HIGH SPATIAL RESOLUTION 100 μm OBSERVATIONS OF THE M83 BAR

B. J. Smith, D. F. Lester, and P. M. Harvey (University of Texas)

We have been conducting a program of high spatial resolution far-infrared observations of galaxies using the Kuiper Airborne Observatory (KAO), to better understand the role of star formation, the general interstellar radiation field, and non-thermal activity in powering the prodigious far-infrared luminosities seen in spiral and interacting galaxies. Here, we present observations of the central region of the well-known barred spiral M83 (NGC 5236).

The observations were made April 22, 1988, using an 8-channel germanium bolometer array mounted at the straight Cassegrain focus of the 0.9m KAO telescope. This array was provided for our use by Frank Low of Infrared Laboratories. The 8 channels are spaced 12.8″ apart at 100 μm, and 8 simultaneous 3.2′ scans were made across the galaxy. The positions of the scans on M83 are shown in Figure 1, where they are superimposed on the CO J = 1 - 0 contours from Sofue *et al.* (1986). Eighteen back and forth sweeps were made across this region during the 35 minute M83 flight leg, with a total integration time on source of 18 minutes. The array was positioned such that channel 3, the most sensitive detector, was centered on the nucleus of M83. For calibration and to obtain the point spread function of the detectors, IRC+10216 was observed on the same flight. IRC+10216 has been shown to be a suitable point source at 100 μm (Lester, Harvey, and Joy 1985).

The resultant channel 3 scans for M83 and IRC +10216, after co-addition and smoothing, are shown in Figure 2. These data show that M83 is extended at 100 μm compared to a point source. A simple gaussian deconvolution of the M83 data with the point source profile from IRC+10216 gives a FWHM of ~19″ for M83. By comparison with IRC+10216, we obtain a flux for the unresolved component in M83 of ~ 110 Jy. This is ~ 1/6 the total flux for M83 (Rice *et al.* 1988) and ~ 1/2 the PSC flux.

The M83 and IRC+10216 profiles in the cross-scan direction (SE-NW) were also compared, and show that M83 is extended in this direction as well, with a width of ~18″. A comparison of the different channel profiles for M83 and IRC+10216 shows that there is an asymmetry in the M83 data, in that the maximum in the profiles shifts from southeast to northwest as channel number increases. This corresponds to the extension in the bar seen in the CO data in Figure 1. Thus the far-infrared emission in the central region of M83 tends to trace the CO bar.

The new 100 μm data is also compared with previous BVRIJK Hα observations from the literature, to determine how well the far-infrared traces the stellar structure, the star formation as measured by Hα, and the optical colors.

REFERENCES

Lester, D. F., Harvey, P. M., and Joy, M. 1986, *Ap. J.*, **304**, 623.

Rice, W., *et al.* 1988, *Ap. J. Supp.*, **68**, 91.

Sofue, Y., Handa, T., Hayashi, M. and Nakai, N. 1986, in *Proceedings of the Star Formation in Galaxies Conference*, ed. C. J. L. Persson, (Pasadena: California Institute of Technology), p. 179.

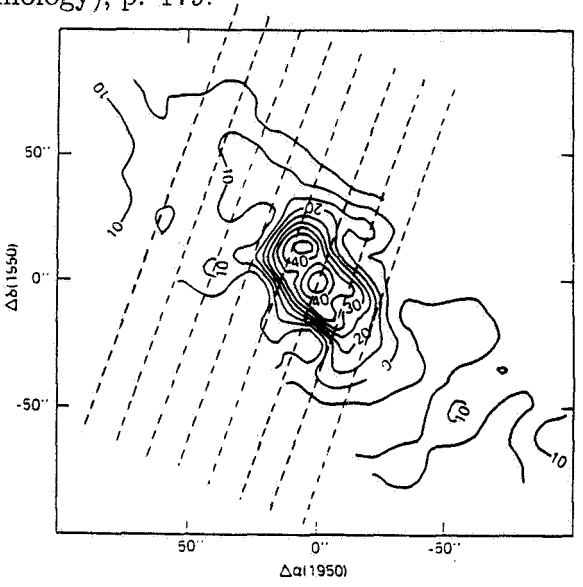

Figure 1. The positions of our scans across the central (bar) region of M83, superimposed on the CO J = 1 - 0 contours from Sofue *et al.* (1986). Detector #1 is the southernmost scan, while detector #8 is the most northern.

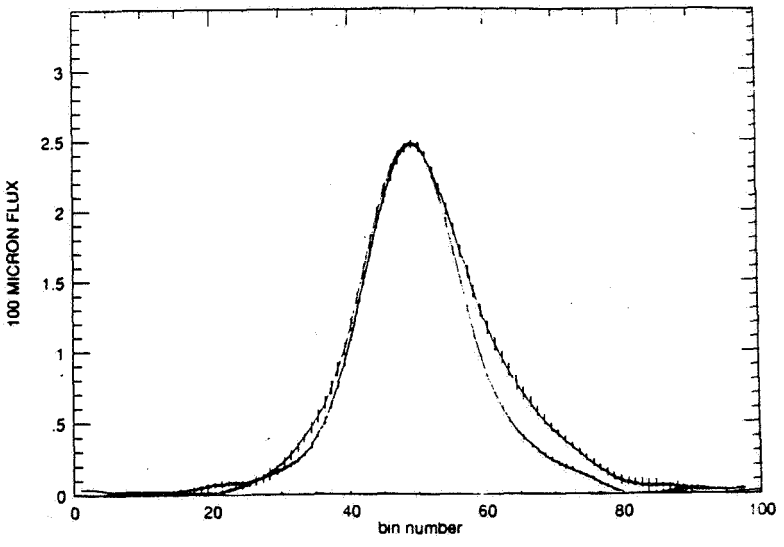

Figure 2. A comparison of the channel 3 final scans for M83 and IRC+10216.