

SPECTROPHOTOMETRY OF AN X-RAY SOURCE NEAR M33

C. A. CHRISTIAN¹

Canada-France-Hawaii Telescope Corporation, Kamuela, Hawaii

AND

R. A. SCHOMMER

Institute of Astronomy, The Observatories, Cambridge, England

Received 1981 July 16; accepted 1981 October 9

ABSTRACT

We have obtained IIDS spectrophotometry of an object identified with the X-ray source near M33 observed by Long *et al.* The source has an apparent radial velocity of $10,800 \pm 800 \text{ km s}^{-1}$, an integrated spectral type similar to a late G or early K giant, and an optical image with noticeably elongated isophotes, suggesting that the source is an elliptical galaxy at $z = 0.03$ rather than a globular cluster.

Subject headings: clusters: globular — galaxies: individual — spectrophotometry — X-rays: sources

Recently, Long *et al.* (1981) reported the detection of 11 discrete sources of X-ray emission associated with M33. One of these sources (No. 9 in their list) is tentatively identified with a nonstellar object for which Hiltner (1960; object n) measured $V = 16.76$ and $B - V = 1.16$. The source also was included in a list of star cluster candidates published by Melnick and D'Odorico (1978; cluster No. 53). As part of a general survey of globular-like objects in M33 (cf. Christian and Schommer 1979), we obtained IIDS spectrophotometry of this object with the Kitt Peak 2.1 m telescope in 1979 December. The spectrum, shown in Figure 1 (top), was obtained at 10 Å resolution through an 8'4 aperture with a 600 lines mm^{-1} grating (KPNO No. 26) used in first order. The spectrum was processed with the standard KPNO IIDS reduction package, including conversion to flux units using spectra of standard stars obtained during the same observing session.

The sizable redshift of the candidate is obvious, even from a brief inspection of Figure 1 (top). Note that the comparison star, NGC 2420 II-3-44 (Fig. 1 [bottom]; cf. West 1967) was observed during the same observing run. The measured radial velocity, $10,800 \pm 800 \text{ km s}^{-1}$ ($z = 0.036$), and the integrated spectral type of the source, late G to K, suggest that the X-ray emission is being produced by a background elliptical galaxy seen in

projection against the outer part of the M33 disk. Hiltner's integrated photometry of this object, confirmed by our recent *BVR* photometry (Schommer and Christian 1982), is more consistent with the colors of an elliptical galaxy than a globular cluster. Examination of a high resolution ($6''.7 \text{ mm}^{-1}$) Ritchey-Chrétien plate taken with the KPNO 4 m telescope by W. E. Schoening and R. Lynds (Fig. 2) also shows that the object is more elliptical than most galactic globular clusters (axial ratio $1 - [b/a] \sim 0.2$; Geisler and Hodge 1980).

Assuming the object to be at its redshift distance and correctly identified as the X-ray source, we calculate an X-ray luminosity (0.15–4.5 keV) of about $3.5 h^{-2} \times 10^{41} \text{ ergs s}^{-1}$ (where $h = H_0 = 100 \text{ km s}^{-1} \text{ Mpc}^{-1}$) with an X-ray to optical flux ratio $f_x/f_b \sim 5 \times 10^{-5}$. This X-ray luminosity is rather large for a normal galaxy and is more characteristic of Seyfert galaxies (Kriss, Canizares, and Ricker 1980). Since the optical spectrum shows no evidence for emission lines (although $H\alpha$ is not observed) and the source does not appear to be imbedded in a rich cluster of galaxies, the object resembles those galaxies reported by Elvis *et al.* (1981). Unfortunately, we have little information about its X-ray variability, nor does the source appear to be a strong radio continuum emitter, as it is not evident on the 1415 MHz map of Israel and van der Kruit (1974).

We also note that the Long *et al.* (1981) source centroid No. 6 lies $32''$ north of our position for object No. 13 in Melnick and D'Odorico (1978). This object has $V = 18.0$ and $B - V = 0.9$ from our preliminary photometry and may well be a globular cluster.

¹Visiting Astronomer, Kitt Peak National Observatory, operated by the Association of Universities for Research in Astronomy, Inc., under contract with the National Science Foundation.

