NRAO ONLINE 57.2

Groningen Meeting, Blaauw, Kerr and Westerhout November 1957[1] (See ESM_26.5)

The report from Kerr of the "Meeting of Galactic Plane Sub-commission, Groningen, November 22, 1957" (attendees Blaauw, Westerhout, Kerr (pro Pawsey)) contained a detailed summary of the deliberations that had occurred during Kerr's six-month visit to Leiden. The report was not dated but was likely prepared by Kerr just before he departed Leiden on 1 December 1957.

The report began with a summary of the objective of the sub-commission: "The … objective is to collect the known facts about the position and shape of the galactic plane, and to make recommendations for the adoption of a new reference system."

Then came a surprise announcement of a change of "meaning" for their assignment, which had been provided at the IAU of 1955. Apparently, Blaauw and colleagues made this modification on their own initiative. Blaauw was, after all, the Chair of IAU Commission 33, "The Structure and Dynamics of the Galactic System".

> It was agreed that a change of meaning should be introduced. Previous galactic planes have been thought of as a gradual convergence towards an ultimate limit, but we recommend that the new system should be **regarded as a reference plane set up for an indefinite time, without intention of later revision.** [our emphasis, perhaps answering Bok's criticism] The new plane should therefore be defined only after observational uncertainty has been brought below the natural waviness of the "plane". The emphasis will then shift to studies of the divergence of particular types of objects from this reference plane, and a phrase such as "a correction to the galactic pole" will make no sense.

The sub-commission announced that the position of the galactic pole would be based on the 21 cm HI "principal plane" since this provided the most complete and reliable determination. The joint Leiden-Sydney solution from the HI surveys in the north and south would be determined in the following months (end 1958 to early 1959). The solution would contain "estimates of the observational uncertainty and cosmic scatter. If the observational uncertainty is found to be less than the cosmic scatter, a definite recommendation can be made for the new plane." Only

[1] The major references for this text were obtained from the Blaauw archive in Groningen: Groninger Archieven, based on the finding aide by P. Huisinga "Plaatsingslijst van het archief van Prof Dr A. Blaauw, astronoom en directeur van het Kapteyn Instituut, 1940-2008." Also from the NAA, the galactic coordinate collection in C3830 C25/7 (Parts 1,2,3) as well as Pawsey correspondence in C3830 Z3/1/6, 7, 8,9 (1955 to 1959).

the newly available high resolution continuum surveys would be used (e.g. the new Westerhout Dwingeloo 20 cm continuum image with a beam size of 0.5 degree), "primarily to see how they compare with the 21 cm [HI] solution.[2] No further action is needed if the continuum and 21 cm [HI] solutions agree with the natural waviness … " As expected, this prediction was later confirmed.

The optical data were to be used: "They will all be studied, but primarily to compare with the [HI] result." The sub-commission pointed out that a solution for the OB stars would only refer to about 1 per cent of the mass of HI in the same limited region of the Galaxy.

The choice of zero of longitude was a special problem, accompanied by some controversy. The sub-commission agreed that the centre of the Galaxy was to be the starting point. "… [T]his seems the most natural choice, and it has been used before. It is not as well defined as the intersection of the equatorial and the new galactic plane, suggested by Bok for the zero-point, but Sagittarius A can be used to define the centre …"

The sub-commission thought that after all possible values for the position of the galaxy centre had been tabulated, the Sgr A position would lie "well within the range of these values [of the centre] … Then it can be taken as an easily-measurable point which defines the centre to within the permissible accuracy."

At this point, the group did not have a name for the new coordinates; Pawsey's suggestion of earlier in the year to use L and B (cap letters) was not even mentioned. The time scale for the sub-commission was governed by the upcoming General Assembly in Moscow in August 1958. The basic 21 cm HI data analysis was to be completed by 1 May 1958, with a proposal for the IAU to distribute in June and July 1958. The group also anticipated that conversion tables (equatorial to new galactic and vice-versa) would be produced by the group in Lund Sweden.[3]

The document summarising the 22 November 1957 meeting in Groningen ended with a statement that Kerr would continue to act on Pawsey's behalf until the latter's return to Sydney in late April 1958. However, Pawsey had not been inactive. During the visit to Pasadena in April 1958, Pawsey had a long meeting on 11 April with Baade, Minkowski, Marteen Schmidt and Dewhirst. He outlined the proposed new coordinate system to these experts. Pawsey's report to Blaauw and Westerhout, posted from Pasadena on 13 April 1958 continued: "I have ...

