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The Interstellar Medium Surrounding the Vela Supernova Remnant

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The Vela SNR occupies a central place in the subject because of the association with the Vela pulsar. Whereas one would have expected the pulsar and its nebula (Vela X) to be near the centre of a shell, the morphology is quite complex as may be seen in Fig. 1. This has led to some controversy, and even association between the pulsar and the SNR has been questioned (Dwarakanath 1991). There may, however, be a simpler explanation for the peculiar morphology. For example, since the radio brightness of a supernova

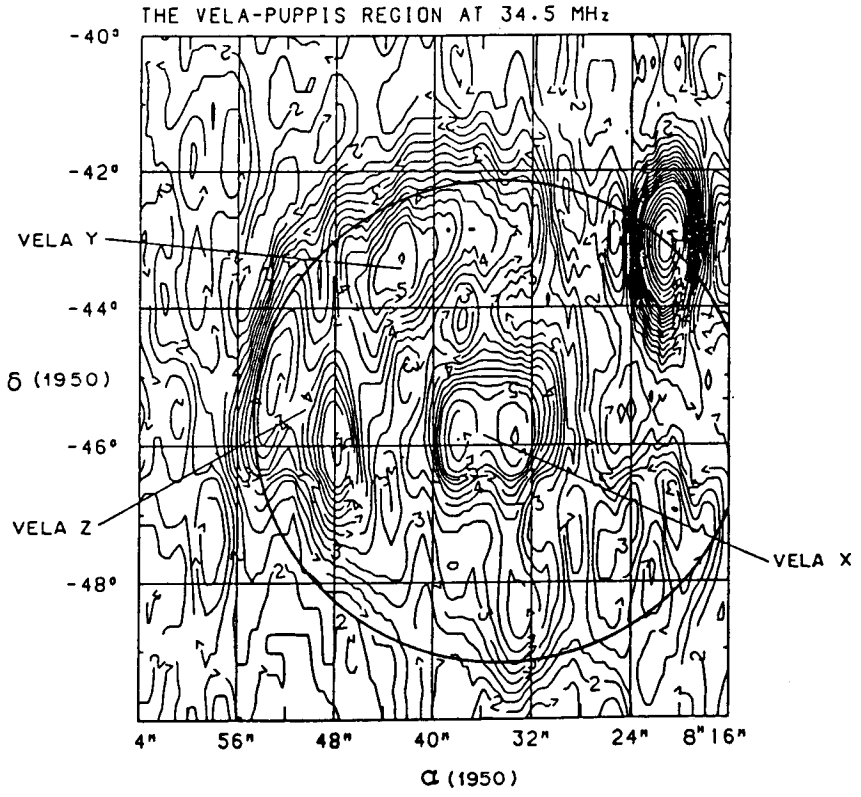

Figure 1. The 34.5 MHz continuum map of the Vela SNR. The contours are labelled in units of 10000 K. The bright feature in the right top corner is SNR Puppis-A and is unrelated to the Vela SNR.

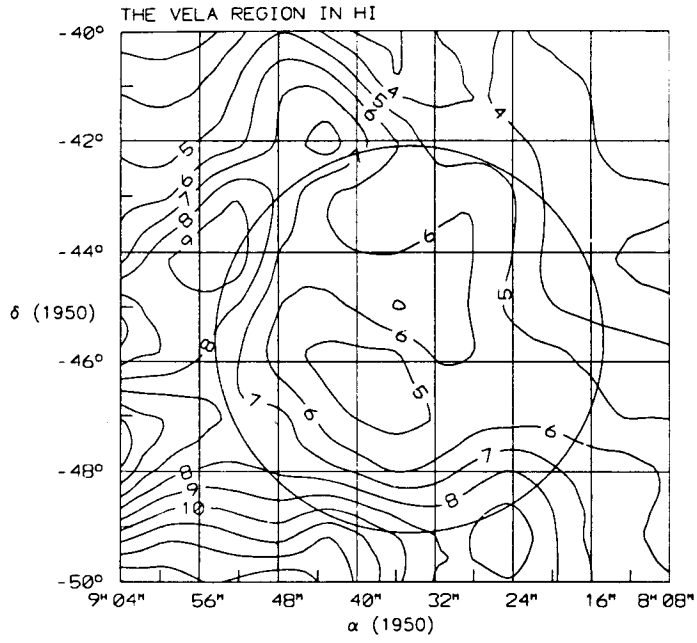

Figure 2. Distribution of Antenna temperature due to HI averaged over −1 to 2 km/s. This range of velocity would roughly correspond to a distance of 500 pc. The contours are labelled in units of 1 K.

remnant is related to the density of the ambient medium into which it is expanding, such an asymmetric morphology could be understood if the distribution of interstellar matter around the remnant is inhomogeneous. In order to clarify this, HI observations were made with the 26 m telescope at Mt. Pleasant Observatory, Hobart, Tasmania during July 1992. The observations were made with a bandwidth of 2.5 MHz and a 512 channel autocorrelator was used as the backend giving a velocity resolution of 1 km/s.

The HI map obtained by us is presented in Fig. 1. The distribution of HI is clearly highly inhomogeneous. The regions of higher density correlate well with the crowding of radio contours in the Vela Y, Z regions of 34.5 MHz continuum map (Fig. 2). Absence of any significant radio emission from the western half of the shell is also consistent with the lower density of HI in those directions.

Thus, our observations support the conjecture that the remnant is expanding in an inhomogeneous region of the interstellar medium resulting in an asymmetric radio surface brightness. In our opinion Vela Y and Z are parts of an incomplete shell of roughly 7.5 deg. in diameter centered around the pulsar and its synchrotron nebula (Vela X) – a conclusion which is consistent with the recent ROSAT observations of this SNR (Aschenbach 1992).

References

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