THE VELOCITY DISPERSION AND DISPERSION PROFILE OF ABELL 963

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1. Introduction

Abell 963 ($z = 0.206$) is still the best candidate for a true arc-counterarc lens configuration (Lavery & Henry 1988). A simple model explains the positions, lengths and patchy light distribution of the two arcs. Photometry indicates the arcs also have the same B-R color (Lavery & Henry 1988; Ellis et al. 1991). However, spectroscopic observations have not confirmed that these arcs originate from the same background galaxy. Ellis et al. (1991) detected a single emission line in the spectrum of the smaller northern arc, identifying it as [O II] λ3727 at a redshift of 0.77. Neither Lavery (1989) or Ellis et al. (1991) detected this emission line in the larger southern arc.

Our overall goal of this program is to compare the various methods of determining the mass distribution profile of A963 in order to determine if the two large arcs are truly from a single background galaxy. Here, we present our preliminary results on determining the velocity dispersion and dispersion profile of this lensing cluster.

2. OBSERVATIONS

These spectroscopic data were obtained over 3 nights in 1993 February on the UH 88-inch telescope of the MKO. Aperture plates were used to obtain spectra of 8 to 13 spectra simultaneously. Spectra and redshifts were

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obtained for a total of 50 objects, as well as several objects with spectra of too low quality for this program. Of these 50, 9 of the galaxies are non-members, 1 is a strong emission line member, and 1 is a star. The remaining 39 objects are red cluster members used in the subsequent analysis.

3. ANALYSIS

We used our highest signal-to-noise spectrum, BOW 2, as our template. Its redshift was determined using six strong absorption features. The wavelength scale of this spectrum was then shifted to the rest-frame.

Recessional velocities for all the red cluster members were determined using the Fourier cross-correlation velocity program in IRAF. These velocities were then averaged to determine the recessional velocity of the cluster. Excluding 2 galaxies, a double system and one galaxy more than 3σ from the mean, we determine $cz = 61450 \pm 260$ and $z = 0.205$ (37 galaxies). Relativistic corrections were applied to each galaxy before calculating the velocity dispersion. We find a mean corrected cluster velocity of 55260 $\pm$ 220 km/s and a radial velocity dispersion of $\sigma_r = 1350$ (+210,-150) km/s.

Dividing the present data into three bins with average radii of 60", 130" and 190", we find velocity dispersions of 1380 km/s (12 galaxies), 1320 km/s (14 galaxies) and 1150 km/s (11 galaxies), respectively. While the differences are not significant, there is at least some indication of a decrease with larger radius. We have spectra of additional cluster members from several other observing runs and will incorporate these data once systematic differences between observing sessions are taken into account. These would increase the sample of red cluster members by 25%.

4. DISCUSSION

The double arc system of A963 poses some basic questions to our understanding of cluster lensing. Higher quality spectra of the arcs are needed to confirm their redshifts. More redshifts are certainly needed, but other observational information is available. Recent ROSAT X-ray data have shown the core radius to be $\sim$3 times smaller than previous determinations, with $r_c=$ 24" and fairly elliptical contours. This X-ray gas may produce the needed perturbation of the potential from circular symmetry (Kovner 1989).

References

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