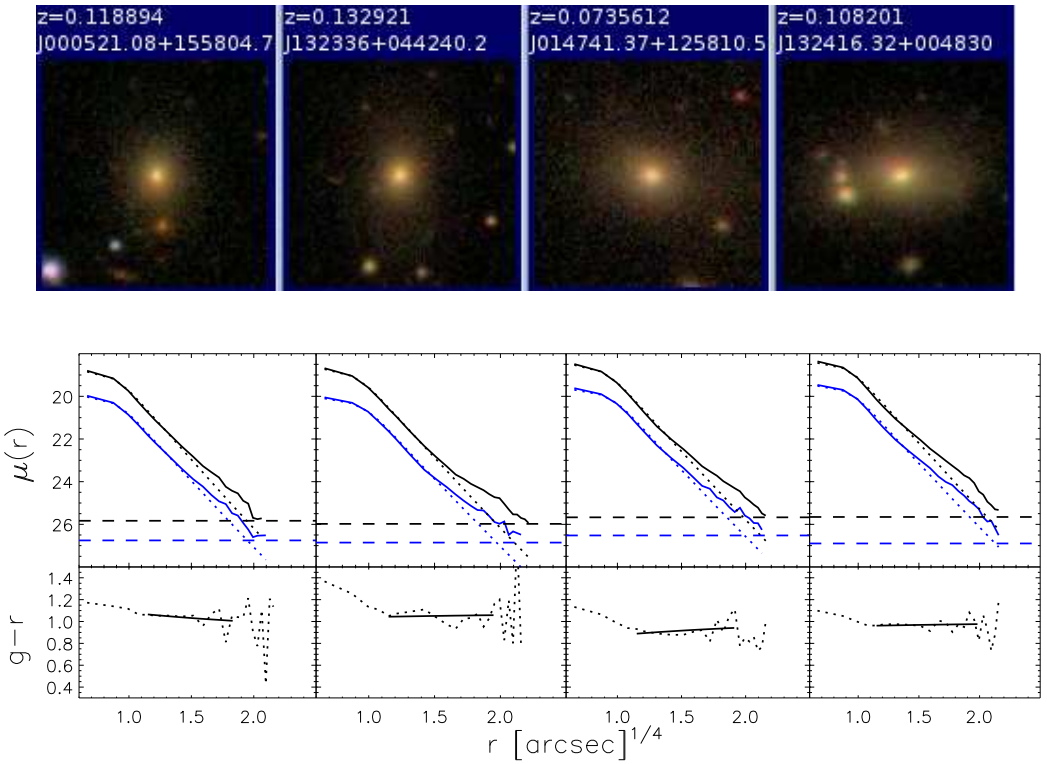

FIG. 2.— Images (top) and surface brightness profiles (bottom) for a set of C4 BCGs which are not well fit by a deVaucouleur profile. The deviation is strongest at large radii (faint surface brightness). Although Sersic profiles provide better fits, Gonzalez et al. (2006) show that the sum of two deVaucouleur components generally provide an even better description of most such profiles.

$H_0 = 70h_{70}$ km s^{-1}Mpc^{-1}.

2. SAMPLE SELECTION AND FITS TO LIGHT PROFILES

We have selected the objects identified as BCGs in the C4 cluster catalog of Miller et al. (2005). This catalog was based on the Second Data Release of the SDSS: DR2. Of the 748 BCGs in the catalog, spectra are available for 580 (fiber collisions mean some BCGs were missed). Some of these are duplicates (i.e. some clusters were listed more than once), and the number which are matched to a parent catalog based on SDSS DR4 is 403. Of these, a visual inspection of the fields centred on C4 BCGs fainter than $M_r < -21$ often showed a brighter galaxy nearby, especially when the C4 BCG was a spiral. If we restrict attention to objects with $M_r < -21$, then 286 have SDSS reported velocity dispersions, and have at least 10 other luminous galaxies ($M_r < -21$) within $1h^{-1}$Mpc. The SDSS does not estimate velocity dispersions from spectra which have strong emission lines, so our requirement that the SDSS reports a velocity dispersion means that the objects we select are almost certainly not AGN. Removing the final cut on 'richness' increases the sample of BCGs to 324, but does not change the results which follow.

Visual inspection of the SDSS images of these objects shows that 25% actually have spiral arms; the absence of emission lines in the spectra of these objects is presumably because the SDSS fiber, with a radius of 1.5 arcsec, only sees the inner bulge. In what follows, we will be careful to distinguish the scaling relations of the ~ 215 genuine early-type BCGs from the rest.

It happens that BCGs are a class of object for which the SDSS photometric reductions are particularly unreliable: the reported magnitudes are in error by far more than the quoted 0.02 mags, with some discrepancies as large as 1 mag (Hyde et al. 2006). This is due to a combination of factors: because BCGs are often in crowded fields, the SDSS reductions tend to overestimate the sky level. This results in underestimates of the BCG magnitude and half-light radius, which are particularly severe for BCGs with large half-light radii. In addition, the surface brightness distributions of BCGs do not always follow pure single component deVaucouleurs profiles, which the SDSS reductions assume. For these reasons, we have performed our own photometric reductions, and examined the image of each BCG by eye. A more detailed discussion of the various issues involved is provided by Hyde et al. (2006), whose results we use below.

Because we will be interested in comparing the properties of BCGs to those of other early-type galaxies, we have also reanalyzed the photometric properties of the sample of 9000 SDSS early-type galaxies defined in Bernardi et al. (2003a). It is these parameters (i.e. those based on Hyde et al. 2006), rather than those output from the SDSS pipeline, which we use in what follows. On average, the Hyde et al. magnitudes are 0.1 mags brighter than those reported by the SDSS DR4 pipeline, and the sizes are about 10% smaller. In crowded fields, and especially for bright objects, Hyde et al. report both brighter magnitudes and larger sizes than does the SDSS. When comparing the scaling relations of these objects with those for the