IRAM $C^{18}O(1-0)$ AND VLA $\lambda\lambda$6 AND 20 CM OBSERVATIONS OF M82

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1) *$C^{18}O$(1-0) OBSERVATIONS.* We observed 13 points of $C^{18}O(1-0)$ (resolution 22") around the nucleus of M82 and obtained typical main beam brightness temperatures of 20–50 mK. The intensity distribution reveals a clear double–peaked structure with the maxima seperated by 25". The relative strength of the peaks w.r.t. the emission from the center is consistent with the presence of two point–like sources located at the peak positions. We compared our data with the 17" CO(1–0) observations of Nakai et al. (1987) and found a strong contrast for the $CO(1-0)/C^{18}O(1-0)$ ratio with high values ($\simeq$30) in the center and low values ($\simeq$15) at the peak positions. This result is consistent with that of Loiseau et al. (1990) who also found with 12" resolution for the ratios of $CO(2-1)/^{13}CO(2-1)$ minima at the ring locations, although not as strong as we found for the $CO(1-0)/C^{18}O(1-0)$ ratio. This high contrast indicates the presence of opically thick gas within the molecular ring and supports the view that the main part of the star forming process occurs in the ring.

2) *VLA CONTINUUM OBSERVATIONS.* We report the first detection of polarized radio emission of M82. The percentage polarization increases from 1% at z $\simeq$100 pc to 20% at z $\simeq$1 kpc. The lack of significant polarized radio emission in the center ($\leq$ 0.1%) is due to strong depolarization, caused by the high density of thermal electrons (e.g. Seaquist et al., 1985) and the presence of a strong magnetic field (Klein et al., 1988). The outflowing hot gas (e.g. Bland and Tully, 1988) may be responsible for depolarization at high z-distances. The observed shape of our polarized intensity map delineates regions where the depolarization decreases, e.g. owing to low densities of thermal electrons and/or weaker and less turbulent magnetic fields. Thus the observations support the view of a conical outflow of hot gas produced by star explosion processes in the center of the galaxy (e.g. Goetz et al., 1990). At both frequencies we find strong evidence for a convective motion of relativistic particles towards the halo of M82. At z–distances of 2 kpc several synchrotron filaments are visible emerging from the plane of the galaxy. The view of a convective outflow of relativistic particles is also supported by the presence of a distinct "gap" in the synchrotron emission (see also Kronberg et al., 1981).

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