Galaxies in 3D across the Universe
Proceedings IAU Symposium No. 309, 2014
B. L. Ziegler, F. Combes, H. Dannerbauer, M. Verdugo, eds.
© International Astronomical Union 2015
doi:10.1017/S1743921314009752

The Cosmic Skidmark: witnessing galaxy transformation at z = 0.19

David N. A. Murphy

Instituto de Astrofísica, Facultad de Física,
Pontificia Universidad Católica de Chile
email: dmurphy@astro.puc.cl

Abstract. We present an early-look analysis of the "Cosmic Skidmark". Discovered following visual inspection of the Geach, Murphy & Bower (2011) SDSS Stripe 82 cluster catalogue generated by ORCA (an automated cluster algorithm searching for red-sequences; Murphy, Geach & Bower 2012), this z = 0.19 1.4L* galaxy appears to have been caught in the rare act of transformation while accreting onto an estimated 10^{13}–$10^{14}\,h^{-1}\,M_\odot$-mass galaxy group. SDSS spectroscopy reveals clear signatures of star formation whilst deep optical imaging reveals a pronounced 50 kpc cometary tail. Pending completion of our ALMA Cycle 2 and IFU observations, we show here preliminary analysis of this target.

Keywords. galaxies: evolution - galaxies: clusters: general

1. Introduction

Study of galaxy populations reveal clearly bimodal properties such as morphology, the colour-magnitude distribution (CMD) and star formation rates (see e.g. Kauffmann *et al.* 2006). The origin of this dichotomy appears to be driven mainly by galaxy environment; compared to those in the low-density field, spiral galaxies in clusters exhibit suppressed star formation, smaller cold-gas reservoirs and truncation of their gaseous disks (Boselli & Gavazzi 2006). The evolution of the CMD into a progressively pronounced "red sequence" (Bower, Lucey & Ellis 1992) at early times, indications of a transitional CM "green valley" and a lack of high-mass blue spirals point to the transformation of late-type spirals into early-type ellipticals within cluster environments. Examples of such transformations (most recently Jáchym *et al.* 2014) are valuable case-studies that deepen our understanding of galaxy evolution. To this end, we present a preliminary look at the "Cosmic Skidmark" - an example of galaxy transformation in action.

2. Data

The Cosmic Skidmark investigation consists of three datasets. The first is with deep (7hr) *griz*-band SOAR Adaptive Module (SAM; Tokovinin *et al.* 2008) photometry (shown in Figure 1 *left*. We compliment this with 14hrs of VLT/VIMOS IFU data covering a 27"x27" FOV over 3837Å–7430Å rest-frame at a spaxel resolution of 0.67"x0.67". Finally, we await completion of a 3hr ALMA Band 3 scan to measure tracers of neutral gas from reservoirs potentially fuelling the sites of strong star-formation. The latter two datasets are partially complete. The z=0.19 redshifting of spectral features permits IFU measurement of [OII] line emission in addition to ALMA mapping of CO(1-0) and CN(1-0) over one pointing covering the target galaxy, group members and environs to a 3σ CO line sensitivity of 0.34mJy.

https://doi.org/10.1017/S1743921314009752 Published online by Cambridge University Press

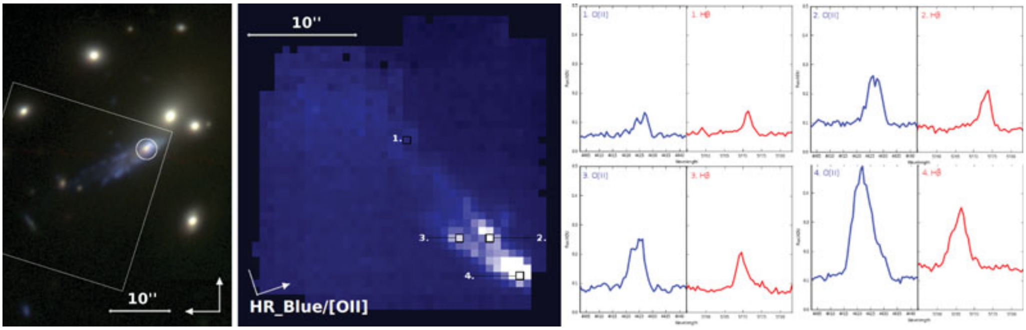

Figure 1. (*left*) SAM *gri*-composite imaging of the Cosmic Skidmark along with the VIMOS/IFU footprint and SDSS spectrographic fiber position. (*middle*) Blue-grism VLT/VIMOS IFU datacube centred on observed-frame [OII] emission (λ_{obs}4420Å). Samples of spectra corresponding to the numbered spaxels are shown *right*.

3. Preliminary findings and outlook

Figure 1 (*centre*) shows a datacube for the high-resolution VPH blue VLT/VIMOS grism centred on the wavelength corresponding to observed-frame [OII] line emission. Spectra for the numbered spaxels can also be found in Figure 1 (*right*). With three key spectral indicators ([OII],[OIII],Hβ) we find clear indications of star formation in the galaxy core (spaxel 4), in agreement with SDSS fiber spectroscopy. Star formation, evident throughout the cometary plume, traces out the dual-tail structure (spaxels 2,3) alluded to in optical imaging. We find evidence for line emission out to 50 kpc from the galaxy core (spaxel 1). Inspection of deep *g*-band SAM imaging near this spaxel reveals a number of small galaxies and clumps clustered downstream at the tail-end of the plume. With *g-r* colours consistent with the group red-sequence suggesting a similar redshift to the Cosmic Skidmark, they may possibly have been disturbed by it's passage through the group. Future work will focus on probing this site, in particular two diffuse ($g\sim$25.2mag/arcsec^2) tidal dwarf-scale sources seen stretching between two brighter sources. VIMOS star-formation maps can be connected to ALMA CO(1-0), CN(1-0) and SiO(3-2) line emission mapping of molecular gas reservoirs and will permit measurement of the star formation efficiency, kinematical differences between the star-forming and cold-gas, gas depletion timescales and outflow signatures. A detailed analysis of this target will appear in Murphy *et al.* (2014, in preparation).

Acknowledgements

The author acknowledges support through FONDECYT grant 3120214.

References

Boselli A. & Gavazzi G., 2006, *PASP*, 118, 517

Bower R. G., Lucey J. R., & Ellis R. S., 1992, *MNRAS*, 254, 601

Geach J. E., Murphy D. N. A., & Bower R. G., 2011, *MNRAS*, 413, 3059

Jáchym P., Combes F., Cortese L., Sun M., & Kenney J. D. P., 2014, *ApJ*, 792, 11

Kauffmann G., Heckman T. M., Brinchmann G., Charlot J., Tremonti S., White C., & Brinkmann S. D. M., 2006, *MNRAS*, 367, 1394

Murphy D. N. A., Geach J. E., & Bower R. G., 2012, *MNRAS*, 420, 1861

Tokovinin A., Tighe R., Schurter P., Cantarutti R., Martinez N., Mondaca M., & Montane E., 2008, *SPIE*, 7015

https://doi.org/10.1017/S1743921314009752 Published online by Cambridge University Press