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Some details in the HI distribution towards the Local Bubble

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Abstract. We discuss details in the galactic HI distribution, which are relevant for studies of the Local Bubble. All results are based on the 21 cm Sky Survey with the Large Pulkovo Radiotelescope. The signal on the drift scans is decomposed into broad and narrow spatial components. After the subtraction of the broad one, two HI details (regions) are distinguished on the records of the Survey. The first detail is associated with the Sancisi-van Woerden filament in the Sco-Oph region. The distance to this filament is determined. It is shown that the second region from the galactic quadrant II is part of the big elliptical ring of HI around the South Pole of the Galaxy.

Key words: radio continuum: ISM – ISM: bubbles — ISM: structure

1. The HI observations

Bystrova and Rakhimov (1977) carried out a HI 21 cm line Survey with the Large Pulkovo Radiotelescope (LPR) — the Pulkovo Sky Survey in the interstellar neutral hydrogen radio line. The region accessible to the LPR (from $\delta = -29°$ to $+40°$) was covered by 29 drift scans each lasting 24 hours. The frequency resolution was 20 kHz and the spatial resolution was one minute in R.A.

The signal on the Survey records can be decomposed in two spatial components responsible for the large-scale and small-scale structures. The maps of the Pulkovo Sky Survey were compiled for these two components of the HI emission separately. The decomposition method consisted in comparison of the narrow detail brightness and the broad component on the adjacent drift scans. Fig.1 demonstrates examples of the R.A. drift scans from 12^h to 24^h for different declinations at a fixed radial velocity ($V = +4.5$ km/s). The large-scale component is shown by the dashed line. These components show different spatial characteristics including possibly different distances from the Sun. Therefore, a comparison of observations in other ranges with HI data needs to be made for each component separately.

In this paper we discuss the results on two details. First, we analyse the region towards the Sco OB-2 association. In this direction the broad structureless component can give a contribution of up to $\sim 40\,\%$ of the total signal. Then we present the characteristics of surroundings of an ellipse-shaped filament near the South Galactic Pole.

2. The distance to the Sancisi-van Woerden filament

In the direction of the Sco OB-2 association, next to the HII regions Sharpless S1 and S7, Sancisi and van Woerden (1970) detected a HI filament (hereinafter S-vW detail) at a velocity of ≈ -11 km/s relative to the local standard of rest. At these velocities, the main HI profiles in the direction of Sco OB-2, centered at about 0 km/s, have weak components. This facilitated the determination of the boundaries of the S-vW detail on the sky. When studying the local interstellar medium (LISM) Crutcher (1982) placed the S-vW detail near the Sun at a distance of 10–20 pc. Fig. 2 shows, however, morphological similarities between the S-vW detail and HI distribution at -6.1 km/s: the S-vW filament fills the gap in the -6.1 km/s emission contours, (see also Bystrova, 1979). Sivan's object consists of the S1 and S7 nebulae and two outer HII filaments (Sivan, 1974). The HI isophotes at -6.1 km/s are located along these outer filaments, and with high probability HI gas and S-vW detail are located at the same distance, about 170 pc, as Sivan's object. That is the whole complex is located outside the Local Bubble. This conclusion is confirmed by Gaussian decomposition of the HI profiles in this direction (Cappa de Nicolau and Pöppel, 1986).

3. HI detail around the South Galactic Pole

According to the analysis reported by Frisch (1995), the HI distribution detail observed at 21 cm between $l = 60°$ and $170°$, and $b = -30° \div -50°$, i.e. in the

