

THE "JET" OF M89: CCD SURFACE PHOTOMETRY

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ABSTRACT. We have obtained CCD images in R and V of Malin's "jet" in the weakly radio and X-ray active E0 galaxy M89 (NGC4552). The luminosity of this feature is approximately 1/4% of the total luminosity of the galaxy; its color is bluer than that of the whole galaxy with a V-R value smaller by about 0.15 magnitudes. The likely explanation of the feature, which looks more like a proboscis than a jet, is that it is, in the words of the Toomres (1972), a "tidal relic of a close encounter", seen from a perspective that may hide a drawn out tail.

1. INTRODUCTION

Malin (1979) discovered three faint features of disturbed morphology in the active E0 galaxy M89 (NGC4552) in specially enhanced sky-limited 1.2-m Schmidt photographs:

- a) A faint optical "jet" at position angle 115° extending 10 arc min (~36 kpc) from the nucleus;
- b) A bulge on the eastern side of the outer envelope
- c) Three concentric arcs of the kind now called "ripples" or "shells" at 5', 7' and 10' from the nucleus.

In addition he reported the detection by R. Eckers (unpublished) of variable 6 cm radio emission from the nucleus. Subsequent spectroscopic investigation (Malin 1981) showed the jet free from emission lines and with a color slightly bluer than the rest of the galaxy. Forman, Jones, and Tucker (1985) detected X-rays from an unresolved point source at the nucleus with luminosity of 3×10^{40} ergs s⁻¹.

We have undertaken a detailed study of the faint optical features of M89 by CCD surface photometry. We report here the preliminary results from measurements of the jet.

2. OBSERVATIONS

We used the MASCOT CCD camera attached to the 1.3-m McGraw Hill telescope. Our results are drawn from a 3604-s V and an 1820-s R exposure of the jet region, and 53-s V and R exposures of the nucleus.

The jet is conspicuous in the CCD images of which the V exposure is displayed in contoured form in Figure 1. The surface brightness of the jet is approximately 2% of the sky background.

3. ANALYSIS

The jet emerges radially westward from the outer halo glow at a distance of about 5 arc min

from the nucleus, and then bends 30° southwest to a straight uniform section about 5 arc min long and 1/2 arc min wide. The maximum surface brightness of jet is approximately 26.8 V mag arcsec⁻².

The ratio of the luminosity of the discernable portion of the jet feature to that of the whole galaxy is $(2.5 \pm 0.5) \times 10^{-3}$. The jet is bluer than the whole galaxy, i.e.

$$(V-R)_{\text{jet}} - (V-R)_{\text{galaxy}} = -0.15 \pm 0.05 .$$

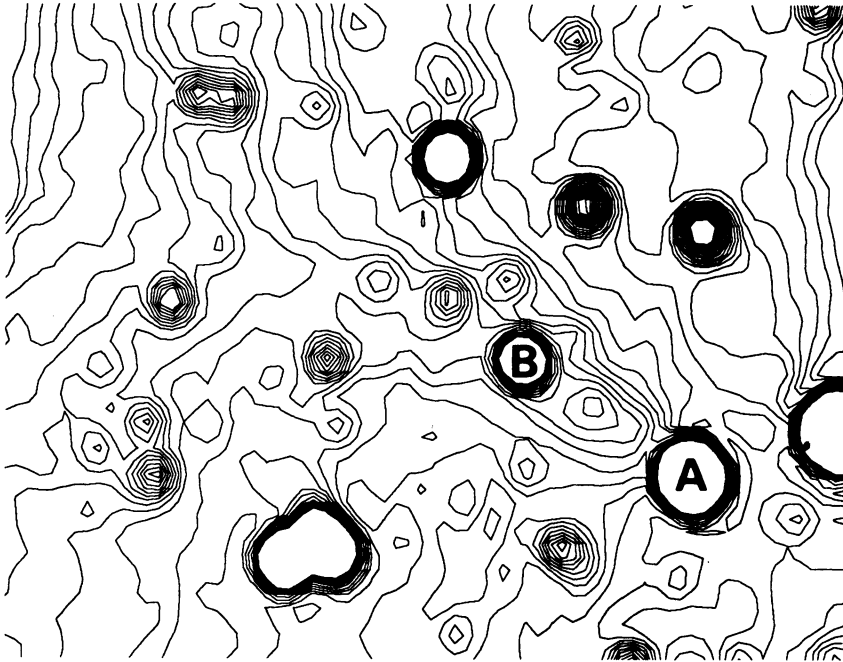


Figure 1. Contour plot of the surface brightness in the vicinity of the "jet" of M89 in the 3604-s V-filter CCD exposure. North is up and east is left. The contours are at intervals of 5 ADU's starting with a maximum of 1500 in the upper left hand corner. The sky level is 1370 ADU's. The separation between foreground stars A and B is 1.2 arc min. The nucleus of M89 is located 8.4 arc min to the east and north of star A. The jet lies along the line defined by the image centers of stars A and B.

4. DISCUSSION

M-89 probably suffered a non-radial encounter with a small galaxy within the last billion years, resulting in a disturbed morphology and a feeding of the nucleus that induced radio and X-ray activity. Modelling of such encounters shows that they can produce tidal streams as well as arc-like features (Quinn 1984). The jet is probably a tidal stream of stars viewed from a perspective that hides a drawn out tail.

REFERENCES

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