1	3882	+ 7.4	J
	22	3256.27	18.6	3624	+12.1	J
	22	3256.31	19.4	3481	+11.8	J
	25	3259.38	21.1	3160	+ 9.5	J
	26	3260.25	18.1	3505	+12.1	Đ
	27	3261.30	19.1	3633	+13.8	J
	27	3261.33	20.0	3473	+14.1	J
	27	3261.37	20.9	3552	+14.1	Đ
	27	3261.41	21.8	3336	+13.1	Đ
	28	3262.29	19.0	3466	+16.6	J
	28	3262.33	19.9	3401	+16.0	J
	29	3263.33	19.9	3290	+17.8	Đ
	29	3263.37	20.9	3236	+17.2	Đ
	30	3264.32	19.8	3271	+18.3	Đ
	30	3264.36	20.8	3216	+18.3	Đ
V	2	3266.28	18.8	3185	+20.9	J
	3	3267.28	18.7	3131	+22.1	J
	3	3267.32	19.6	3037	+21.0	J
	4	3268.28	18.7	3395	+23.3	Đ
	4	3268.31	19.6	3198	+21.9	Đ
	11	3275.37	20.9	3296	+15.9	J
	11	3275.41	21.9	3305	+14.9	J
	12	3276.33	20.0	3131	+16.0	Đ
	12	3276.37	20.9	3093	+15.7	Đ
	16	3280.28	18.7	2912	+16.3	J
	25	3289.30	19.1	2554	+18.3	J
	25	3289.33	20.0	2224	+17.8	J

	Date	Date Julienne 2440000	TU	TUO–TUC	t_i	Obs
V	28	3292.28	18.8	2025	+14.0	J
	28	3292.31	19.4	2139	+13.2	J
	30	3294.32	19.7	2488	+18.1	Đ
	30	3294.36	20.6	2622	+17.2	Đ
VI	4	3299.38	21.2	2035	+15.1	Đ
	4	3299.42	22.2	1816	+13.1	Đ
	8	3303.39	21.3	2184	+20.2	J
	8	3303.43	22.3	2005	+20.2	J
	9	3304.41	21.9	2420	+22.1	Đ
	9	3304.45	22.8	2625	+21.6	Đ
	10	3305.37	20.8	2476	+23.8	J
	10	3305.41	21.8	2134	+23.2	J
	12	3307.40	21.6	2050	+22.5	J
	13	3308.36	20.6	2127	+24.8	Đ
	13	3308.40	21.6	2021	+23.1	Đ
	17	3312.31	19.4	1726	+21.2	J
	17	3312.35	20.3	1824	+21.0	J
	20	3315.30	19.2	2048	+23.5	J
	20	3315.34	20.1	2191	+22.4	J
	29	3324.31	19.6	1674	+20.1	J
	29	3324.35	20.5	1771	+20.0	J
VII	6	3331.30	19.1	1668	+20.2	J
	6	3331.33	20.0	1512	+19.6	J
	8	3333.30	19.1	1406	+25.3	J
	8	3333.33	19.9	1508	+24.9	J
	8	3333.37	20.9	1314	+24.6	J
	13	3338.28	18.8	1592	+23.0	J
	13	3338.32	19.6	1782	+21.8	J
	13	3338.35	20.4	1564	+21.4	J
	27	3352.28	18.7	1222	+19.1	Đ
	27	3352.32	19.6	1534	+18.2	Đ
	28	3353.28	18.6	1269	+20.7	Đ
	28	3353.32	19.6	1517	+19.8	Đ
	29	3354.28	18.6	1471	+22.2	Đ
	29	3354.31	19.5	1192	+21.3	Đ
	30	3355.35	20.4	1464	+23.7	Đ
	30	3355.38	21.1	1015	+23.2	Đ
VIII	3	3359.34	20.1	1059	+18.9	Đ
	3	3359.37	21.0	1201	+18.3	Đ
	4	3360.30	19.1	1155	+21.2	Đ
	4	3360.33	20.0	1114	+20.5	Đ
	6	3362.29	19.0	0691	+22.7	Đ
	6	3362.33	19.9	0813	+21.8	Đ
	7	3363.29	18.9	1346	+22.9	Đ
	10	3366.32	19.7	0882	+23.9	Đ
	12	3368.27	18.6	0966	+22.1	Đ
	12	3368.31	19.5	1087	+20.3	Đ

