A Search for Infrared Emission from Extragalactic Clouds in the Sculptor Group of Galaxies

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Infrared emission from extragalactic clouds in the Sculptor group of galaxies was searched using IRAS data. No infrared emission was found. A substantial difference between interstellar and intergalactic clouds is suggested.

Introduction

In 1975, Mathewson *et al.* reported the discovery of a complex of HI intergalactic clouds in the vicinity of NGC300 in the Sculptor Group of galaxies. The largest of these clouds lies close to the south-east of NGC300. Galaxy counts in the area of the cloud and in comparison areas were undertaken to see if any dust was associated with neutral hydrogen (Abadi and Edmunds 1977). These investigations seem to indicate the existence of absorbing matter associated with the neutral hydrogen in the clouds. Extinction in the largest cloud, after Abadi and Edmunds (1977), amounts to 0.1 magnitude.

The dust composition within intergalactic clouds and the respective physical conditions are unknown. Therefore, a search for any possible infrared radiation emitted from such clouds is of special interest. Investigations of this kind have already been done for the intergalactic HI cloud in the M96 Group (Schneider *et al.* 1989) and for the extincting area called the Okroy Cloud (Wszolek *et al.* 1989). In the first case, for the cloud similar to NGC300's companions but at a distance about three times greater, no far-infrared emission was detected using IRAS data. On the other hand, for the Okroy Cloud an enhancement of IRAS 100m emission was detected in the cloud center.

In the present paper, using IRAS data, we study the infrared radiation coming from NGC300's companions.

The Search for Dust Emission

Our search method was as follows: First, rectangle fields of 5 deg × deg containing NGC300 and its five HI companions were separated from original IRAS fields. After subtracting large-scale cosecant-law galactic and zodiacal gradients, maps with the highest possible resolution were made within a restricted area. The maps were produced for 12, 25, 60 and 100*m*m IRAS bands, for the first and second IRAS coverages. One such map is shown in Figure 1. No infrared emission attributable to HI clouds was found on any of these maps. Since, in the field under consideration, the standard deviation of the flux from the baseline fit amounts to about 0.1 MJy/sr for the 100*m*m IRAS band, the maximum far-infrared brightness of these clouds must lie below this value.

Conclusions

The clouds we studied are at a distance about three times smaller and have a few times higher column densities than the cloud in the M96 Group. Also, taking into account that they are closer to the South Galactic pole than the M96 cloud is to the North pole, it is clear that detection conditions in the far-infrared are much better for the Sculptor Group clouds.

Pierce and Tully (1985) argued that 100*m*m emission from intergalactic clouds should be detectable by IRAS if the gas/dust ratio in such clouds is comparable to that in our Galaxy, while heating is provided by UV radiation from surrounding galaxies. The ratio N(HI)/Av (Av =

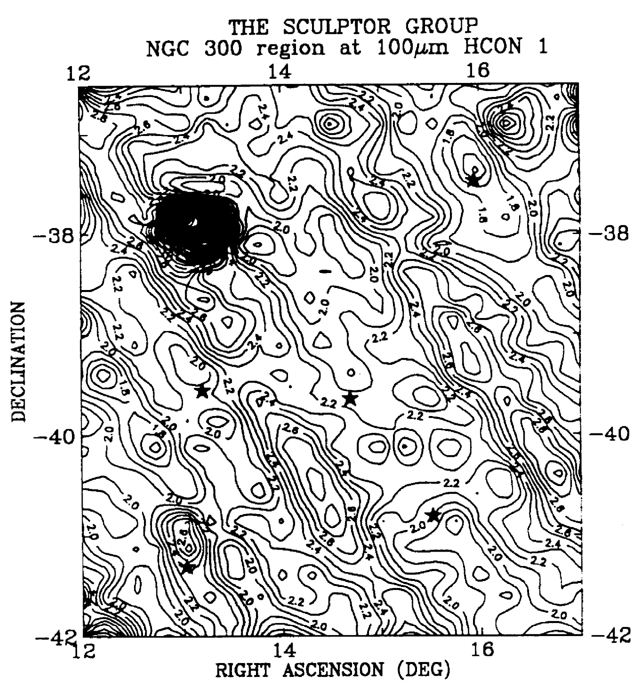

Figure 1. *Map of infrared emission at 100mm (IRAS data). NGC300 lies in upper-left corner. Centers of HI clouds (dimension of each is less than 1 square degree) are denoted by asterisks. Units of isoline descriptions are MJy/sr.*

visual extinction) for the biggest NGC300 companion is at least a few times less than the typical value for HI clouds in our Galaxy. Therefore, many facts argue in favour of the hypothesis that clouds in Sculptor Group are more dusty and should be detected in the far-infrared IRAS data.

The absolute lack of infrared emission attributable to these clouds allows us to conclude that they must differ substantially from interstellar clouds in our Galaxy. In the first instance, the chemical content may be different. The intergalactic clouds are not heated as strongly as interstellar clouds. Therefore, the temperature of dust grains in intergalactic clouds may be as low as 5 K, or even less. At such low temperatures, hydrogen can change much more easily from gaseous to solid and molecular hydrogen. If this is the case, the ratio N(HI)/AV should drop, and this is what is observed for the largest cloud in the Sculptor Group.

Our investigations show that intergalactic dust at very low temperatures (~ 3 K) is a serious possibility. This dust may prove to be the source of the 3 K background radiation.

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