Remarkable Details in the Local Bubble's HI Distribution

Natalija V. Bystrova

St.Petersburg Branch of the Special Astrophysical Observatory, Pulkovo, 196140 St.Petersburg, Russia

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 antenna temperature scans were decomposed in two components and after the subtraction of the broad one two details in the residual are presented in this paper. The first is an estimate of the distance to the Sancisi-van Woerden filament in the Sco-Oph region. The second is the connection of a 21 cm feature in the southern galactic quadrant II with the negative-velocity elliptical brightness distribution around the South Pole of the Galaxy.

1 The HI Observations

Bystrova and Rachimov (1977) performed an HI 21 cm line survey with the Large Pulkovo Radiotelescope (LPR) - the "Pulkovo Sky Survey in the interstellar neutral Hydrogen Radio Line" (Bystrova and Rachimov (1977)). All sky visible for the LPR, i.e. between the declinations from $-29°$ to $+40°$ was covered by 29 drift scans 24 hours long each. The frequency resolution was 20 kHz and the spatial one in publications - one minute in RA. The antenna temperature scans were decomposed in two components to extract small scale structures and for the Pulkovo Sky Survey Atlas (Bystrova (1980)) maps were generated for the two components of the HI emission separately. The method consisted in a comparison of small details and the antenna temperature of a broad underlying component between adjacent drift scans in the measurement sequence. Fig.1 demonstrates examples of the RA drift scans from 12 to 24 hours for different declinations at fixed velocity with the approximate division on the two components. Because these components show different spatial characteristics including possibly different distance from the Sun both have to be compared with observations at other wavelengths separately.

This paper presents results on two details found in the residuals after subtraction of the broad component. First we analyse a region towards the Sco OB-2 association. There the broad structureless component can amount up to about 40% of the total signal. Then we present the surrounding of a filament near the south galactic pole.

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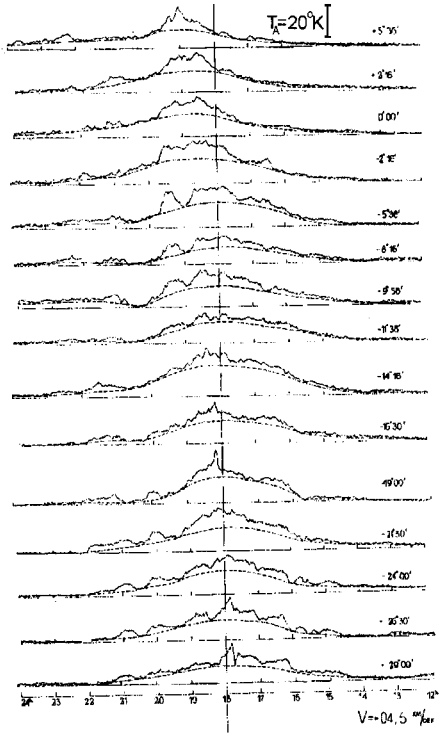

Fig. 1. Examples for HI drift curves of the St.Petersburg LPR Survey in RA-Dec coordinates

2 The Distance to the Sancisi – van Woerden Filament

In the direction of the Sco OB-2 association, next to the HII regions Sharpless 1 and 7, Sancisi and van Woerden detected an HI filament at the LSR-velocities around $-11\,\mathrm{km/s}$ (Sancisi and Van Woerden (1970)). At these velocities the main HI profiles centered at about $0\,\mathrm{km/s}$ have weak components. This facilitated the determination of the borders on the sky of the S-vW detail. Studying the LISM (Crutcher (1982)) the S-vW detail was placed near the Sun at the distance of $10 - 20\,\mathrm{pc}$. Figure 2 shows, however, morphological similarities between the S-vW detail and a feature at $-6.1\,\mathrm{km/s}$: the S-vW filament fills gap in the $-6.1\,\mathrm{km/s}$ emission contours, see also Bystrova (1979). Sivan's object consists of the S1 and S7 nebulae and of two outer HII filaments(Sivan (1974)).The HI contours at $-6.1\,\mathrm{km/s}$ follow these outer filaments and are most probably located at the same distance of about $170\,\mathrm{pc}$ as is then also the S-vW detail. I.e. the whole complex is located outside the Local Bubble. Cappa de Nicolau and Pöppel (1986) confirmed this result from their Gaussian decomposition of the HI profiles in this direction.

