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CO(2-1) LARGE SCALE MAPPING OF THE PERSEUS CLUSTER CORE WITH HERA

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Abstract. Cold molecular gas has recently been found is several cooling flow clusters cores with single dish telescopes. High spatial resolution imaging of some of these clusters then revealed the peculiar morphology and dynamics of the CO emission lines, pointing out a perturbed very cold component in the cluster centers. We report here the observations of NGC 1275, in the Perseus cluster of galaxies. This object is the strongest cooling flow emitter in the millimeter. The 9 dual polarization pixels of the HERA focal plane array, installed on the 30m telescope, enabled to image the large scale emission of the cold molecular gas which is found to follow the very peculiar Halpha filamentary structure around the central galaxy. We discuss here this association and the non-rotating dynamics of the cold gas that argue for a cooling flow origin of the molecular component.

1 Mapping the filamentary structure

These observations were made from 1st to 3rd January 2005 at the IRAM-30m telescope. We used the HERA (HEterodyne Receiver Array), a focal array of 18 SIS receivers, 9 for each polarisation, tuned at the CO(2-1) line, for NGC 1275 (226.56 GHz). The sampling was 6 arsec (full sampling). We built four such maps, covering the central 138x138″, and also a 5th one covering 66x66″ towards the north. Figure 1 shows in contours the CO(2-1) emission, overlaid on a Halpha image of the filamentary structure pointed out by Conselice et al. (2001).

2 Origin of the molecular gas

The CO contours appear to surround a northern radio lobe cavity, also traced in the X-ray gas. The hot gas, compressed towards the rims, cools there more efficiently, which could explain the presence of CO gas. The kinematics deduced from the CO spectra is not regular, and it is not possible to follow a rotational

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pattern. The mass of cold gas found here (4 10^{10} $M_{\odot}$) is quite a large amount for a single galaxy. So, it is likely that we see here, for the first time, a filamentary cold gas coming from a cooling flow as predicted by X-ray observations.

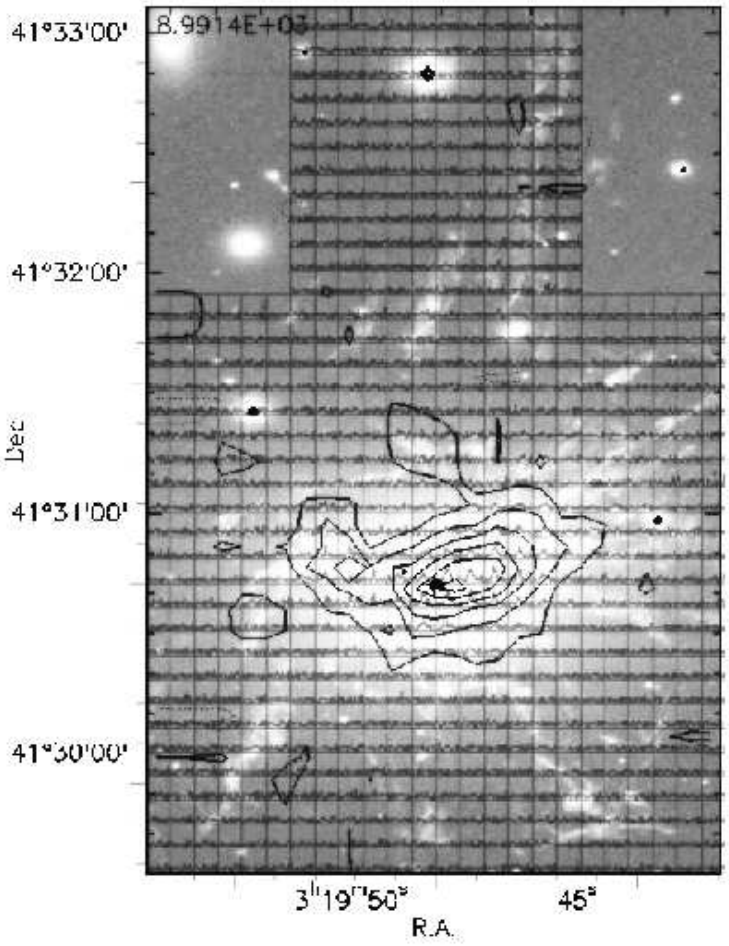

Fig. 1. Halpha image from Conselice et al (2001), with CO(2-1) contours superimposed. Contours are linear, form 10 to 100% of the maximum emission of 8.3 K km/s, in T_A^* scale. The boxes show the spectra obtained with a velocity scale from -600 to 600 km/s, and a temperature scale in T_A^* from -10 to 40 mK.

References

Conselice at al. 2001, AJ, 122, 2281
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