21-CM OBSERVATIONS OF HIGH-VELOCITY CLOUDS

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(a) Four high-velocity clouds (HVCs) with large negative velocities have been mapped at high sensitivity, with an angular resolution of 12 arcmin and a velocity resolution of 1.8 km s^{-1} (Cohen & Mirabel, in press). Although these are small isolated clouds they show the same two-component velocity structure that is observed in the large Northern HVC complexes at lower velocity. In addition the cool dense core of one of the clouds is found to be rotating. This rotation, and also the regular velocity patterns within the four clouds, indicates that the clouds are unlikely to be interacting with galactic material. It is interesting that similar observations of the Magellanic Stream do not show narrow velocity components, suggesting that there is a real physical difference between the Stream and other HVCs (Mirabel, Cohen & Davies, in press).

(b) A systematic search has been made for intergalactic HVCs associated with nearby dwarf irregular galaxies. Four regions containing eight such galaxies were searched to a detection limit of $\sim$0.1 K, the observations covering a velocity range of 2000 km s^{-1}. New HVCs were detected in three of the regions, and several lay within small projected distances of the galaxies. However their velocities differ by more than 100 km s^{-1} from those of the galaxies, so the HVCs cannot be gravitationally bound to the galaxies unless the latter contain much more mass than has so far been observed. One of the HVCs shows unusual properties which suggest that it may be a proto-dwarf irregular galaxy in the Local Group.

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W. B. Burton (ed.), The Large-Scale Characteristics of the Galaxy, 545–546.

DISCUSSION (After Dr. Giovanelli's talk)

Heiles: I got the impression from the spectra of your new galaxy that the rotation velocity was smaller at the points which are located furthest from the center. This makes it one of the few galaxies known which does not have a flat rotation curve at the last measured point.

Giovanelli: The profiles on the outskirts of the galaxy are fairly noisy, although there does seem to be such an effect as you point out. However, I want to underscore that these are still raw profiles, uncorrected for the effect of the sidelobes which may be picking out radiation near the center of the galaxy.

de Vaucouleurs: The HI clouds that you have observed in the general direction of M31 share the large negative velocities (about 400 km s^{-1}) characteristic of the IC 10-M31-M33 and associated galaxies. This is suggestive of distances of order 0.5 Mpc. As Dr. Einasto showed yesterday, objects closely associated with the Galaxy (distances < 0.25 Mpc) have lower characteristic velocities.

Heiles: An upper limit to the distance can be obtained from the consideration that as you move the cloud further away the density drops and, at some point, the density is too low to collisionally excite the 21-cm transition, in which case it will have an excitation temperature of 3 K and thus be invisible. I suspect that at 1 Mpc distance the density would be less than 10^{-3}.

DISCUSSION (After Dr. Mirabel's talk)

Giovanelli: What is your velocity resolution in the cloud near NGC 6822, where you report rotation on the order of 5-10 km s^{-1}?

Mirabel: The rotation in the cloud adjacent to the Sagittarius galaxy and NGC 6822 is $\sim$ 15 km s^{-1} per degree. Our velocity resolution is 1.8 km s^{-1}.

Mathewson: If the clouds found near galaxies are contrails due to the passage of the galaxies through a hot intergalactic medium, then no association would be expected between the velocity of the galaxies and the velocity of the HI clouds.

Haynes: The region occupied by the very-high-negative-velocity clouds is also the region where the tip of the Magellanic Stream shows velocities of -380 km s^{-1} itself.

Mirabel: Relative to your comment on the possibility that the very-high-velocity clouds recently discovered may be associated with the stream: High-resolution observations of the stream and of four of these new, very-high-velocity clouds show different spectral properties, suggesting that they are different kinds of objects.