33. COMMISSION DE LA STATISTIQUE STELLAIRE

PRÉSIDENT: M. C. V. L. CHARLIER.

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The most important desiderata in all work on stellar statistics are at present certain auxiliary tables that are generally wanted and some desirable revisions of the results obtained from observations in different branches of stellar astronomy and some changes in the publications of these results.

1. *Tables for conversion of equatorial into galactic coordinates.* The Galaxy being the natural fundamental plane of our stellar universe it is evident that all researches on stellar statistics ought to be based on the position of the stars and their motions in relation to a galactic groundplane. Most desirable would be to have all star-catalogues referred to a system of coordinates which would make such positions totally independent of precession and other similar changes in the system of coordinates. The transition from equatorial coordinates, expressed in thousandths of a second, to corresponding galactic values is, however, a laborious work and must be performed with logarithmic tables having 8 decimal places. Such catalogues may surely be formed in the future but are at present scarcely possible.

In most stellar statistical investigations it is not, however, necessary to know the coordinates of a star with such a great accuracy. It is enough to know approximately the galactic longitude (l) and latitude (b) of the objects in consideration. Such tables for an approximate calculation of l and b have been published by Kapteyn, Pannekoek, Walkey, Innes, Plassmann (and perhaps by others) and by the Harvard Observatory. At the observatory of Lund, where the galactic coordinates have been exclusively used in all stellar statistical investigations for the last ten years, a conversion table has been calculated giving to the whole degree the values of l and b corresponding to every whole degree in α and δ. The tables cited above differ more or less regarding the position adopted for the galactic plane and regarding the extent of the tables. The most extended is that of Lund (not published). It has, however, been found desirable to give the values of l and b more accurately than in whole degrees. An accuracy to hundredths of a degree might, however, be sufficient (the tables of Pannekoek have been given to this limit, but only for each fifth degree in α and δ). For that reason I propose that such tables should be calculated and published through Commission 33 before the next meeting.

Regarding the position adopted for the galactic plane I think the coordinates

$$\alpha = 12^{h}\,40^{m}, \quad \delta = +28^{\circ}$$

of the galactic pole may at present be considered as the most suitable. It has been adopted in the tables of Harvard and Lund and has some practical advantages giving the coordinates in round degrees. A close inquiry as to the position of the galactic plane has not yet been given but even the definition of this plane is still vague and the principal thing is to refer the coordinates to a fixed plane, that approximately coincides with the plane of the Galaxy, which condition is sufficiently fulfilled by the plane defined by Pickering.

2. *Tables for conversion of equatorial into galactic proper motions.* Though the formation of catalogues giving the galactic positions of the stars in thousandths

https://doi.org/10.1017/S0251107X00013213 Published online by Cambridge University Press

of a second is at present too expensive, it is rather easy to convert the proper motions of the stars in α and δ into proper motions in l and b. It is for that purpose sufficient to give a table of the angle ϕ between the declination circle and the galactic latitude circle of a star. Such tables have long been used at the observatory of Lund though their extent is not entirely sufficient. It is even here necessary to give the values of ϕ for every whole degree of α and δ and to express the values of ϕ in *hundredths* of a degree.

I propose that such tables should be calculated and published through Commission 33 before the next meeting.

By numerical trials I have found that the expense of the calculation of both Tables I and II together, to the given extent, amounts to about £180.

The tables would suitably be printed in *quarto* and would embrace 180 pages having 45 lines per page.

3. *Catalogue of radial velocities.* In all statistical investigation a great difficulty generally arises in the comparison of results from different observatories and observers. The methods used by different observers treating the same problem are generally not identical and the published results are often not sufficiently exhaustive to put the statistician in a position to determine with sufficient accuracy the relative and absolute systematic corrections to the results from different sources. The result may naturally often be obtained through correspondence with each observer, but this time-absorbing operation can sometimes be shortened by suitable co-operation. The division of the astronomical problems between different commissions introduced by the International Astronomical Union facilitates highly such a co-operation. An excellent work of that kind has been performed by Commission 30, which at the meeting in Cambridge through a sub-committee made such a research on the observations of different observatories of the radial velocities of the stars.

I propose that a complete table of all now known radial velocities may be elaborated by Commission 33, taking into consideration the systematic and individual corrections to the observed radial velocities calculated by Commission 30. The work may most suitably be entrusted to some member of Commission 33.

4. *Catalogue of the absolute magnitudes of the stars.* A catalogue similar to that proposed in the preceding paragraph has in the last year been performed by Prof. Schlesinger for *the stellar parallaxes.* Many such catalogues are now wanted; some of them are being worked at by different astronomers, some cannot be executed before first performing a thorough comparison between the methods used by different observers, a direct comparison between the scales used and a definite standardizing of the values obtained for the absolute magnitudes. To form such a catalogue I think it most suitable to appoint a *sub-commission*—that eventually may have to collaborate with other commissions—having the task of elaborating to the next meeting a complete catalogue of all absolute magnitudes now known.

