AM2020−5050: AN ELLIPTICAL GALAXY WITH AN OUTER RING

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ABSTRACT. Photometric and spectroscopic observations show that the inner component of AM2020−5050 is an elliptical galaxy, unlike other polar-ring galaxies which have an S0 disk at the center. A comparison of the central velocity dispersion with the rotational velocity in the ring suggests the presence of a nearly spherical gravitational potential. The inner component has a rapidly rotating core with rotational velocities at 3″ substantially higher than at 8″. Although the optical ring is quite narrow, H_α emission is observed all the way through the center of the galaxy, indicating the presence of an extended gaseous disk.

OBSERVATIONS AND RESULTS

Observations have shown that the central components of polar-ring galaxies tend to be highly inclined S0 disks, with a large rotational velocity and small velocity dispersion. Photographs of the polar-ring galaxy AM2020−5050 led us to believe that the central component in this case might be an elliptical galaxy. We obtained photometric and spectroscopic observations using the 4 meter telescope at CTIO to check this hypothesis.

Photometry in the B and V bands with a CCD detector at prime focus shows that the luminosity profile follows an $R^{\frac{1}{4}}$ law characteristic of an elliptical galaxy (see Figure 1), rather than the exponential law seen in most disk galaxies. The ring is bluer than the central component with $B - V = 0.6$ compared to $B - V = 0.9$.

Long-slit spectra obtained in the blue (4100 - 5600 Å) show that the central component rotates quite slowly at 8″, unlike S0 disks which rotate rapidly. The ratio of the rotational velocity to the central stellar velocity dispersion is $V/\sigma_o = 0.4$, characteristic of an elliptical galaxy. However, the inner 3″ are rotating substantially faster, showing the presence of a rapidly rotating core.

Spectra obtained at H_α measure the rotation of the gas in the polar ring. The rotation curve has a constant gradient in the inner region, followed by a well defined turnover at about 10″. Beyond this radius the rotation curve is flat or slightly rising. Perhaps the most surprising fact is that while the ring appears to be a narrow feature at about 12″ radius, H_α emission is actually observed all the way through the nucleus. This suggests that the ring may represent the locus of most intense star formation within an underlying gaseous disk.

T. de Zeeuw (ed.), Structure and Dynamics of Elliptical Galaxies, 413–414.

DISCUSSION

In most polar-ring galaxies, a comparison between the rotational velocities in the ring and in the S0 disk provides a measurement of the flattening of the gravitational potential. In AM2020−5050, however, the low value of V/σ_o shows that the inner component is an elliptical galaxy rather than an S0 disk. Since most of the dynamical support comes from the velocity dispersion rather than rotation, a comparison between σ_o and V_{ring} is more relevant.

For bulge-dominated spiral galaxies, Whitmore and Kirshner (1981) find that $V_{disk}/\sigma_o = 1.54 \pm 0.06$. The value for the polar ring of AM2020−5050 is approximately the same, $V_{ring}/\sigma_o = 1.5 \pm 0.1$. This suggests that the rotational velocity of the ring is about the same as it would be in a hypothetical gaseous disk of the central elliptical component. Therefore, the gravitational potential of AM2020−5050 seems to be nearly spherical, even though the shape of the luminous matter is that of an E4 galaxy.

REFERENCES

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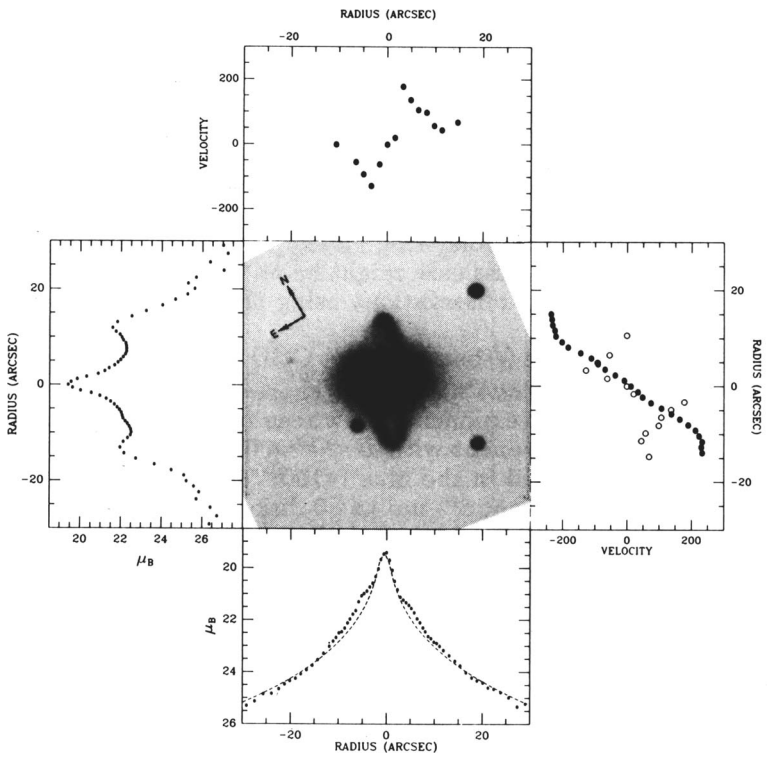

Figure 1. Photometric and Kinematic Observations of AM2020-5050.

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