## 1. Dust

Using *Ellipse* routine in IRAF[1] the surface brightness profile of MS0735 was derived. Using the information deduced by this routine a model galaxy was created using *bmodel*. This model is assumed to be a pure light model (i.e. no extinctions). Using the radiative transfer equation,

$$e^{-\tau} = \frac{I(r)}{I_{\circ}(r)} \tag{1}$$

the observed image and the model image, an optical depth image was created. Here the observed image is I(r), the model image is $I_{\circ}(r)$ and the tau image was created by performing the following arithmetics on the images.

$$\tau = ln\ \frac{I_{\circ}(r)}{I(r)} \tag{2}$$

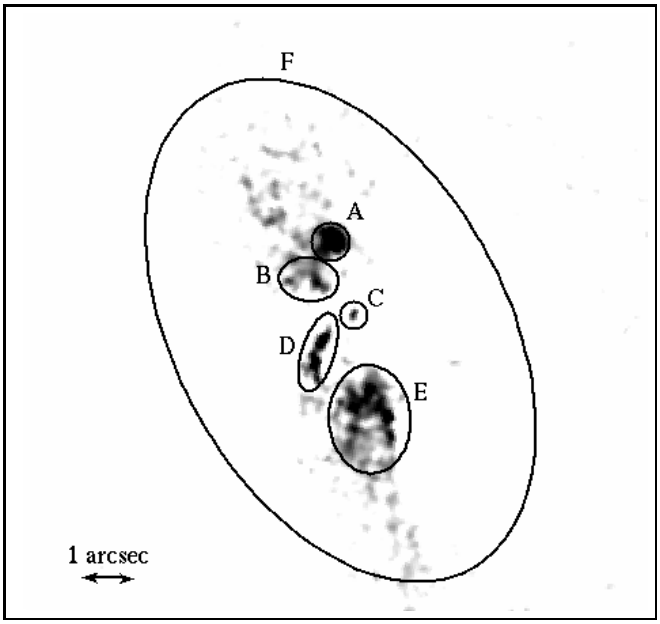


Fig. 1.— Residual map of Herc A after subtraction of the model galaxy. Regions of high extinction have been chosen for dust calculation.

[1]IRAF is a general Image Reduction and Analysis Facility providing a wide range of image processing tools. IRAF is a product of the National Optical Astronomy Observations and was developed for the astronomical community, although it is widely used in other scientific disciplines.

Table 1. Measurement of gas and dust mass in Herc A using the optical depth.

| Region | Area of Region ($10^{43}$ $cm^2$) | $<\tau>$[a] | $N_H$ ($10^{20}$) | Total Gas Mass ($10^6$ $M_\odot$) |
|---|---|---|---|---|
| A | 2.27 | 0.341±0.128 | 7.02±2.64 | 13.5±5.06 |
| B | 3.31 | 0.149±0.047 | 3.06±0.961 | 8.57±2.69 |
| C | 0.23 | 0.178±0.034 | 3.66±0.698 | 0.712±0.25 |
| D | 0.14 | 0.212±0.069 | 4.37±1.43 | 5.17±1.69 |
| E | 10.16 | 0.187±0.062 | 3.86±1.27 | 33.1±10.9 |
| F | 71.19 | 0.331±0.075 | 6.81±1.55 | 276.5±62.65 |

Note. — The uncertainty in measured quantities are derived using Poisson statistics combined with the statistical error.

[a]Optical Depth.

## 2. SFR

We used XMM-Newton Optical Monitor, Ultraviolet (UV) images to determine a star formation rate (SFR) for Herc A. The data were retrieved from the online XMM archives in MAST (Multimission Archive at STScI) . We retrieved XMM-OM Medium 2 (M2) with 13.77 ks exposure time and Wide 1 (W1) with 5 ks exposure time. The properties of these filters are listed in the table below. Recently Salim et al. (2007) proposed a relationship which estimates the SFR using UV luminosities.

$$SFR(M_{\odot} yr^{-1}) = 1.4 \times 10^{-28} \times L_{\nu}\ (ergs\ s^{-1} Hz^{-1}) \tag{3}$$

The luminosity of the UV images were determined in apertures at radii of multiples of the PSF for each filter. The total count rate (cps) within an aperture was measured and a frequency normalized luminosity was calculated. This in turn allowed for the SFR calculations using equation (1).

$$F = F_{\circ} \times \lambda \times cps \quad ergs\ s^{-1} cm^{2} \tag{4}$$

$$L = F \times 4\pi \times D_L^2 \quad ergs\ s^{-1} \tag{5}$$

$$L_{\nu} = \frac{L \times \lambda}{c} \quad ergs\ s^{-1} Hz^{-1} \tag{6}$$

It is noted that the SFRs measured for all images are upper limits, i.e. no detections were made, except for 5 ks exposure using the XMM-OM Wide 1 filter. In this image a minimal detection is made. In this image a minimal detection is made which is several times the PSF of the filter (fig. below). An ultraviolet luminosity and a star formation rate of 1.16±0.16 $\times$ $10^{42}$ erg/s, 0.157±0.022 $M_{\odot}/yr$ respectively in an aperture of sixe 10″.