5. *Units of length and time.* In all work on stellar statistics it is of the greatest importance to use suitable units of length and time. Not only in statistics treating the observed positions of stars and nebulae, but still more in all theoretical work on statistical mechanics and its many applications. William Herschel, the founder of stellar astronomy, realizing the importance of such units, used in the discussion of his celebrated star gauges, as unit of length one "*Sirius distance,*" regarding Sirius as the nearest star and considering this distance approximately

https://doi.org/10.1017/S0251107X00013213 Published online by Cambridge University Press

equal to the mean distance of the stars in our universe. An expression of this unit in known units of length it was not possible for him to find. Such a determination was performed by Seeliger who, accepting a parallax of Sirius of 0."2, defined the stellar unit of length—by him called *Sirius-weite*—as 1 031 324 planetary units (distances of the earth from the sun). Being myself in my first publication on stellar statistics (1911) under the necessity of using such a unit I have found it adequate to define this unit not as Seeliger by a parallax but by another length. This was possible, without changing noticeably the unit previously used, by defining it equal to

$$10^6 \text{ planetary units} = 1{\cdot}494 \times 10^{19} \text{ cm.}$$

Had my publication been written in German I had without doubt maintained the name used by Seeliger "Sirius-weite." Now it was necessary to translate it into English and trying as much as possible to adhere to the practice of William Herschel and to use simultaneously a word of international import I have chosen the term "Siriometer."

Certainly formal objections can be made to this name as was also pointed out by the Astronomer Royal, Sir Frank Dyson, at the meeting of the Royal Astronomical Society, where the memoir in question was presented. To avoid this inconvenience Prof. Turner suggested (1912) a new name "Parsec" which is formally good but necessitates a new unit of length: the fifth part of a "Sirius-weite."

Since this time "Siriometer" and "Parsec" have been used alternately by astronomers as stellar units in statistical investigations: "Siriometer" perhaps has been used most in statistical memoirs issued from the observatory of Lund, whereas "parsec" has got a more general application especially after the recommendation given to it at the meeting of the I.A.U. in Rome 1922.

This is, to make a long story short, the history of the stellar unit of length.

The simultaneous use of two totally different units in stellar astronomy cannot be desirable. Being myself the proposer of one of these units and having this time the possibility of participating in a meeting of the International Astronomical Union I look upon it as a duty incumbent upon me to do what I can for bringing order in this deplorable chaos as far as this may be possible with the help of the Union.

Most simply, perhaps, some think the difficulty would be solved by accepting the definition used by the "majority" (*i.e.* at present the "parsec"). Well, but not *only* by the reason that this definition is favoured by a majority. In political things it is often—though not ever—necessary for a minority to yield *because* it is a minority. In scientific questions, however, another principle is, I think, prevailing, namely that the decision is dependent on the *reasons* of the different opinions and not on the circumstance that a certain opinion is embraced by a majority.

The units in question have that common attribute that both are based on the mean distance of the earth from the sun (the planetary unit of length). But whereas the "Siriometer" is defined directly as 10^6 such planetary units, the "parsec" is defined as the distance at which the planetary unit of length is seen under an angle of one second of arc. Now, it was perhaps the practice in the fifteenth and the sixteenth century to define a distance by an angle and to speak of parallaxes instead of linear distances. The determination of trigonometrical parallaxes is still one of the most fundamental astronomical problems, but the conversion of these parallaxes into actual lengths are made with the same ease whether a "parsec" or any other distance is used as unit of length. There is no benefit or convenience at all in our days to consider the distance of a star as that length from which a certain base is seen under such and such an angle. Supposing a planetary unit of length to be the most convenient and natural in all researches on the planetary system it seems to me that a certain multiple of this length is the rational unit in all stellar investigations.

I agree that against the *name* "Siriometer" certain objections can be raised. But there are other names to be chosen. Some French astronomers and, as I hear, also some Belgian, have suggested *Herschel* as the name of this unit. The astronomers would then follow a good practice of our physicists. Why not at the same time introduce a name of the *planetary* unit, long wished-for? If we call it a *Kepler*, we should in an adequate manner honour two of our greatest astronomers.

Independently of the name we can simply speak of the stellar unit of length and I propose that the Commission may recommend to the astronomers and especially to Commission 3 to use

$$1 \text{ stellar unit of length} = 10^6 \text{ planetary units of length} = 1{\cdot}494 \times 10^{19} \text{ cm.}$$

Without further argument I propose as a consequence that

$$1 \text{ stellar unit of time} = 10^6 \text{ tropical years.}$$

6. *Definition of absolute magnitude.* It seems to me to be a natural consequence of any definition of a stellar unit of length that the absolute magnitude of a star is to be defined as the apparent magnitude at the distance of *one* stellar unit. Supposing that the proposition of the preceding section is accepted I therefore propose that the Commission may recommend to the astronomers the following definition of the absolute magnitude:

The absolute magnitude of a star is equal to the apparent magnitude of the star at the distance of 10^6 *planetary units of length.*

C. V. L. Charlier
President of the Commission

Lunds Observatorium
25 *June*, 1928

https://doi.org/10.1017/S0251107X00013213 Published online by Cambridge University Press