Date		Date Julienne 2440000	TU	TUO– TUC	t_i	Obs
VIII	16	3372.30	19.2	1051	+21.5	J
	16	3372.34	20.1	0987	+20.2	J
	17	3373.26	18.4	0729	+21.1	Đ
	17	3373.30	19.2	1140	+20.2	Đ
	20	3376.29	19.0	0555	+22.0	J
	20	3376.32	19.8	0480	+21.4	J
	26	3382.27	18.6	0239	+19.0	J
	26	3382.31	19.5	0096	+18.1	J
	27	3383.27	18.5	0956	+21.2	Đ
	27	3383.31	19.4	0832	+20.3	Đ
	29	3385.27	18.4	0247	+23.8	Đ
	29	3385.30	19.3	0455	+22.9	Đ
	30	3386.26	18.3	0995	+22.8	J
	30	3386.30	19.2	0773	+21.9	J
	31	3387.37	20.9	0508	+20.7	Đ
	31	3387.40	21.7	0860	+20.1	Đ
IX	2	3389.33	19.9	0485	+21.0	Đ
	2	3389.36	20.7	0275	+19.8	Đ
	3	3390.36	20.6	0405	+20.7	J
	3	3390.39	21.5	0394	+19.4	J
	4	3391.25	18.0	0750	+21.7	J
	4	3391.29	18.9	0521	+21.2	J
	5	3392.28	18.8	9970	+21.8	Đ
	5	3392.32	19.8	0087	+21.2	Đ
	6	3393.32	19.6	0280	+21.6	J
	6	3393.35	20.4	0415	+21.4	J
	7	3394.31	19.6	0354	+22.6	Đ
	7	3394.35	20.4	0401	+21.8	Đ
	12	3399.23	17.5	0152	+20.3	J
	12	3399.26	18.4	0113	+19.6	J
	15	3402.26	18.2	9902	+17.0	J
	15	3402.29	19.0	9623	+16.5	J
	28	3415.29	19.0	9833	+11.1	J
	28	3415.33	19.8	9965	+10.0	J
	29	3416.22	17.3	9314	+10.1	Đ
	29	3416.28	18.7	8964	+ 8.8	J
	30	3417.29	19.0	9789	+12.2	J
	30	3417.32	19.7	9582	+11.6	J
X	1	3418.28	18.8	9495	+15.2	Đ
	3	3420.35	20.4	9700	+10.4	J
	3	3420.39	21.4	9333	+ 9.6	J
	4	3421.20	16.9	9216	+11.9	Đ
	4	3421.26	18.3	9241	+11.2	Đ
	5	3422.31	19.4	9483	+14.1	J
	5	3422.34	20.2	9650	+14.1	J
	6	3423.23	17.5	9223	+15.9	Đ
	8	3425.38	21.0	9359	+16.4	J
	16	3433.24	17.8	9247	+13.4	J