Table 2. Properties of the Ultraviolet observations.

| Filter | Central Wavelength ($\mathring{A}$) | $m_{\circ,AB}$ | PSF (arcsecs) | $F_{\circ}$ (ergs/s/$cm^2$/$\mathring{A}$/cps) |
|---|---|---|---|---|
| M2 | 2310 | 17.41 | 1.8 | $2.20 \times 10^{-15}$ |
| W1 | 2910 | 18.57 | 2 | $4.76 \times 10^{-16}$ |

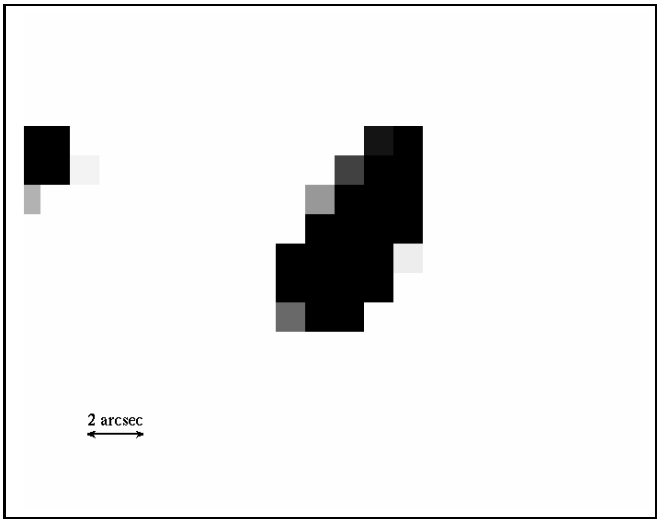


Fig. 2.— XMM-OM Wide 1 long exposure image shows a faint UV detection of Herc A. The color map is inverted in this image.

## 3. HST Observation

Our data was obtained from the HST archives on MAST. It is a 864 second exposure of Herc A using the STIS broadband 50CCD filter with central wavelength of 5850$\mathring{A}$ with standard zero point magnitude of 26.518. The plate scale of 0.051" per pixel corresponds to an angular size of 2.67 kpc per arcsecond at the redshift of Herc A. The following corrections were applied to the zero point magnitude: extcor (0.0924), kcor (0.309), evolucor (-0.191), fluxcor (0.622).

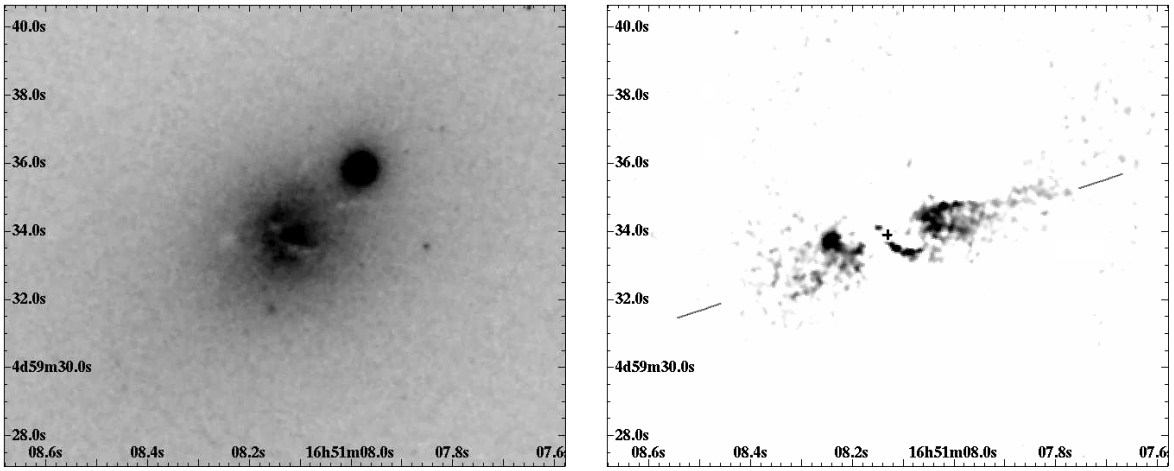


Fig. 3.— Inverted color map of Herc A. Left panel: Herc A with its companion galaxy, the dust lanes are visible in lighter color. Right panel: The dust lanes of Herc A, with the radio outburst direction noted.

## REFERENCES

Salim, S., et al. 2007, ApJS, 173, 267