44. HYDROGEN-LINE OBSERVATIONS OF THE GALACTIC CENTRE REGION

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A detailed study of the galactic centre region is being made with the 210-foot telescope at Parkes and a 48-channel hydrogen-line receiver. Line profiles have been recorded on a 6-min-of-arc grid over a central area 2° square, and also along the galactic equator and a number of other longitude lines. These observations, which have been partially reduced, show that the structure and motions of the gas are very complex in the neighbourhood of the centre.

3-kpc Arm

The 3-kpc "expanding arm" has received special attention. One of the important questions is whether or not the arm is a continuous entity over a wide range of longitude. Figure 1 shows the height of the profile peak whose velocity indicates that it corresponds to this feature, for the series of points 0°.1 apart along the galactic equator. The longitude range over which the feature can be distinguished is l^{II}=333 to 4°. The rather considerable variations in intensity are similar to those found along a normal spiral arm (see this volume, paper 20). Continuity is clear everywhere, except in the region of l^{II}=348°, where two separate peaks can be seen, and the structure is not immediately obvious.

Figure 2 shows the observed radial velocity of the 3-kpc arm peak over the same longitude range. The velocities also show fine structure, and the 348° region is again complex. However, the general run of the velocities seems to be continuous over the whole region, leading to the conclusion that the 3-kpc arm is probably as continuous throughout its length as any other spiral arm.

The arm cannot be seen beyond $l^{II} = 334°$, because the relevant peak disappears by merging with the main section of the profile. If the arm is tangential at this longitude, its distance from the centre is 3·5 kpc (for a Sun-centre distance of 8·2 kpc). It must be stressed, however, that there is no direct evidence on the position or shape of this "expanding arm". We can only say with certainty that portion of it is $\geqslant$3·5 kpc from the centre.

The first series of scans perpendicular to the equator has given values for the latitude width between half-density points of around 1°, but the detailed variation of this width with longitude is not compatible with the conventional picture of a nearly circular arm, unless the layer thickness varies considerably. The peak intensity occurs at positive latitudes (0°.1 to 0°.3) in the longitude range 356–345°, and at $-0°.1$ for $l^{II} = 340$ and 336°.

Rougoor and Oort (1960) found, in observations near the galactic centre direction, that the upper (northern) portion of the arm is moving out from the centre more rapidly than the lower part. This "rolling motion" seems to be present over most of the longitude range covered by the arm.

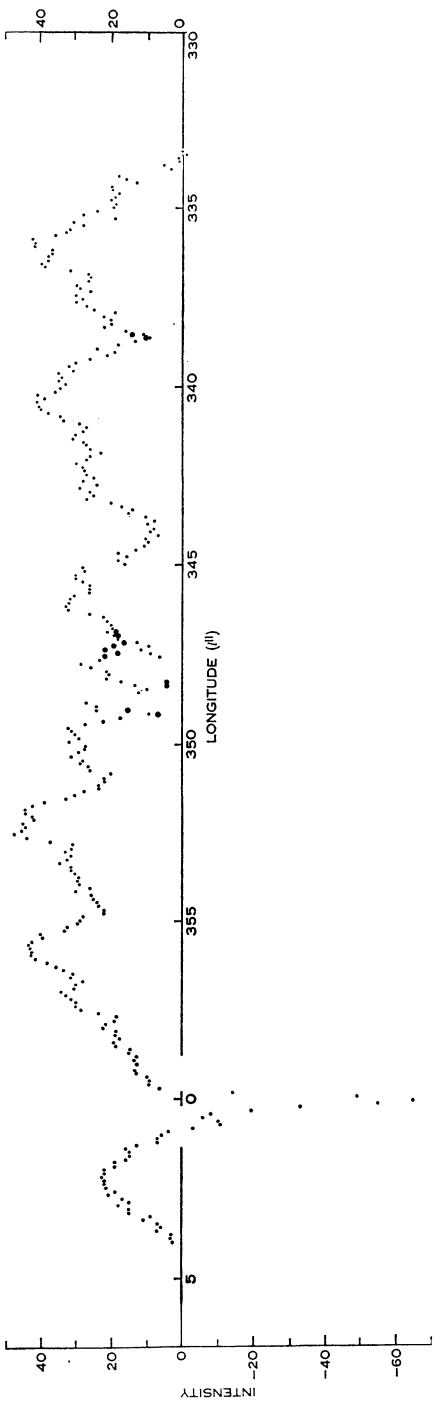

Fig. 1.—Intensity of 3-kpc arm peak, read from profiles at points along the galactic equator. (Scale unit = 1·5 °K in T_A.)