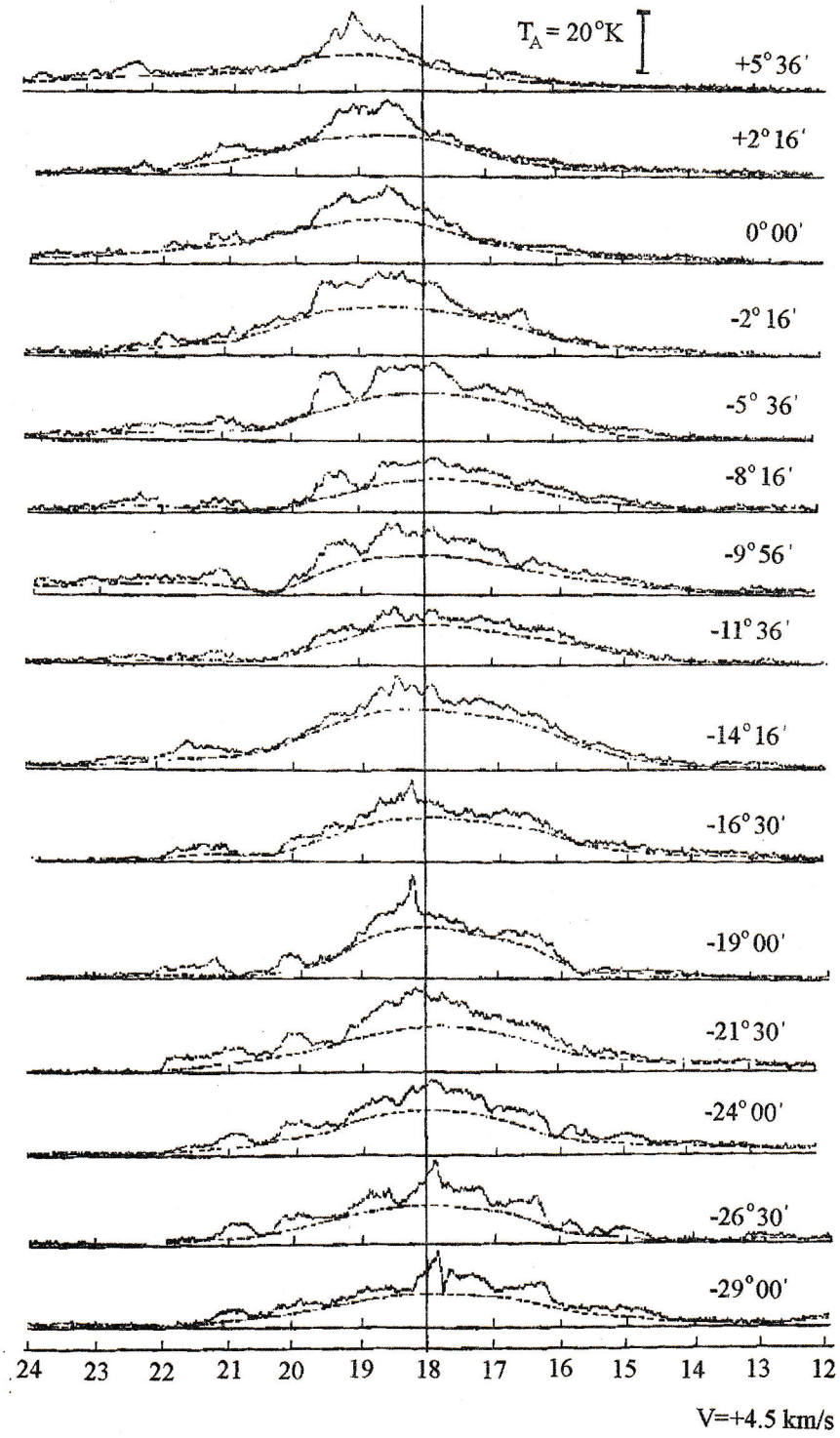

Figure 1: *Examples for HI drift curves of the St.Petersburg LPR Survey in RA-Dec coordinates.*

second galactic quadrant, surrounds the Local Bubble and is at about 40–80 pc from the Sun. This feature was observed in Pulkovo Survey (Bystrova, 1980) and is presented in Fig. 3 together with the unpublished images in the polar galactic projection. The velocities at which the detail is best seen are −16.6 and −11.3 km/s relative to the local standard of rest. Our comparison shows that it is not a separate detail but part of an ellipse-shaped detail around the South Galactic Pole. The shape of the ellipse changes for other velocities. The full extent of the feature was ob-

