Galaxies in 3D across the Universe
Proceedings IAU Symposium No. 309, 2014
B. L. Ziegler, F. Combes, H. Dannerbauer, M. Verdugo, eds.

doi:10.1017/S1743921314009922

KMOS Clusters and VIRIAL GTO Surveys

D. Wilman[1,2,*], R. Bender[1,2], R. L. Davies[3], J. T. Mendel[2], J. Chan[2], A. Beifiori[1,2], R. Houghton[3], R. Saglia[2], N. Förster Schreiber[2], S. Wuyts[2], P. van Dokkum[4], M. Cappellari[3], J. Stott[5], R. Smith[6], M. Fossati[1,2], S. Kulkarni[2], S. Seitz[1], M. Fabricius[2], R. Sharples[5], G. Brammer[7], E. Nelson[4], I. Momcheva[4], M. Wegner[1] and I. Lewis[3]

[1]Universitäts-Sternwarte München, Scheinerstr. 1, D-81679 Munich, Germany
[2]Max-Planck-Institut für extraterrestrische Physik, Giessenbachstr. 1, D-85741 Garching, Germany
[3]Physics Department, University of Oxford, Denys Wilkinson Building, Keble Road, Oxford OX1 3RH, UK
[4]Department of Astronomy, Yale University, New Haven, CT 06511, USA
[5]Institute for Computational Cosmology, Durham University, South Road, Durham DH1 3LE, UK
[6]Department of Physics, University of Durham, South Road, Durham DH1 3LE, UK
[7]Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA
[*]email: dwilman@mpe.mpg.de

Abstract. We present the KMOS (**K**-band **M**ulti-**O**bject **S**pectrograph) Cluster and VIRIAL (**V**LT **IR** **I**FU **A**bsorption **L**ine) Guaranteed Time Observation (GTO) programs. KMOS provides 24 arms each feeding an integral field unit (14×14 spaxels of 0.2″ pixels) for IZ, YJ, H and K band near infrared (NIR) medium resolution spectroscopy (R ∼ 3500). Targets are selected from a 7.2′ diameter patrol field. Ultra-deep spectroscopy of ∼ 80 early-type cluster galaxies (∼ 20hr on source) and ∼ 200 (∼ 10hr on source) early-type field galaxies at $1 < z < 2$ will dramatically improve the situation at $z > 1$ for which measurements of stellar velocity dispersions and absorption indices are limited to a few, often relatively young passively evolving galaxies (e.g. Bezanson 2013). In ESO Periods P92 and P93, 15 nights worth of data has been collected for KMOS-Clusters and 6 nights for VIRIAL: this will be supplemented with more data in upcoming semesters. All galaxies have multiband HST imaging including existing or upcoming WFC3 IR imaging, providing stellar mass maps and sizes. Combined with our dispersion measurements, this will allow us to examine the fundamental plane and the dynamical mass of a large sample of $z > 1$ galaxies for the first time, for both cluster and field galaxies.

Acknowledgements

D. Wilman and M. Fossati acknowledge support from the Deutsche Forschungsgemeinschaft (DFG) via Project ID 387/1-1. We thank the conference organizers for the opportunity to present this work.

References

Jee, M. J., *et al.*, 2011, *ApJ*, 737, 59
Mullis, C. R., *et al.*, 2005, *ApJ*, 623, L85
Kurk, J., *et al.*, 2009, *A&A*, 504, 331
Bezanson, R., *et al.*, 2013, *ApJ*, 779, L21