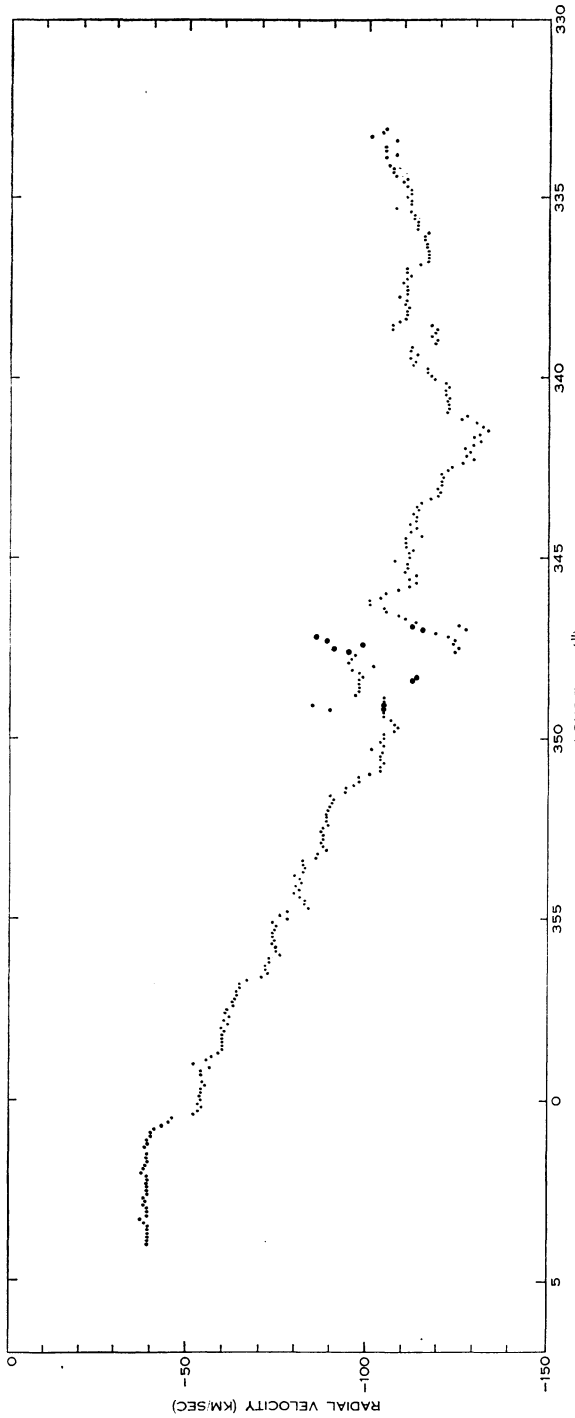

Fig. 2.—Velocity of 3-kpc arm peak, for points along the galactic equator.

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The wide absorption dip near longitude zero in Figure 1 suggests that the "3-kpc arm" is absorbing radiation from all the continuum components found by Drake (1959) and by Cooper and Price (this volume, paper 40) near the direction of the centre. However, the observed variation of emission along the arm is so large that we cannot clearly separate absorption effects from localized decreases in emission.