Date		Date Julienne 2440000	TU	TUO–	t_i	Obs
X	16	3433.28	18.6	9203	+12.2	J
	17	3434.20	16.9	8672	+10.8	Đ
	17	3434.24	17.8	8974	+10.1	Đ
	18	3435.27	18.5	9280	+12.0	J
	18	3435.31	19.4	9132	+11.4	J
	19	3436.21	17.0	8687	+13.1	Đ
	20	3437.26	18.4	9182	+13.0	J
	20	3437.30	19.2	8963	+12.6	J
	21	3438.19	16.7	8861	+12.2	Đ
	21	3438.23	17.5	8999	+11.8	Đ
	22	3439.19	16.6	8953	+12.9	J
	22	3439.23	17.4	9137	+12.3	J
	23	3440.29	19.0	9374	+14.1	Đ
	24	3441.26	18.1	8902	+14.2	Đ
	24	3441.29	19.0	9022	+13.2	Đ
	25	3442.37	20.9	9013	+12.8	J
	25	3442.40	21.6	9196	+12.3	J
	26	3443.28	18.9	9345	+13.0	J
	26	3443.33	19.9	9239	+12.5	J
	27	3444.18	16.3	8539	+14.6	Đ
	27	3444.21	17.1	8752	+13.6	Đ
	28	3445.24	17.9	9098	+15.0	J
	28	3445.28	18.6	9073	+14.4	J
XI	9	3457.21	17.1	8402	+12.3	J
	9	3457.25	17.9	8211	+11.9	J
	11	3459.21	17.1	8464	+13.9	Đ
	11	3459.24	17.8	8586	+13.7	Đ
	12	3460.28	18.7	7998	+15.4	J
	12	3460.32	19.6	8226	+15.6	J
	14	3462.36	20.6	8028	+ 9.5	J
	14	3462.40	21.5	7686	+ 8.2	J
	20	3468.18	16.2	8195	+ 4.0	J
	24	3472.21	17.0	7885	+ 4.3	J
	24	3472.25	18.0	7889	+ 3.9	J
XII	4	3482.14	15.4	7357	–0.6	J
	4	3482.18	16.3	7213	–1.4	J
	5	3483.18	16.2	7495	–1.0	J
	5	3483.22	17.2	7539	–1.7	J
	6	3484.15	15.6	7306	+0.3	Đ
	8	3486.21	17.0	7287	+2.6	J
	8	3486.25	18.0	7483	+2.9	J
	12	3490.20	16.8	7352	–2.0	J
	12	3490.24	17.7	7205	–3.0	J
	13	3491.16	15.7	7212	–2.1	Đ
	13	3491.20	$16^h.7$	6980	$-2^o.3$	Đ

OBSERVATIONS À LA LUNETTE ZENITHALE (De 110 mm) DU SERVICE DE LATITUDE DE L'OBSERVATOIRE DE BEOGRAD EN 1978

R. Grujić, M. Djokić

(Reçu le 23 mars, 1979)

SOMMAIRE:

On a présenté les valeurs de latitude ansi que quelques données météorologiques prises au cours d'observations.

TABLEAU I

Les valeurs observées de φ (Tableau I) sont reduites à la manière déjâ signalée (Ševarlić, B., Teleki, G.) mais sans tenir compte des erreurs progréessives et périodiques et de coefficient de température (Milovanović, V. et les autres). Les réductions ont été faites dans le système FK4 et on a appliqué les corrections des déclinaisons présentées dans le Tableau 2 (Grujić, R. et les autres).

La valeur du tour de la vis micrométrique adoptée était: R = 40″.0481.

Tableau I

Les valeurs de latitude ansi que quelques données météorologiques au cours d'observation

DATE	τ	OBS.	T_z	T_i	T_v	Bo	GR.	φ_a	φ_b	φ_d
1978										
I 3	1978.008	RG	2°.5C	1°.6C	1°.8C	740.4	I	10″.404	10″.508	"
	.009	RG	4.2	2.0	3.2	738.5	II	10.295	10.314	10.380
11	.030	RG	1.2	− 1.0	0.0	736.5	II	10.584	–	10.584
II 21	.143	RG	− 8.1	− 5.5	− 6.6	745.1	II	–	10.298	10.298
22	.145	MD	− 2.9	− 2.6	− 2.6	743.2	II	10.120	10.046	10.083
III 1	.169	RG	10.4	10.7	10.3	737.1	III	10.082	–	10.082
4	.173	RG	9.7	10.6	9.8	734.3	II	–	10.180	
	.173	RG	8.4	8.6	8.4	735.0	III	9.987	9.931	10.033
12	.195	RG	− 0.2	1.8	1.0	742.1	III	–	10.173	10.173
28	.239	RG	8.4	7.2	7.0	744.8	III	9.926	9.968	9.947
29	.241	MD	11.6	9.4	9.6	741.9	III	9.985	9.834	9.910
IV 12	.280	RG	15.6	14.4	14.6	735.7	III	–	9.874	9.874
V 4	.340	RG	13.2	14.2	13.4	743.0	IV	9.758	–	9.758
16	.373	RG	9.4	11.4	10.8	741.0	IV	–	9.964	
	.373	RG	8.8	10.0	9.7	741.1	V	10.032	10.010	10.002
VI 7	.433	MD	20.0	19.8	19.2	740.9	V	9.993	10.088	10.040
19	.466	RG	14.8	16.2	15.2	740.9	V	10.219	10.115	10.167

