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Preliminary report

ORBIT ORIENTATION FOR BINARIES WITH ORBITAL INCLINATION $i = 90^o$

G. M. Popović and S. Ninković

Astronomical Observatory, Volgina 7, 11160 Belgrade-74, Yugoslavia

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SUMMARY: Among more than 1000 binaries there are 20 systems with orbital inclination $i = 90^o \pm 3^o$. Their spatial orientation is examined. It is concluded that almost 50% of them have quasi complanar orientation. The mean great circle representing this quasi complanarity has its pole at a position of

$$\alpha = 239.^o2 \pm 12.^o3$$

$$\delta = 31.^o8 \pm 19.^o7 \ .$$

1. INTRODUCTION

At the Belgrade Astronomical Observatory orbital-plane inclinations for 78 binaries were examined in Popović (1998). The ascending nodes of these systems are known. This examination, with some corrections, was repeated also in 1999 (Popović et al., 2000). Although the distribution of the positions of these orbital poles somewhat differed from those corresponding to random inclinations, it was impossible to infer anything concerning a grouping of orbital-plane poles. A similar conclusion had been reached by other authors who had studied this problem earlier and whose results are cited in both papers mentioned above.

In the present paper we examine the orbital-plane inclinations for binaries with inclination $i = 90^o \pm 3^o$. With respect to the Earth, resp. the Sun, these orbits are projected along straight lines and their spatial orientation is distributed randomly. In other words the poles of these planes are located randomly.

The aim of the present paper is to find some conclusion concerning the orientation of orbital planes whose inclination $i = 90^o$.

The calculation of the position of the orbital-plane pole for such a system, in addition to the system position (α, δ), also includes the position angle of the orbit projection, i. e. the position of the straight line defined by this projection. This position coincides with the orbit node whereby it is irrelevant to know which one is the ascending , resp. descending node because this is without effect as to the orbit spatial orientation. Therefore, these systems form an additional material (to the systems with known node) which can contribute to our conclusions concerning the spatial orientation of orbital planes.

Table 1. 20 binaries with orbital inclination $i = 90° \pm 3°$.

ADS or Name	RA,D(2000)	i[°]	Node[°]	Author
238	00173+0852	90	125.0	1987,Baize
283	00209+6740	88.50	84.9	1957,Muller
862	01030+4722	87.00	176.7	1966,Heintz
Mlr 377	02231+7021	90	157.2	1991,Muller
Fin 333	02434-6643	89.9	35.5	1978,Heintz
2324 Aa	03049+5330	88	242.6	1982,McAlister
3248	04290+1610	92.6	77.7**	1956,Bos
4617	06024+0939	91.8	27.6***	1964,Osva
6185	07352+3058	92.48	149.49***	1989,Ha&a
8086	11124-1830	91.494	146.298	1983,CoDo
8098	11322+3615	91.4	120.1	2000,Hart
8231	11363+2747	87.539	153.329	1983,CoDo
8804	13100+1731	90.06	192.34	1989,Ha&a
10074	16294-2626	90	93.7	1978,Baize
I 253	19190-3317	92.15	138.20	1954,van den Bos
14499	20591+0418	92.17	105.15	1965,Zell
15988	22299+0425	90	117.6	1988,Zul
16138	22387+4418	87.95	154.00	1966,H&al
Mlr 3	22356+5413	90	169.0	1991,Mul
16417	22585+0922	90	166.7	1991,Cester

