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DETAILED STRUCTURE OF THE ISM IN THE LUMINOUS INFRARED GALAXY ARP193.

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We describe high resolution observations of the neutral hydrogen absorption towards the nuclear regions of the luminous infrared galaxy Arp 193 made with MERLIN and the VLA. We find a rotating ring of neutral gas of radius $\sim$ 400 pc. The radio continuum spectral index is consistent with a scenario where the most recent star formation is occurring at the centre of this ring.

Figure 1 shows the HI column density towards the nuclear region of Arp 193. For a spin temperature of 100 K the total mass of absorbing HI is 5.6×10^7 M$_\odot$, which compares to a derived H_2 mass of 1.3×10^9 M$_\odot$ over the same area, as derived from the CO data of Downes & Solomon (1998). The flux ratio $f_{\rm HI}/f_{\rm CO(2-1)}$ shows a minimum midway between the two HI column density peaks seen in Fig. 1. If the excitation conditions are similar across this region then the ISM is particularly poor in atomic gas towards the projected centre of the HI ring.

The radio spectral index, α (where $S_\nu = \nu^\alpha$), between 1.4 and 8.4 GHz has values close to -0.6 over most of the nuclear region, but at the projected position of the centre of the ring has a value of -0.1. Such a shallow spectral index could result either from free-free absorption at 1.4 GHz or from the emission in this region being dominated by the thermal radio flux. Radio continuum data at a third frequency are required to distinguish between these two possibilities. Whichever the mechanism giving rise to the shallow spectral index, the data imply that there is a large region of ionised gas in the central region. Two possible scenarios could explain these data: 1) The interaction triggered infall of neutral ISM, perhaps via a bar, to the central kilo-parsec of the remnant. Here it accumulated at a dynamical resonance to form a ring. Some fraction of the gas however, falls to smaller radii and fuels the star formation. 2) Interaction triggered the infall of neutral gas to form a central disk. Star formation in the centre of this disk then ionises a large fraction of the gas forming a cavity in the neutral components.

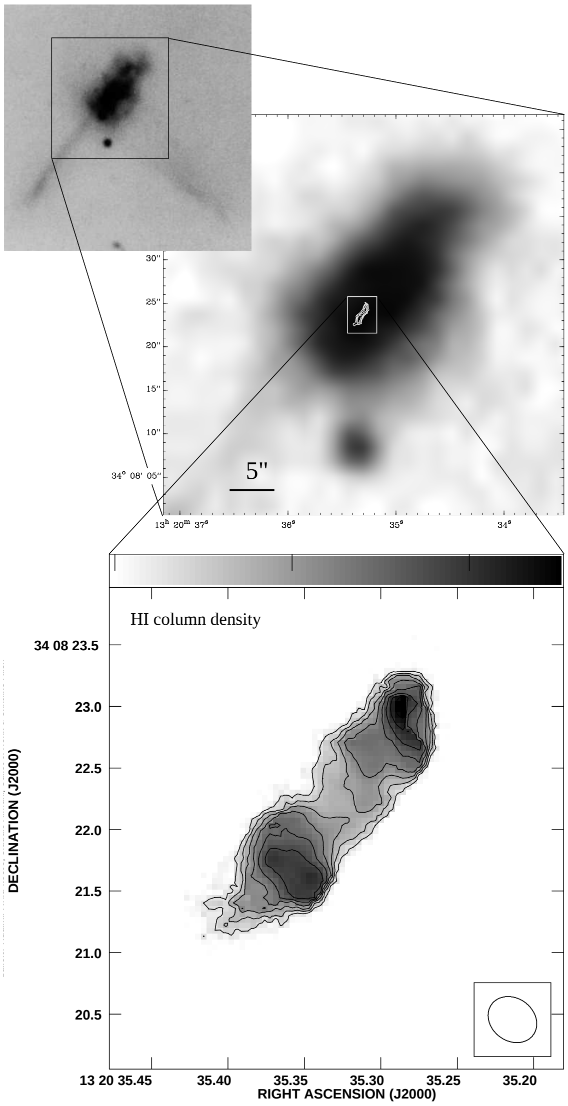

Fig. 1. The distribution of absorbing HI in Arp 193 with respect to an optical ground-based image. Contour levels are $(5, 10, 15, \ldots 40) \times 10^{21}$ $(T_s/100\,{\rm K})$ cm^{-2}. The synthesised beam shown is $\sim 0''.4$ in diameter.

REFERENCES

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