HI-SHELLS IN M31

E. Brinks and E. Bajaja
Leiden Observatory, Leiden, The Netherlands

1. INTRODUCTION

Close inspection of the channel maps which make up the high resolution M31 HI-data set (Brinks, this volume) resulted in finding numerous shell structures and bubble-like regions. To avoid any bias in the interpretation we shall call holes, in the course of this contribution, all those structures where we find a deficiency of neutral gas. Some of the holes can be identified directly in a total surface density map of M31, but due to blending of the various velocity components, e.g. the warp, holes tend to loose contrast. Therefore the best way to search for the holes is by inspection of the full resolution channel maps ($\Delta\alpha \times \Delta\delta \times \Delta V$ = 24" × 36" × 8.2 km s^{-1}).

2. RESULTS

At present some 300 holes are listed, of which some fraction might be spurious, i.e. not due to structure in the HI surface density but caused by kinematical effects. The sizes of the holes range from about 1 kpc to less than the beam size, i.e. smaller than 80 pc. The definition of a hole is subjective and strongly dependent on the contrast in the channel maps. A prerequiste for a hole to be listed is that it is present in a range of channel maps and that it is stationary.

Figure 1(a) shows the channel map centered at -370.8 km s^{-1}, as a typical example, in which several holes can be seen. Figure 1(b) is a position-velocity diagram along a line parallel to the minor axis of M31 centered on the hole indicated by an arrow in figure 1(a), which is located at 15.4 minutes of arc to the south of the center along the major axis and 12.3 to the east along the minor axis. This particular hole shows an expanding (or contracting) shell-like structure. The spectrum at its center (figure 1(c)) indicates that there is no HI at the velocity of the channel map shown.

The expansion velocity of about 14 km s^{-1} and the amount of HI in the shell derived from this velocity profile would indicate, assuming

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spherical symmetry, a kinetic energy of about 6×10^{50} erg.

One hole has been studied in detail (Brinks, 1981). It coincides with NGC 206, a bright OB-association. This hole is about 400 x 800 pc in size and about 2.10^6 $M_\odot$ of HI is deficient, assuming a uniform background HI density. The stars of the association are a strong source of UV-emission and they are embedded in a low surface brightness HII-region. The energy required to produce this hole is of the order 10^{52} ergs. The NGC 206 hole is quite similar to the (super)shells as discussed by Heiles (1979) in our own galaxy and to the superbubbles in the Large Magellanic Cloud discussed by Meaburn (1980). Although much work still has to be done, the holes seem to be related to regions with young stars and recent star formation.

Figure 1a: Channel map at -370.8 km s^{-1}. The cross indicates the center of M31. East is at left; North at top.

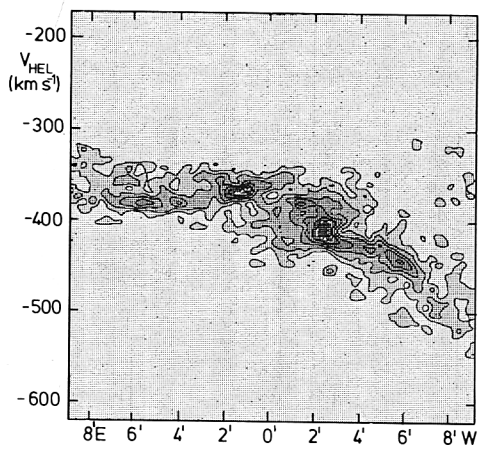

Figure 1b: Position-velocity diagram along a line parallel to the minor axis of M31 and centered on the hole indicated in (a) by an arrow. The first contour levels are 2.5, 10, 20, ... K.

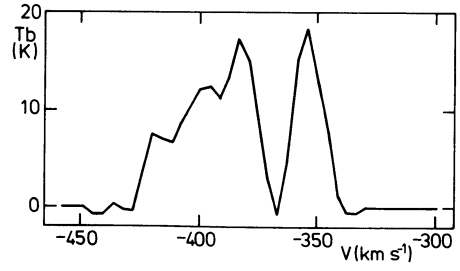

Figure 1c: Velocity-profile at the center of the hole indicated in (a).

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