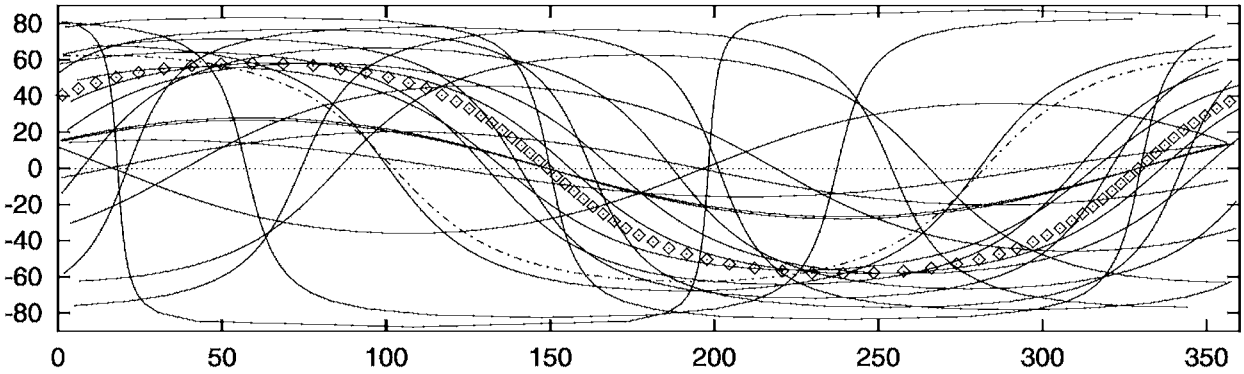

Fig. 1. *The great circles of 20 orbits with orbital inclination $i = 90^o$; the mean great circle and the galactic equator indicated.*

2. TREATED MATERIAL

Among more than 1000 binaries only 20 of them have orbital-plane inclination $i = 90^o \pm 3^o$ (Table I). Such errors in the orbit calculating are usual. In addition, this enables the number of examined systems to be enlarged by more than 50%. The columns of Table I contain the following data
1. star designation;
2. its equatorial coordinates (α, δ) for the epoch 2000.0;
3. orbit inclination i;
4. posiition angle (i. e. node) of orbit projection;
5. the year of orbit publication and the author;
The asterisks following the node value indicate the epoch for which the orbital elements are calculated.

3. TREATMENT OF THE MATERIAL AND RESULTS

The orientation of the orbital planes is presented by the positions of great circles contained by these planes. The positions of "orbital-planes great circles" i. e. of their poles are calculated in the same way as it was done by Popović (1993) with the great circles of the proper motions and their poles.

In Fig. 1 we present the positions of the great circles of 20 orbital planes. Their inclinations are $i = 90^o \pm 3^o$. Unlike the orbit orientations associated with random inclinations where any particular orientation could not be indicated (Popović, 1998; Popović *et al.*, 2000), here a "quasicomplanarity" of

several orbital planes is quite apparent. There are five orbital planes which clearly do not fit into this quasicomplanarity: ADS238, ADS862, Mlr377, Fin333, ADS4617.

The mean plane around which most of others oscillate is here determined from 9 orbits of the following pairs: ADS2324Aa, ADS6185, ADS8086, ADS10074, I253, ADS15988, ADS16138, Mlr3 and ASDS16417.

This mean circle is presented in Fig. 1 by the heavy line. For its pole the following equatorial coordinates are obtained

$$\alpha = 239.^o2 \pm 12.^o3$$

$$\delta = 31.^o8 \pm 19.^o7 \ .$$

In order to locate this region of "quasicomplanar" planes in the Galaxy in Fig. 1 is also presented the galactic plane (dashed line).

It will be of interest to study the orientation of this group of orbits after their number is increased since a sample of 20 orbits must not be accepted as representative. A consideration of these systems with taking into account also the parallax may throw more light as to the position of these systems in the Galaxy.

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ОРИЈЕНТАЦИЈА ОРБИТА ДВОЈНИХ ЗВЕЗДА СА НАГИБОМ ПУТАЊЕ $i = 90^o$

Г. М. Поповић и С. Нинковић

Астрономска опсерваторија, Волгина 7, 11160 Београд-74, Југославија

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Претходно саопштење

Међу више од 1000 двојних звезда има 20 система са орбиталним нагибом $i = 90^o \pm 3^o$. За ове системе испитана је просторна оријентација. Закључено је да скоро 50% од њих има "квазикомпланарну" оријентацију. Средњи велики круг који презентује ову квазикомпланарност има пол на положају

$$\alpha = 239.^o2 \pm 12.^o3$$

$$\delta = 31.^o8 \pm 19.^o7 \ .$$