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NEUTRAL HYDROGEN ASSOCIATED WITH THE SUPERNOVA REMNANT LUPUS LOOP

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RESUMEN

Las observaciones en la línea de 21-cm de hidrógeno neutro en la zona del Lazo de Lupus, muestran la existencia de dos cáscaras concéntricas en expansión alrededor del remanente observado en continuo de radio de la supernova. Se derivan los parámetros físicos de las mismas.

ABSTRACT

H I observations around the Lupus Loop show the existence of two expanding concentric shells. We derive their physical parameters.

Key words: INTERSTELLAR MATTER – LINE PROFILES – NEBULAE-SUPERNOVA REMNANTS

H I observations around the supernova remnant Lupus Loop have been performed with the 30-m radiotelescope of the Instituto Argentino de Radioastronomía. The observations cover the area $14^h28^m \leqslant \alpha \leqslant 15^h52^m$, $-45° \leqslant \delta \leqslant -34°$, with a grid spacing of 1° in both coordinates and 2 km s^{-1} of velocity resolution, in the velocity interval $-140 \leqslant v \leqslant +80$ km s^{-1}.

The contour map of H I integrated over the velocity range $-16 \leqslant v \leqslant +14$ km s^{-1} shows the neutral hydrogen forming a nearly complete ring structure around the radio-continuum remnant. Within this feature we can distinguish three different regions characterized by the distribution of the isolines. The inner region shows tightened isolines following the boundaries of the radio-continuum. Then, an intermediate region shows spreaded isolines and several minima in the H I distribution. Finally, the outer region shows again compressed contour density lines.

Therefore we can conclude that there are two concentric H I shells of about 9° and 20° of diameter, respectively.

From a kinematical analysis of the associated gas, assuming a distance of 500 pc for the remnant, we derive the parameters summarized in Table 1.

A correlation with the X-ray observations by Riegler *et al.* (1980), shows the existence of two soft X-ray maxima which lay outside the radio-continuum remnant but clearly between both shells of neutral hydrogen. This is an indication that the inner shell is expanding within a hot rarefied cavity created by the previous passage of the shock front leading the external shell.

On the other hand, a study of young objects in the area shows that nearly all the early-type stars with distances between 350 and 700 pc are located inside the external shell in the E-S side, and younger objects like T-Tauri stars and infrared sources, follow the north contours. The T-Tauri stars appear immersed in a dark optical filament.

Therefore we conclude that there were two different mechanisms acting consecutively in the region. The external H I shell is a bubble probably blowed 7.6×10^6 years ago by the stellar wind originated in a massive star, perhaps the supernova precursor. The internal H I shell, was created by the explosion of the supernova Lupus Loop.

TABLE 1

PHYSICAL PARAMETERS OF THE LUPUS LOOP

	Linear radius (pc)	Expansion velocity (km s^{-1})	Mass ($M_\odot$)	Kinetic energy (erg)
Inner shell	40	20	2.7×10^4	1×10^{50}
Outer shell	90	7	5.1×10^4	2.5×10^{49}

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REFERENCES

Riegler, G.R., Agrawal, P.C. and Gull, S.F. 1980, *Ap. J. (Letters)*, **235**, L71.

DISCUSSION

Pacheco: Con los números presentados se necesitan cerca de 4×10^3 $M_\odot$ año^{-1} para explicar la cáscara externa con un viento estelar debido a la precursora de la supernova.

Cersósimo: Creo que el continuo presentado puede ser térmico. ¿Sería posible detectar líneas de recombinación?

Dubner: El continuo es esencialmente no térmico. Es posible detectar líneas de recombinación en el borde de la cáscara.

Rosado: Creo que las densidades son muy bajas para que el choque pueda inducir formación de estrellas. Lo que es probable es que este material se encuentre distribuido en glóbulos muy densos.

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