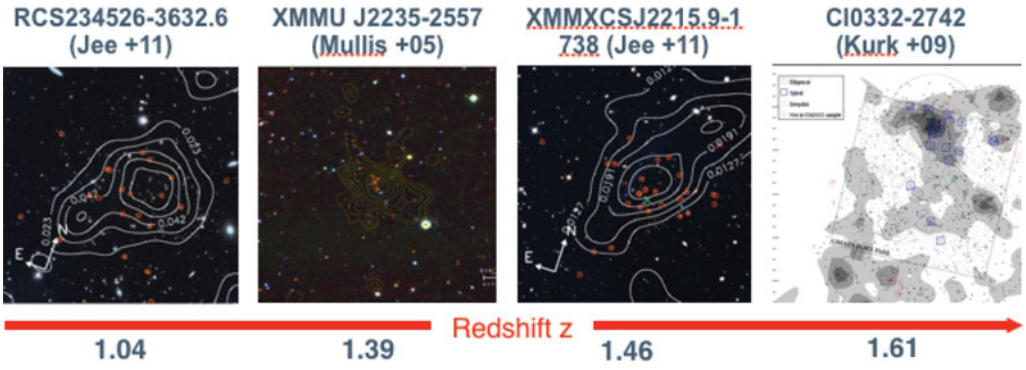

Figure 1. High redshift galaxy clusters observed with KMOS as part of the KMOS Clusters Guaranteed Time program. Well studied clusters at $z > 1$ with known galaxy redshifts, deep photometry and HST imaging are selected for KMOS observations. The panels show existing cluster HST imaging with Xray emission contours (first and third panels) and galaxy density contours (right panel) and are taken from the papers labelled above. Very deep ($\gtrsim$20 hour) KMOS YJ and IZ band observations of $\gtrsim$20 galaxies per cluster provides a large sample of $\gtrsim$80 high redshift cluster galaxies. Most KMOS arms are allocated to brighter red sequence galaxies, with remaining arms allocated to fainter red galaxies or bright blue galaxies with spectroscopic redshifts consistent with the cluster redshift. Clusters which lack high resolution HST imaging in the NIR are soon to be observed with WFC3. All clusters will then have multiband high resolution imaging to complement the KMOS spectroscopy. We have already collected 15 nights worth of data in P92-93 and an optimal data reduction is being developed which maximises S/N and allows us to measure the stellar velocity dispersion for many objects. Fainter objects and indices can be measured for stacked data where the S/N of individual objects is not sufficient.

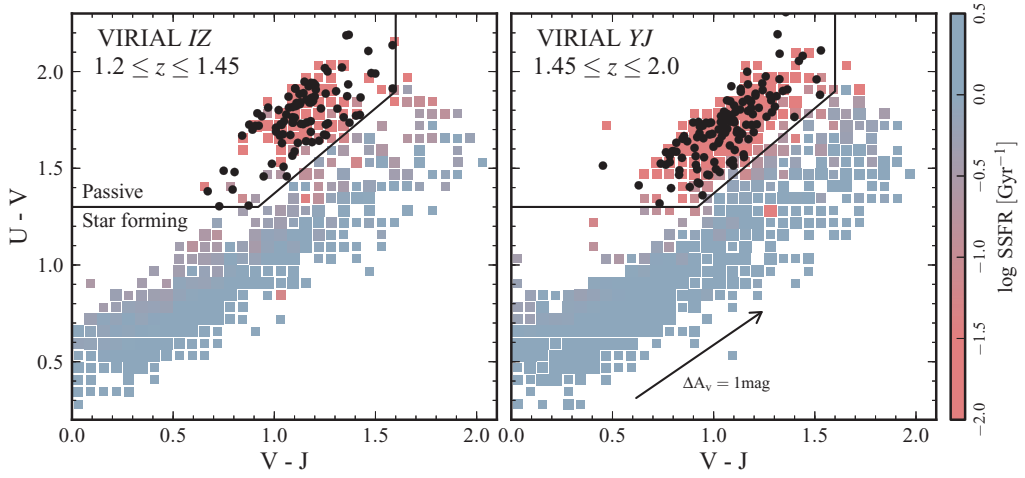

Figure 2. *UVJ* selection of galaxies for the VIRIAL field survey of passive galaxies in $U - V$ versus $V - J$ space. We select galaxies from the upper left of the diagram (black points correspond to galaxies selected for KMOS observations, bounded by the solid lines). This method separates passively evolving stellar populations from star forming populations including those with high dust extinction, as the dust vector is parallel to the selection threshold (see arrow in right panel). We select galaxies in 2 different redshift ranges, corresponding to the KMOS IZ ($1.2 \leqslant z \leqslant 1.45$, left panel) and YJ ($1.45 \leqslant z \leqslant 2.0$, right panel) grisms. Targets are selected from deep fields with deep CANDELS multiband HST photometry and 3dHST grism spectroscopic redshifts. Observations of $\gtrsim$ 10hours for $\gtrsim$ 200 galaxies complement those of the KMOS clusters program in terms of environment, depth, selection, redshift range and spectral coverage.

https://doi.org/10.1017/S1743921314009922 Published online by Cambridge University Press