

ERO R1 in the field of CL0939+4713 – Evidence for an S0-like galaxy at $z \sim 1.5$

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Abstract. An elongated ERO with $R - K' = 7.5$ behind the cluster A851 at $z=0.4$ was found to lie at $z = 1.5$ both by the photometric redshift and by a cross correlation method of its H-band SED with local E/S0 spectra. The luminosity profile is well represented by a seeing convolved exponential disk, and the lack of redshifted H-alpha emission indicates that it has a dynamically relaxed disk with an old stellar population. Gravitational lensing of the cluster is not strong enough to stretch the image and cannot convert the de Vaucouleurs law into an exponential law.

1. S0-like ERO at redshift 1.5

The properties of the extremely red object ERO J094258+4659.2, identified by Iye et al. (2000, PASJ, 52, 9) as ERO R1 in their deep images of the cluster A851 are reported. We estimate its redshift independently by eight-band photometric redshift determination (Figs. 1 and 2) and by a cross-correlation method of an H-band spectrum with the optical spectra of local E/S0 galaxies, and conclude that it lies at $z \sim 1.5$. Although its colours are consistent both with an elliptical galaxy and an S0 galaxy at that redshift, its elongated shape and exponential luminosity profile (Fig. 3) suggest the presence of an evolved stellar disk component. We rule out the possibility that these properties are strongly influenced by gravitational lensing by the foreground cluster as the cluster mass is not sufficiently large to induce a strong lensing effect, and therefore conclude that this object is more likely to be an S0-like galaxy, rather than a lensed elliptical. The H-band spectrum does not show strong H-alpha emission and the star forma-

tion rate therefore appears to be very modest. The presence of such a galaxy with an apparently relaxed disk of stars at this high redshift provides a new and strong constraint on theoretical models which aim to explain the formation and evolution of galaxies.

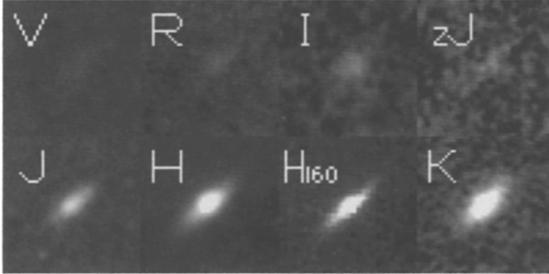


Fig 1. Images of ERO R1 in 8 bands.

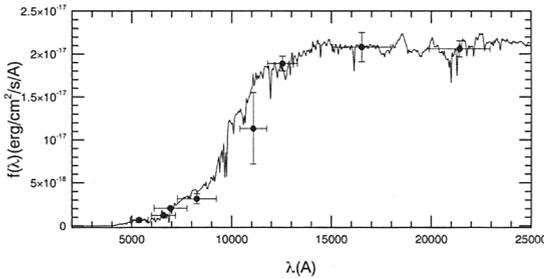


Fig 2. Observed SED of ERO R1 and a model SED for an E/S0 at $z = 1.5$.

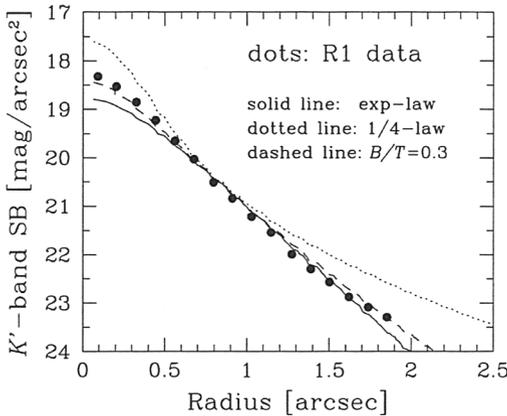


Fig 3. Luminosity profile of ERO R1, consistent with an exponential law.