Radial kinematics of brightest cluster galaxies
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Introduction
Brightest cluster galaxies (BCGs) are special. They have extremely high luminosities, diffuse and extended structures (see Figure 1), and dominant locations in clusters. Because of their special location in the cluster, they are believed to be sites of very interesting evolutionary phenomena (e.g. dynamical friction, galactic cannibalism, cooling flows). This special class of objects may well require there to have been a special process of formation. Mergers between smaller galaxies, massive star formation in the early stages of the formation of the cluster due to the (now extinguished) cooling flows, or monolithic collapse that may originate from unusually large primordial fluctuations, are all possible formation mechanisms. These processes will leave different imprints in the dynamical properties and in the detailed chemical abundances of the stars.

We have initiated a project devoted to the investigation of a large sample of BCGs, their kinematic and stellar population properties, and the relationships between those and the properties of the cluster. We have obtained high signal-to-noise ratio, long-slit spectra of 49 of these galaxies with the Gemini North and South telescopes.

Galaxy Sample and Observations
We selected and observed a statistically significant sample of nearly BCGs over a 30-month period 2006–2008. The selection methods and criteria are described in Loubsier et al. (2008). A subset of 10 of the brightest galaxies selected were observed at the 4.2 m WHT telescope in June 2008. Further to this, we obtained 41 galaxies with the GEMINI North and South telescopes in the 2006B, 2007A and 2007B observing semesters. Observations of the Lick calibration stars are from the Gemini Science Archive from previous programmes (PI: B. Miller).

Spatially Resolved Kinematics Results

Figure 1 shows the luminosity–velocity dispersion relation fitted with a linear least-squares fit to the BCG data, even though the data exhibit a large amount of scatter. The Faber–Jackson relation for normal elliptical galaxies is shown from the Faber–Jackson relation (Figure 3 & 4). However, because of the generally large central velocity dispersions, the BCG data is consistent with the trend for very massive elliptical galaxies to be supported by the random motions of stars and not by rotation. At least 15 (out of 49) BCGs show clear velocity substructure in their profiles (Figure 5, 6 & 7). Six (out of 49) BCGs were found to have a positive velocity dispersion gradient (Figure 8).

Conclusions and Further Work
Clear rotation curves were found for a number of galaxies for which major axis spectra were obtained, and in particular, two galaxies were found to have rotational velocities exceeding 100 km s<sup>-1</sup>. The large rotation is unequivocally in the light of numerical simulations, which predict that the bombardment of small satellites without gas is very effective at heating the disc and creating a spherical supported by velocity anisotropy. However, in general the BCG data are consistent with the trend for very massive elliptical galaxies to be supported by velocity anisotropy on the anisotropy-luminosity diagram. At least 1% per cent of the BCGs show very clear velocity substructure. Despite the undoubtedly special nature of BCGs due to their extreme morphological properties and locations, the kinematic properties investigated here seem normal when compared with their ordinary giant elliptical counterparts. However, there are exceptions: 1) BCGs lie above the Faber–Jackson relation, which is naturally explained if the galaxies formed through dissipationless mergers of elliptical galaxies on radial orbits; and 2) the rising velocity dispersion profiles found for a small number of BCGs, which are generally not found in ordinary ellipticals, and might imply a rising M<sub>e</sub> ratio. For the stellar population analysis of this sample of BCGs, see poster by Loubsier et al. at this meeting.

Figure 9 shows the luminosity–velocity dispersion relation fitted with a linear least-squares fit to the BCG data, even though the data exhibit a large amount of scatter. The Faber–Jackson relation for normal elliptical galaxies is shown from the Faber–Jackson relation (Figure 3 & 4). However, because of the generally large central velocity dispersions, the BCG data is consistent with the trend for very massive elliptical galaxies to be supported by the random motions of stars and not by rotation. At least 15 (out of 49) BCGs show clear velocity substructure in their profiles (Figure 5, 6 & 7). Six (out of 49) BCGs were found to have a positive velocity dispersion gradient (Figure 8).

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Observations presented here were obtained with the WHT and Gemini North and South telescopes.