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COMMUNICATIONS FROM THE OBSERVATORY AT LEIDEN.

On the median period of binary systems near our sun, by *Ejnar Hertzsprung*.

Of the 15000 known double stars there are only about 50 for which it is at present possible to derive reliable orbits, while about 1000 show at least the first traces of orbital motion. The rest is — when the components are physically connected — so far practically fixed. It would therefore appear that not much more can be said about the median period of the double stars of our catalogues than that it must be very long — probably thousands of years.

But if we ask for the median period of the binary systems contained in an arbitrary volume of space, and consider the neighbourhood of our sun as representative of such an arbitrary volume, it proves to be possible to give a much less vague answer.

The following list contains 21 double stars for which a parallax of more than $''1$ has been found. For 13 of these objects the period P has been taken from the calculated orbits. For 7 of the other 8 pairs the apparent radius vector was divided by the apparent yearly orbital motion and the resulting number of years multiplied by 4.4. This last factor was found empirically from 75 double stars of known orbital elements by calculating in each case the proportion between the apparent radius vector and the apparent annual orbital motion for the epoch 1900. The median value*) of the period divided by this proportion is 4.4. The last double star included, viz. γ Leporis, with a distance between the components of $95''$, does not as yet show any sensible orbital motion. The period was therefore roughly estimated in the following hypothetical way. From the same 75 double stars with known orbital elements mentioned above it was found that the median factor by which the apparent separation of the components at an arbitrary moment must be multiplied in order to get the semi major axis is 1.13. The measured parallax of γ Leporis is $''148$.

*) 16 percent or 12 of the 75 values were greater than 15.1 and just as many less than 2.5. The period P of a binary with sensible orbital motion may therefore be calculated in this way with a mean error in $\log P$ of roughly $\pm .4$.

Supposing the sum of the masses to be $2\odot$ the hypothetical period is 13000 years or $\log P = 4.1$.

For each system of 3 or more stars the shortest period found in that system has been taken. As a matter of fact including of the periods of the few distant companions would cause no essential change in the median period of the 21 systems here considered. The logarithm of this median period is seen from the accompanying table to be 1.9 corresponding to a period of 80 years. The distribution in $\log P$ is practically Gaussian, the mean deviation from the mean being ± 1.0 . For binary stars near our sun we therefore approximately have $\log P = 2 \pm 1$ (mean deviation).

Star.	adopted $\log P$ (P in years)
χ Draconis...	—1
ξ Ursae maj..	.3
β 395.....	1.4
ζ Herculis...	1.5
α Canis min..	1.6
β 416.....	1.6
μ Herculis...	1.6
Lac 353 *)...	1.7
α Canis maj..	1.7
Krüger 60...	1.7
α Centauri...	1.9
70 Ophiuchi..	1.9
ξ Bootis....	2.2
σ_2 Eridani...	2.3
61 Cygni....	2.6
<i>Sh</i> 190.....	2.8
Σ 2398.....	2.9
Σ 1321.....	3.0
α Tucanae *)	3.0
<i>Grb</i> 34.....	3.4
γ Leporis....	4.1

*) Lac 353 and α Tucanae have been counted as two systems, although they have common proper motion and are thus probably physically connected.