TABLE 4

THE CYGNUS LOOP AREAS Ω AND ANGULAR RADII θ AT THE FIVE FREQUENCIES

Frequency (MHz)	Ω [(°)^2]	θ (°)
2720	7.52	1.547
1420	8.64	1.658
820	9.46	1.735
408	9.88	1.773
34.5	8.44	1.639

with caution because of the limited usefulness due to selection effects (see Green 2009; Urošević 2010, and references therein). The updated theoretical relations were derived by Duric & Seaquist (1986), based on the Bell (1978a,b) diffuse shock particle acceleration theory, and by Berezhko & Völk (2004) based on the non-linear kinetic theory of the diffuse shock acceleration mechanism. The $\Sigma - D$ diagram at 1 GHz with the theoretically derived evolutionary tracks taken from Berezhko & Völk (2004) and with our value for the Cygnus loop superposed, is shown in Figure 10. To superpose the Cygnus position, we used the following results of our calculations: the mean value of the brightnesses at 1 GHz and the diameter, calculated as $D = 2r \sin\bar{\theta}$, where $\bar{\theta} = 1°.67$ is the mean angular radius for all five frequencies. The distance $r = 0.44$ kpc is taken from Green's (2009) catalogue of SNRs. So we added this point to the diagram: $(D, \Sigma) = (25.7$ pc, 4.98×10^{-22} W/(m^2 Hz Sr)). From its position in this diagram it can be concluded that the Cygnus loop evolves in the low density environment and the initial energy of the supernova (SN) explosion was relatively low (see Figure 10).

4.1. *Flux density spectrum*

On the basis of the values for brightnesses given in the fourth column of Table 1 and our calculated values for the loop size Ω (Table 4), we derived flux values in Jy. The calculated flux densities are given in Table 5. As the Cygnus loop is well studied SNR, it is possible to perform a multi-frequency spectral study. In Figure 11 we present a summary of some results obtained from other papers and from our study. Our results are labeled with asterisks. In this figure, we have seventeen results for the flux density values S_ν of Cygnus loop derived in several papers (values are given in Table 3 of Uyaniker et al. (2004) and five results from our paper.

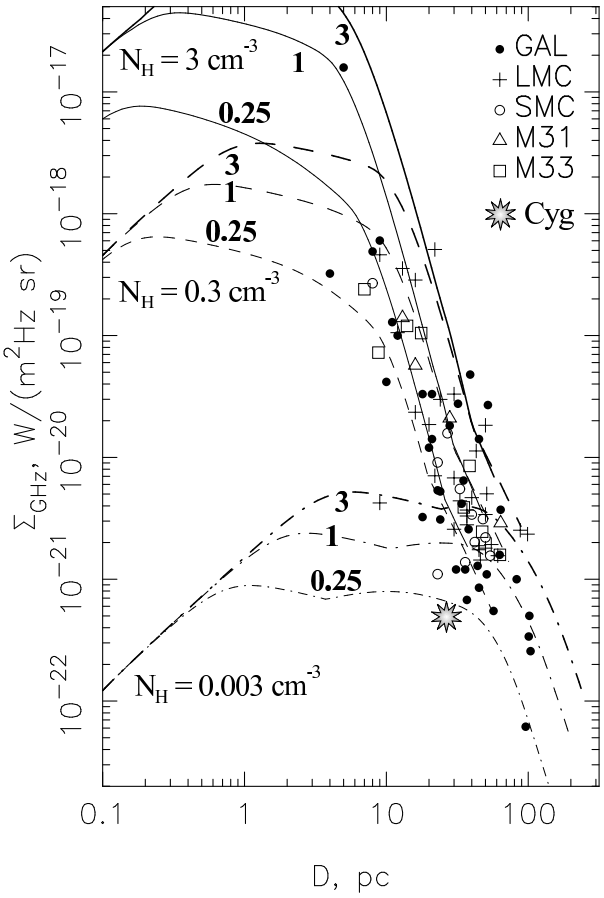

Fig. 10. The surface brightness versus diameter diagram from Berezhko & Völk (2004), with the value for Cygnus loop added. Three different densities for the interstellar matter (ISM) ($N_{\rm H} = 3$, 0.3 and 0.003 cm^{-3}) are presented, plus three values for the (SN) explosion energy ($E_{\rm SN} = 0.25$, 1 and 3×10^{51} erg).

It can be seen from Figure 11 that our added flux values fit very well among other fluxes, which shows the correctness of our method, and also that we determined the loop area and its brightness well.

TABLE 5

FLUX DENSITIES (Jy) THAT WE CALCULATED AT THE FIVE FREQUENCIES

Frequency (MHz)	Flux density (Jy)
2720	83.37±2.60
1420	80.05±8.13
820	139.35±12.10
408	235.44±15.36
34.5	1309.04±65.65