HOW WELL DO WE KNOW THE ROTATION CURVE OF OUR GALAXY?

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The existence of variations from a smooth curve, in the form of waves, in the rotation curves of galaxies was pointed out earlier, and an interpretation was proposed based on the argument that the waves were the manifestation of the coexistence of different populations in a galaxy (see for example Pişmiş 1965, 1974). Observations in the past few years have shown that "undulations" in the rotation curve of spiral galaxies are rather common phenomena; maxima and minima occur roughly at arm and interarm regions, respectively. The velocity fields of the majority of the 23 galaxies compiled by Bosma (1978) exhibit well-defined waves. In particular the velocity field in the 21-cm HI line of M81 by Visser shows clearly the correlation of the waves with the spiral structure.

It is reasonable to expect that our Galaxy will also have undulations in its rotation law. In fact radial velocities of HII regions (optical and CO velocities) are consistent with this expectation; moreover they show that the Sun is located close to a minimum.

Now, (i) we accept the above to be true and (ii) make the plausible assumption that the spiral structure can be represented by a pair of symmetrically located logarithmic spirals, with equations $R = a \exp b\lambda$ and $R = a \exp b(\lambda+\pi)$, respectively. Here R is the galactocentric distance and λ the galactocentric polar angle. From (i) and (ii) it follows immediately that the rotation curve of the Galaxy (and of other galaxies) is not unique, as it will be a function of λ. As λ varies the waves will gradually be displaced. The rotation curve may be smoothed out only when $\Delta\lambda$ reaches the value of 180° (see Fig. 11 in Pişmiş, 1981). In external galaxies an average rotation curve where the waves are smoothed out can be obtained easily, as one can observe the object at all central angles. But in our Galaxy this is not possible; the eccentric position of the Sun allows observation of the terminal velocities within $\Delta\lambda = 120^{\circ}$ at best.

H. van Woerden et al. (eds.), The Milky Way Galaxy, 107–108.

It is true that an overall rotation law can be estimated by having recourse to distances of galactic objects, but it will conceal the λ-dependence of the rotation curve. We suggest further that the cause of the well-known "north-south asymmetry" of the rotation curve should be sought for in the light of the arguments brought forth above. (For more details we refer to a review paper by Pişmiş, 1981).

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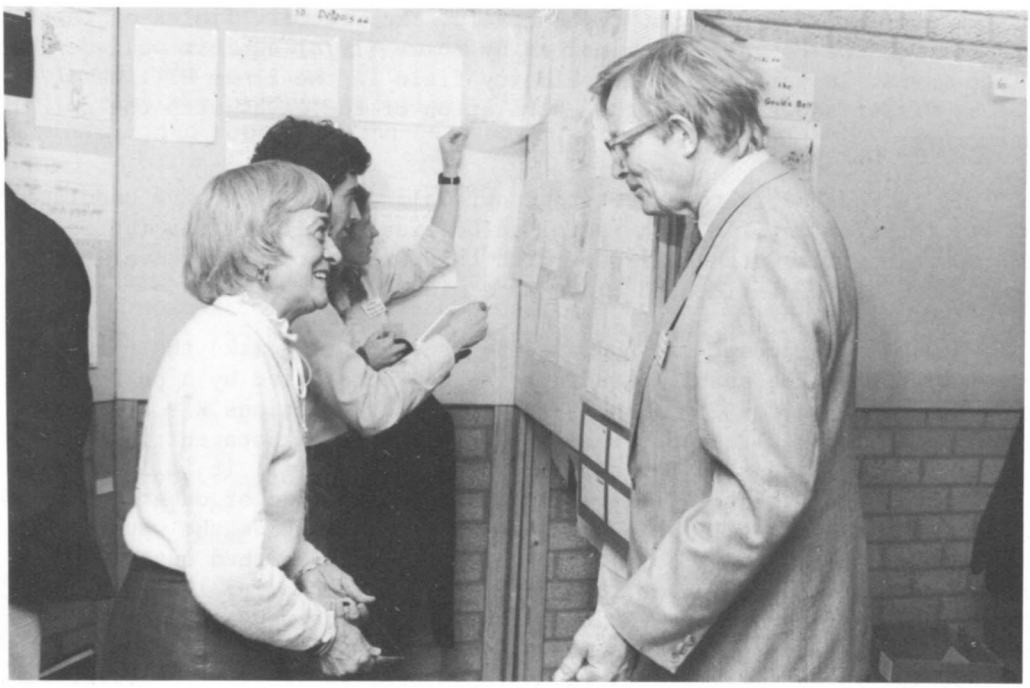

P. Pişmiş and H.C. van de Hulst during lunch-break. In background: D. Leisawitz and K. Mead discuss a poster. CFD

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