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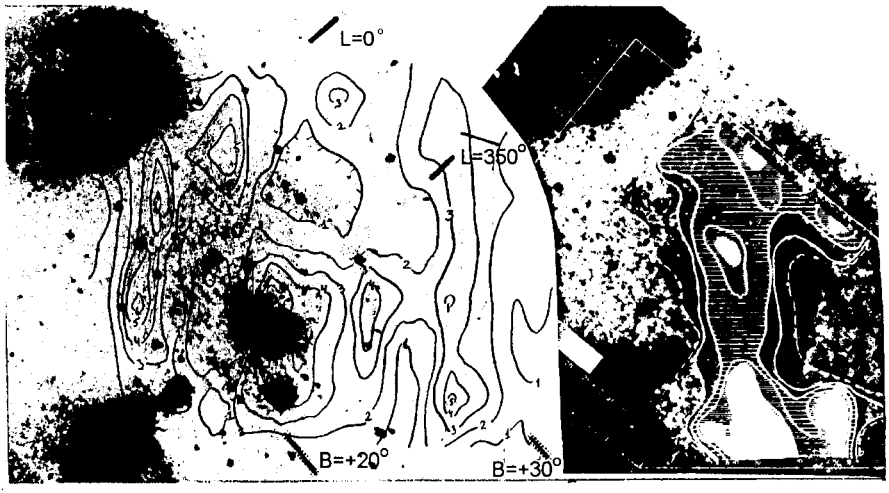

Fig. 2. HI contours of antenna temperatures at −6.1 (left) and about −11 km/s (right, the S-vW detail) overlayed on the optical image of the Sivan's object

3 The Neutral Hydrogen Feature Around the South Galactic Pole

According to the analysis by Frisch (1995) the 21 cm feature between $l = 60°$ to 170°, $b = -30°$ to $-50°$ constitutes the Quadrant II boundary of the Local Bubble at about 40 − 80 pc from the Sun. This feature was observed in St.Petersburg and is presented in Fig.3. The LSR-velocities are −16.6 and −11.3 km/s where the detail is seen at best. But the measurements show that it is not a distinct feature. It is 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 observed in the southern hemisphere (Heiles and Cleary (1979)). The angular size of this ellipse is more than 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 remained unknown. The results from Frisch (1995) can suggest that the entire ellipse is located at a distance around 40 − 80 pc. 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 rest of the ellipse.This analysis will then test the proposed association between the detail and the rest of the ellipse around the south galactic pole.

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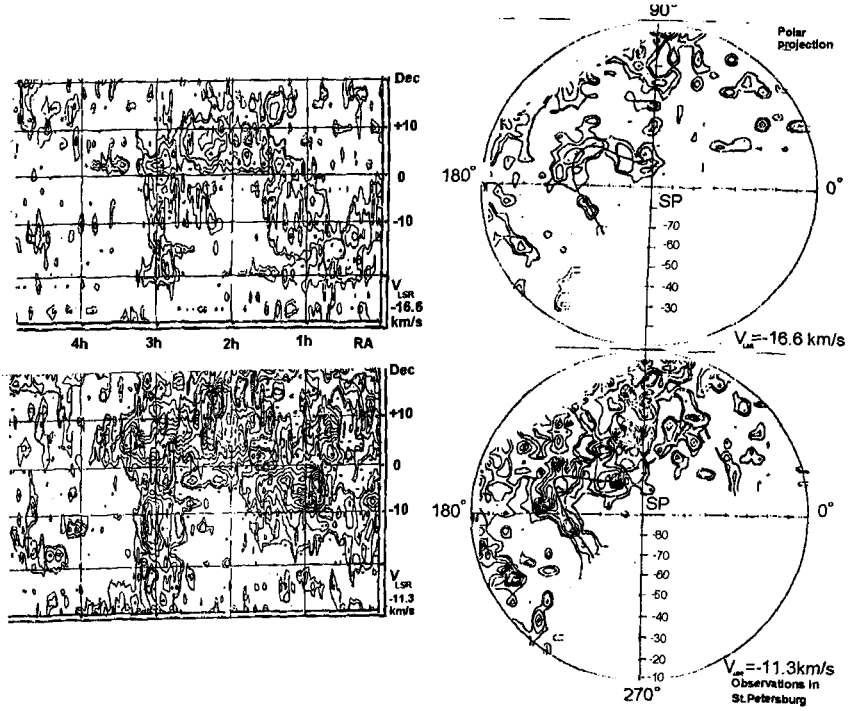

Fig. 3. The northern part of the 21cm feature in equatorial and in galactic polar projections for the velocities −16.6 and −11.3 km/s

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