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N91-14177

STRIPPING OF GAS AND DUST FROM THE ELLIPTICAL GALAXY M86

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1 Introduction

Past observations of the X-ray morphology of M86 have revealed that the galaxy is experiencing ram-pressure stripping due to its large velocity (1500 km s^{-1}) relative to the intracluster medium of Virgo (Forman *et al* 1979, Fabian, Schwartz, and Forman 1980).

Our observations indicate that the X-ray emitting gas in the plume of M86 is still being produced from the continual heating of gas and dust stripped from nearer the galaxy's centre.

2 Observations

We have obtained two-dimensional *IRAS* images of M86 which have revealed that there are two spatially separated regions of emission, one at 60μ and the other at 100μ of the *IRAS* wavebands. The 100μ emission, presumably from cool dust (at approximately 20K), appears to be located near the centre of the galaxy together with HI (detected by Bregman, Roberts and Giovanelli 1988), while the 60μ emission (whose origins of emission will be discussed later) appears to lie more than 3 arcminutes away from the optical 'centre' in a direction slightly South of the centre of the plume.

Optical images produced by scanning U.K.Schmidt plates with the A.P.M. at the I.o.A., reveal asymmetric isophotal contours along the major axis of the galaxy (first reported by Nulsen and Carter in 1987, which they propose as excess emission due to star formation). This excess optical emission is co-incident with the direction of the 60μ infra-red emission.

Infrared Astronomy Satellite
(IRAS)
M86 plume

M86 plume

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3 Discussion

M86 has an extended X-ray morphology, possibly characteristic of a cooling flow, with a distortion in the atmosphere caused by ram-pressure stripping. The $1.5 \cdot 10^8 M_{\odot}$ of HI detected in the centre of M86 is also interpreted by Bregman *et al* as resulting from a cooling flow, due to the lack of rotational support in the gas. The possible $3 \cdot 10^5 M_{\odot}$ of dust at the centre of M86 emitting at 100μ , has presumably accumulated from mass-loss from M-giant stars, and has been protected from sputtering by the cool HI gas. Both these accumulations could have occurred over less than a crossing-time, i.e. since M86 last passed through the dense medium of the cluster core where it had the majority of its gas removed.

Now that the galaxy is again approaching the cluster core, and has reached supersonic speeds relative to the cluster gas, first the gas in a shallow gravitational potential is stripped and heated to X-ray temperatures, as seen in the plume, and then gas deeper in the galaxy's potential well is removed and heated. It appears that we are now observing the **continued** stripping of the gas and dust in the centre of the galaxy, given that the 60μ emission is displaced from the galaxy centre in roughly the apparent direction of the plume.

The observed 60μ emission may be due to the heating of the cooler dust previously at the centre of the galaxy (i.e. at 90K compared to 20K), though the observed luminosity may be explained by OI line emission at 63μ . The OI emission could produce all the required luminosity from approximately $10^6 M_{\odot}$ of gas, though it would appear more plausible if the 60μ emission were due to a combination of gas and dust emission.

The picture of the gas and dust being forced out of the galaxy, presumably along the shallowest potential gradient i.e. the major-axis, is reinforced by the asymmetrical optical isophotes. Whether the extended optical emission in the direction of the infra-red emission is due to star formation still has to be investigated.

4 References

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