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The stellar structure of early-type galaxies: a wide-field Mitchell Spectrograph view

N. F. Boardman[1]†, A. Weijmans[1], R. C. E. van den Bosch[2], L. Zhu[2], A. Yildirim[2], G. van de Ven[2], M. Cappellari[3], P. T. de Zeeuw[4,5], E. Emsellem[4], D. Krajnović[6] and T. Naab[7]

[1]School of Physics and Astronomy, University of St Andrews, KY16 9SS UK
[2]Max Planck Institute for Astronomy, Königstuhl 17, D-69117 Heidelberg, Germany
[3]Sub-department of Astrophysics, Department of Physics, University of Oxford, Denys Wilkinson Building, Keble Road, Oxford OX1 3RH
[4]European Southern Observatory, Karl-Schwarzschild-Str. 2, 85748 Garching, Germany
[5]Sterrewacht Leiden, Leiden University, Postbus 9513, 2300 RA, Leiden, The Netherlands
[6]Leibniz-Institut für Astrophysik Potsdam (AIP), An der Sternwarte 16, D-14482 Potsdam, Germany
[7]Max-Planck-Institut für Astrophysik, Karl-Schwarzschild-Str. 1, 85741 Garching, Germany

Much progress has been made in recent years towards understanding how early-type galaxies (ETGs) form and evolve. SAURON (Bacon *et al.* 2001) integral-field spectroscopy from the ATLAS3D survey (Cappellari *et al.* 2011) has suggested that less massive ETGs are linked directly to spirals, whereas the most massive objects appear to form from a series of merging and accretion events (Cappellari *et al.* 2013). However, the ATLAS3D data typically only extends to about one half-light radius (or effective radius, R_e), making it unclear if this picture is truly complete.

We observed twelve nearby ETGs using the Mitchell Spectrograph (Hill *et al.* 2008). We extracted stellar kinematics out to the fourth Gauss-Hermite moment, reaching $3R_e$ in most cases. We found no abrupt transitions in the ETG's λ_R (Emsellem *et al.* 2007) profiles beyond $1R_e$, consistent with our ETGs having mostly passive recent histories.

We used triaxial (van den Bosch *et al.* 2008) Schwarzchild (1979) modelling to investigate one galaxy - NGC 3998 - in more detail (Boardman *et al.* 2016). We find NGC 3998 to be near-oblate, with an axis ratio $q < 0.49$ at 1 R_e. We obtain an I-band M/L of $4.7^{+0.32}_{-0.45}$, in good agreement with independent stellar population modelling results (Cappellari *et al.* 2013). Our models prefer low dark matter fractions, with a fraction of $(7.1^{+8.1}_{-7.1})\%$ within $1R_e$. Our best-fit model contains few non-rotating orbits beyond $1R_e$, from which we infer that late-time accretion was not significant for this galaxy.

References

Bacon, R., Copin, Y., Monnet, G., *et al.* 2001, *MNRAS*, 326, 23
Boardman, N., Weijmans, A., van den Bosch, R. C. E. *et al.* 2016, *MNRAS*, 460, 3029
van den Bosch, R. C. E., van de Ven, G., Verolme, E. K., Cappellari, M., & de Zeeuw, P. T. 2008, *MNRAS*, 385, 647
Cappellari, M., Emsellem, E., Krajnović, D., *et al.* 2011, *MNRAS*, 413, 813
Cappellari, M., McDermid, R. M., Alatalo, K., *et al.* 2013, *MNRAS*, 432, 1862
Emsellem, E., Cappellari, M., Krajnović, D., *et al.* 2007, *MNRAS*, 379, 401
Hill, G. J., MacQueen, P. J., Smith, M. P., *et al.* 2008, *Ground-based and Airborne Instrumentation for Astronomy II*, article id. 701470
Scwarzschild, M. 1979, *ApJ*, 232, 236

† E-mail: nfb@st-andrews.ac.uk