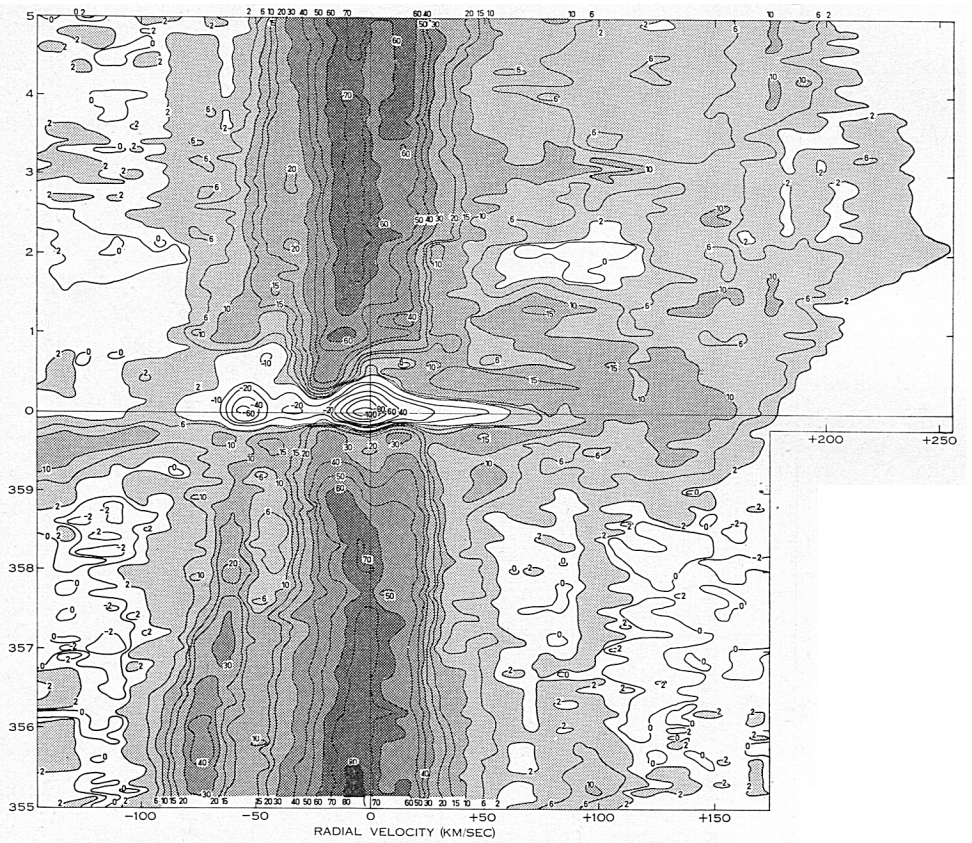

Fig. 3.—Contour diagram along galactic equator, for longitudes 355–5°.

Central Region

The results obtained along the galactic equator in the central region are shown in Figure 3, in which contours of intensity are plotted on a longitude-velocity grid. (Observations have not yet been made at velocities below −150 km/sec.)

The pattern is clearly very complex, and this conclusion is supported by the results obtained so far at other latitudes, in which a number of additional features appear. The rapidly rotating central disk of Rougoor and Oort (1960), which can be clearly seen in Figure 3, running across the diagram with an upward slope from left to right, is broken up into a number of pieces when viewed with the higher resolution of 14 min arc.

Some of the smaller structural features of the neutral hydrogen appear to coincide in position with components of the continuum distribution near the centre. This agreement suggests that the continuum sources are at least partly thermal.

Absorption

Very striking absorption effects are observed in the vicinity of the continuum source at the centre, Sagittarius A. The intensity levels in Figure 3 are unreliable in this region, because the receiver overloads in the presence of the strong continuum radiation, and the necessary corrections have not yet been applied.

The high resolution enables the central absorption to be seen unaccompanied by emission from surrounding areas. Several components of absorption at different velocities can be seen in Figure 3, corresponding to absorption in bodies of gas in different positions along the path from the centre to the observer. There is a general asymmetry in the longitude distribution, but the various portions of the absorption spectrum show different variations with longitude, leading to a very complex overall pattern, which has not been fully interpreted at this stage of the analysis.

References

DRAKE, F. D. (1959).—NRAO Ann. Rep. No. 1: 2.
ROUGOOR, G. W., and OORT, J. H. (1960).—*Proc. Nat. Acad. Sci.* (*Washington*) **46**: 1–13.

Discussion

Westerhout: Many of the features on your map seem to have typically the width of the band (of the receiver) and of the beam. Are they not noise fluctuations? If not, then this is very interesting, because it means that you are about to resolve really small features and with a narrower velocity and space resolution the whole pattern might break up completely.

Kerr: The smallest details of the diagrams are certainly influenced by noise, but all others are clearly real. Some of the features are very sharp in angle and velocity, and I agree that these could be further resolved.

45. HIGH-RESOLUTION OBSERVATIONS OF THE GALACTIC CENTRE AT 1420 MC/S IN THE CONTINUUM AND IN THE NEUTRAL HYDROGEN LINE

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The large Pulkovo radio telescope has a beamwidth of 7 min of arc in R.A. at a frequency of 1420 Mc/s. The continuum emission from the source Sagittarius A was measured with a bandwidth of 5 Mc/s. The mean drift curve is shown in Figure 1. It can be separated into components according to Drake (1959) as indicated in the figure. The galactic ridge is also shown. The right ascension, the antenna temperature, the observed angular diameter, and the flux density of each component are given in Table 1. The errors given in the table can be somewhat higher in the case of components 2 and 3 because of the difficulties of separating them. The calibration of the antenna and receiver was made using the flux densities of the sources IAU 19N4A,

* Presented by Y. N. Parijsky.