Tableau I (suite)

DATE	τ	OBS.	T_z	T_i	T_v	Bo	GR.	φ_a	φ_b	φ_d
1978										
VII 11	1978.526	RG	18°7C	20°3C	19°5C	739.9	V	10.258	–	10.258
12	.529	RG	21.3	22.2	21.2	740.7	V	10.270	10.145	10.208
16	.540	RG	15.6	18.4	17.0	740.7	V	10.279	10.261	10.270
17	.542	RG	18.3	19.5	18.6	741.8	V	10.256	10.292	10.274
20	.548	RG	17.1	19.0	17.9	737.2	V	10.108	10.282	10.195
24	.559	RG	14.8	16.9	15.7	741.5	V	10.230	10.306	
	.560	RG	13.7	14.8	14.2	741.5	VI	10.441	10.256	10.308
26	.564	RG	18.6	19.5	18.5	741.3	V	–	10.263	10.263
VIII 7	.600	MD	26.0	25.1	24.8	734.2	V	10.158	10.273	10.216
15	.622	MD	18.0	19.4	18.0	747.2	V	–	10.217	10.217
16	.624	MD	21.0	21.7	21.1	741.6	V	10.290	10.168	
	.625	MD	19.4	20.0	19.5	741.5	VI	10.392	–	10.283
23	.644	MD	19.2	19.6	18.6	741.6	VI	10.492	–	10.492
IX 3	.674	MD	14.2	15.5	14.4	738.4	VI	10.418	10.450	10.434
11	.696	RG	21.0	19.7	20.1	735.3	VI	10.404	10.581	10.492
14	.704	RG	11.0	13.1	12.0	742.3	VI	10.610	10.657	10.634
17	.712	MD	13.7	14.4	13.8	744.0	VI	10.627	10.543	10.585
25	.734	RG	18.2	17.0	17.0	744.7	VI	10.510	10.553	10.532
X 4	.759	RG	13.4	15.2	14.1	738.4	I	10.640	–	10.640
7	.767	RG	11.6	13.5	12.5	747.8	VI	–	10.749	10.749
8	.770	MD	13.8	14.5	14.3	746.8	VI	10.495	10.473	10.484
9	.772	RG	13.2	13.8	13.6	746.7	VI	10.537	10.614	10.576
11	.778	MD	14.0	13.8	13.7	749.0	VI	10.588	10.579	
	.778	RG	12.0	12.8	12.8	749.2	I	10.676	10.554	10.599
15	.789	RG	10.8	11.8	10.8	742.9	VI	10.661	10.666	10.664
16	.792	MD	10.0	11.0	10.4	740.2	VI	10.528	10.555	
	.792	MD	9.3	9.5	9.4	740.0	I	10.535	10.460	10.520
17	.794	RG	11.3	11.1	11.1	735.5	VI	10.655	–	10.655
22	.808	RG	3.8	7.0	5.7	741.2	VI	–	10.636	
	.808	RG	3.4	5.7	4.8	740.7	I	10.688	–	10.662
24	.813	MD	8.0	8.4	7.6	748.8	VI	–	10.516	10.516
25	.814	RG	7.2	8.2	8.0	741.6	I	10.634	–	10.634
XI 4	.844	RG	2.8	4.2	3.5	750.6	I	10.746	10.632	10.689
XII 20	.970	RG	1.4	0.0	0.0	741.1	I	10.670	10.586	
	.970	RG	4.2	1.5	2.8	741.7	II	10.402	10.343	10.500

La légende:

Date: Année, mois et date d'observation.
τ: Partie d'année tropique.
Obs.: Observateurs R. Grujić (RG), M. Djokić (MD).
T_z: Température à l'abri météorologique éloigné 50 m de l'instrument.
T_i: Température de l'instrument.
T_v: Température de l'air dans la salle d'obsérvation (valeur moy. des lectures des thermométres sud et nord).
Bo: Lecture du barométre en mmHg (tenant compte de la température de barométre).
GR.: Numéro de la groupe.
φ_a, φ_b: La latitude de la sous-groupe *a*, resp. *b*
φ_d: La valeur moy. de la latitude de la nuit.

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