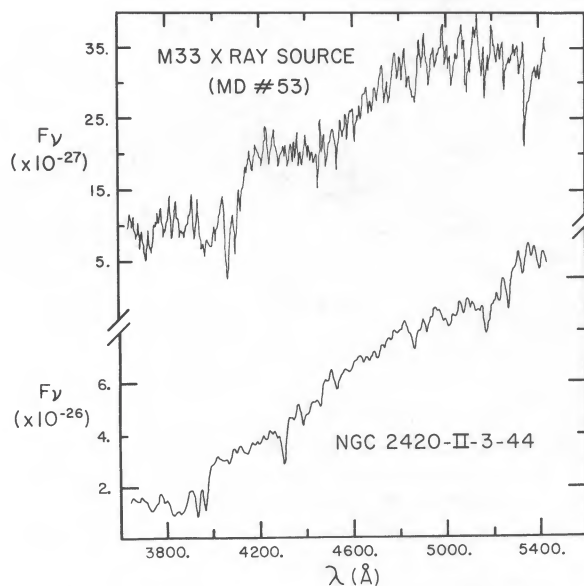


FIG. 1.—IIDS spectrophotometry of (*top*) the proposed optical counterpart of the X-ray source near source M33 observed by Long *et al.* (1981) and (*bottom*) star II-3-44, a late G-type star in the open cluster NGC 2420, which was observed during the same observing run. The radial velocity of the X-ray source is $10,800 \pm 800 \text{ km s}^{-1}$.

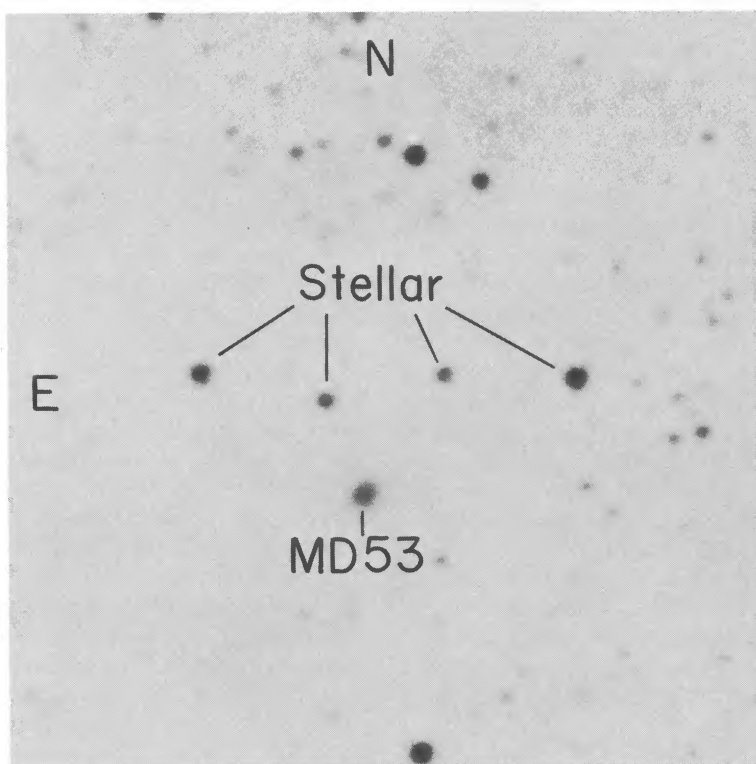


FIG. 2.—An enlargement of a portion of a high resolution plate ($\sim 6''.7 \text{ mm}^{-1}$) taken at Kitt Peak by R. Lynds and W. E. Schoening. The 150 minute exposure was taken on an unfiltered, unbaked IIa-O 14 inch \times 14 inch plate (KPNO plate No. 8) with the KPNO 4 m telescope at the Ritchey-Chrétien focus. The image of the source has markedly elliptical isophotes, particularly when compared to the stellar image nearby.

X-RAY SOURCE NEAR M33

L15

REFERENCES

- Christian, C. A., and Schommer, R. A. 1979, *Bull. AAS*, **11**, 632.
 Elvis, M., Schreier, E. J., Tonry, J., Davis, M., and Huchra, J. P. 1981, *Ap. J.*, **246**, 60.
 Geisler, D., and Hodge, P. W. 1980, *Ap. J.*, **242**, 66.
 Hiltner, W. 1960, *Ap. J.*, **131**, 163.
 Israel, F., and van der Kruit, P. C. 1974, *Astr. Ap.*, **32**, 361.
 Kriss, G. R., Canizares, C. R., and Ricker, G. R. 1980, *Ap. J.*, **242**, 492.
 Long, K. S., D'Odorico, S., Charles, P. A., and Dopita, M. A. 1981, *Ap. J. (Letters)*, **246**, L61.
 Melnick, J., and D'Odorico, S. 1978, *Astr. Ap. Suppl.*, **34**, 359.
 Schommer, R. A., and Christian, C. A. 1982, in preparation.
 West, F. R. 1967, *Ap. J. Suppl.*, **14**, 384.

CAROL A. CHRISTIAN: Canada-France-Hawaii Telescope Corporation, P.O. Box 1587, Kamuela, HI 96743

R. A. SCHOMMER: Institute of Astronomy, The Observatories, Cambridge CB3 0HA, England