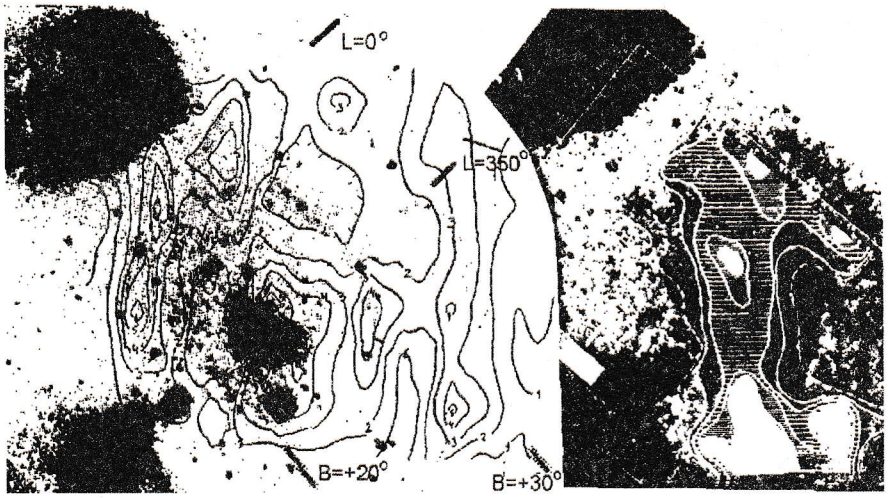

Figure 2: *HI contours of antenna temperatures at −6.1 (left) and about −11 km/s (right, the S-vW detail) overlayed on the optical image of Sivan's object.*

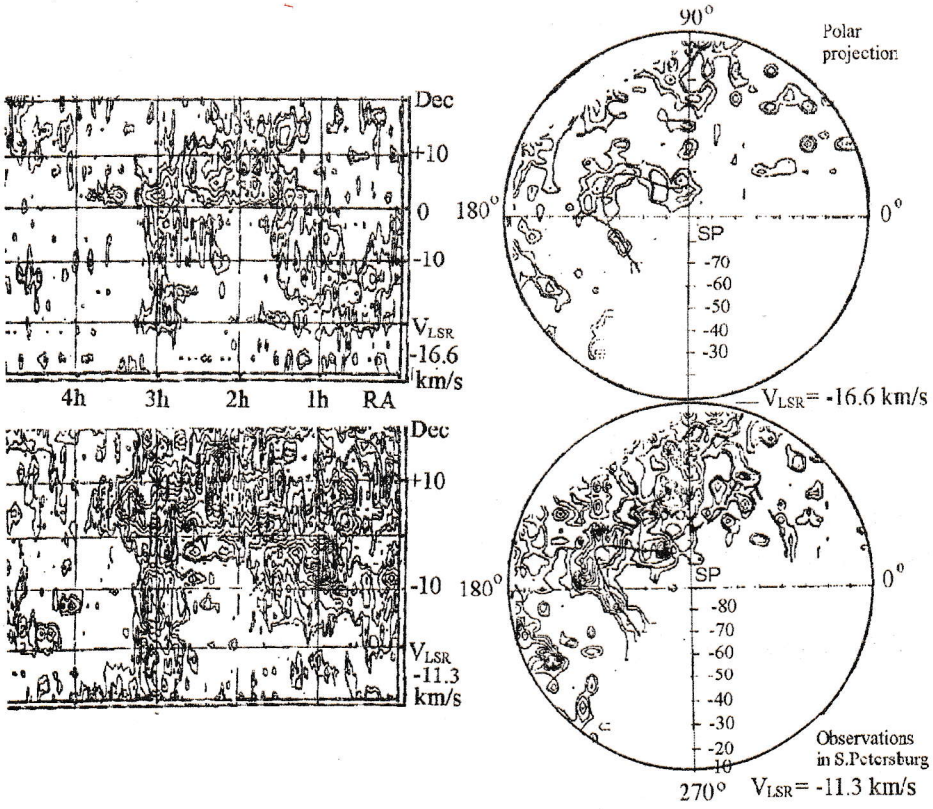

Figure 3: *The northern part of the 21 cm feature in equatorial and in galactic polar projections for the velocities −16.6 and −11.3 km/s.*

served in the southern hemisphere H I survey (Heiles & Cleary, 1979). The angular size of this ellipse is over 80° × 50°, and the position angle of the major axis is about 130° – 310° in longitude. Till now the distance to this ellipse-shaped detail has remained unknown. The results from Frisch (1995) can suggest that the entire ellipse is located at a distance of about 40-80 pc from the Sun. A future combined study of hydrogen and X-ray emission will possibly provide further information on the distance of the features in the second galactic quadrant and in the other parts of the ellipse. Such a study will then test the proposed association of the considered detail and the rest of the ellipse around the South Galactic Pole.

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