[2] The previous resolution for the Leiden and Sydney HI surveys had resolutions of 1.4 deg (Sydney) and 1.9 deg (Leiden). The continuum surveys had comparable or poorer angular resolution.

[3] Ohlsson, Reiz and Torgård published conversion tables (old galactic coordinates to right ascension and declination) in 1956, a year after the proposal for a new system had been made in 1955. This project was completed three years before the new coordinates were published in 1959.

had a very interesting discussion … which I take as indicating the way in which more progressive astronomers will react to the proposals which [the sub-commission] may make."

Firstly, Pawsey summarised the existing data. A key finding was that the HI disk of the galaxy could be defined to about 0.2 degree. Then, for the zero point of the new system, "The radio source Sagitarius[4] A [sic] has a reasonable probability, but not certainty, of being at the nucleus of the galaxy."

The conclusions so far were clear:

1. The gaseous disk of the galaxy was the best reference frame. The properties of the thin HI disk indicated "fundamental significance".
2. "We should base the system on an assumed position of the centre given by the position of Sagitarius A [sic] … specified in precise celestial coordinates. This position is within the uncertainty of all other determinations. It has a chance of giving us an order of magnitude better accuracy"; that is with expected errors of several arc min.
3. Pawsey suggested that the new coordinate system should be proposed in 1958, "despite the possibility of subsequent improvement. There is a great deal of work requiring galactic coordinates going on now; the advantages of a system now outweigh the disadvantages of a system which is not sufficiently precise **for only a few of the applications.**" [5] [his emphasis]
4. The system should have longitude running from -180 to 0 to +180 degrees with a zero at the galactic centre. Latitude should be -90 to 0 to +90 degrees with the equator at zero. Marteen Schmidt had suggested this scheme. From the Pawsey letter of 14 April 1958 from Pasadena:

> The point is that the galaxy as viewed from the earth has two planes of symmetry: the galactic equator and the galactic central meridian. Hence if it is appropriate to use a plus and minus system in latitude, it is equally important to use it in longitude. And it is a great convenience to do so for it is then easy to compare regions not only which are equally above and below the equator but which are left and right of the centre … We are proposing a true latitude and longitude system like the terrestrial one … [Pawsey was a proponent of this system since] we are interested in displaying similarities and differences on the

[4] Dick McGee explained to Goss in the era 1995, that he was always amused by Pawsey's inability to spell SAGITTARIUS correctly. The April 1958 letter is an example of this error, with two incorrect spellings.

[5] Pawsey meant that the proposed system would be appropriate for the vast majority of likely observational programmes. Only a few would suffer due to the uncertainty of the zero points and orientation of the new system.

> two sides of a plane of pseudo-symmetry. In fact the plus and minus system would simply be a reflection of the change of perspective which occurred when it was recognised that the sun was not near the centre of the galaxy [at the beginning of the 20th century]. Nevertheless I anticipate a lot of opposition. [Pawsey's prediction turned out to be correct.]

As Pawsey concluded the letter to his Dutch colleagues, he proposed a detailed time scale for the preparation of reports in 1958. "I think it would be good politics to circulate a copy [of the draft sub-Commission report] to Commission [33 and 40] members before Moscow [IAU GA]."

In mid-1958 a vigorous discussion began involving Blaauw, Pawsey and Westerhout on the best manner to rename the galactic coordinate system. The day before Pawsey left for Europe on 5 July 1958, Pawsey wrote Blaauw: "Current suggestions here for the designation symbols are l and b (thus unchanged) or l′ and b' with the name of the system 'IAU 1958 system'."

(Additional Note 1 in NRAO ONLINE 57.1 presents a discussion of the numerous proposals for the new nomenclature.)