The Cosmic Skidmark:

witnessing galaxy transformation at z=0.19

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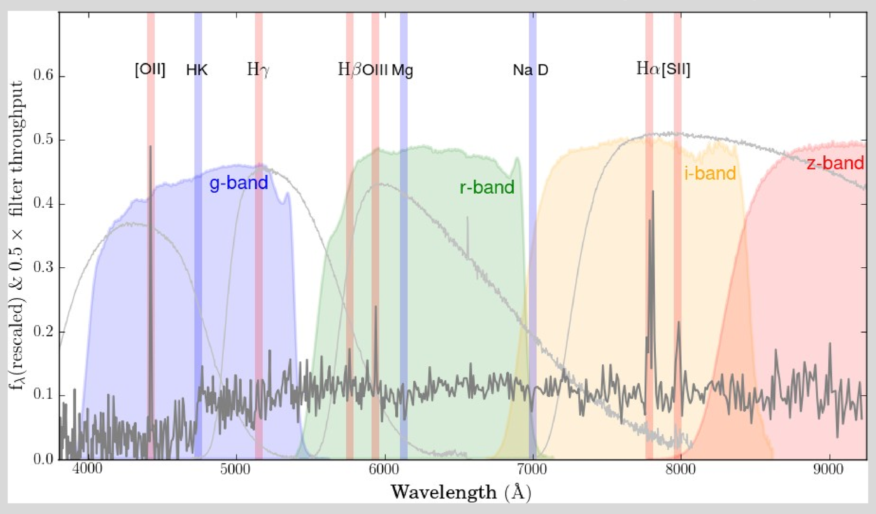
We present an early-look analysis of the "Cosmic Skidmark". Discovered following visual inspection of the Geach, Murphy & Bower (2011) SDSS Stripe 82 cluster catalogue generated by ORCA - an automated cluster algorithm searching for red-sequences (Murphy, Geach & Bower 2012), this z=0.19 1.4L★ galaxy 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 (Stott et al. 2012). Pending additional data from ALMA Cycle 2, we show here preliminary analysis of VLT/VIMOS IFU spectroscopy and deep SOAR Adaptive Module (SAM) LGS optical imaging.

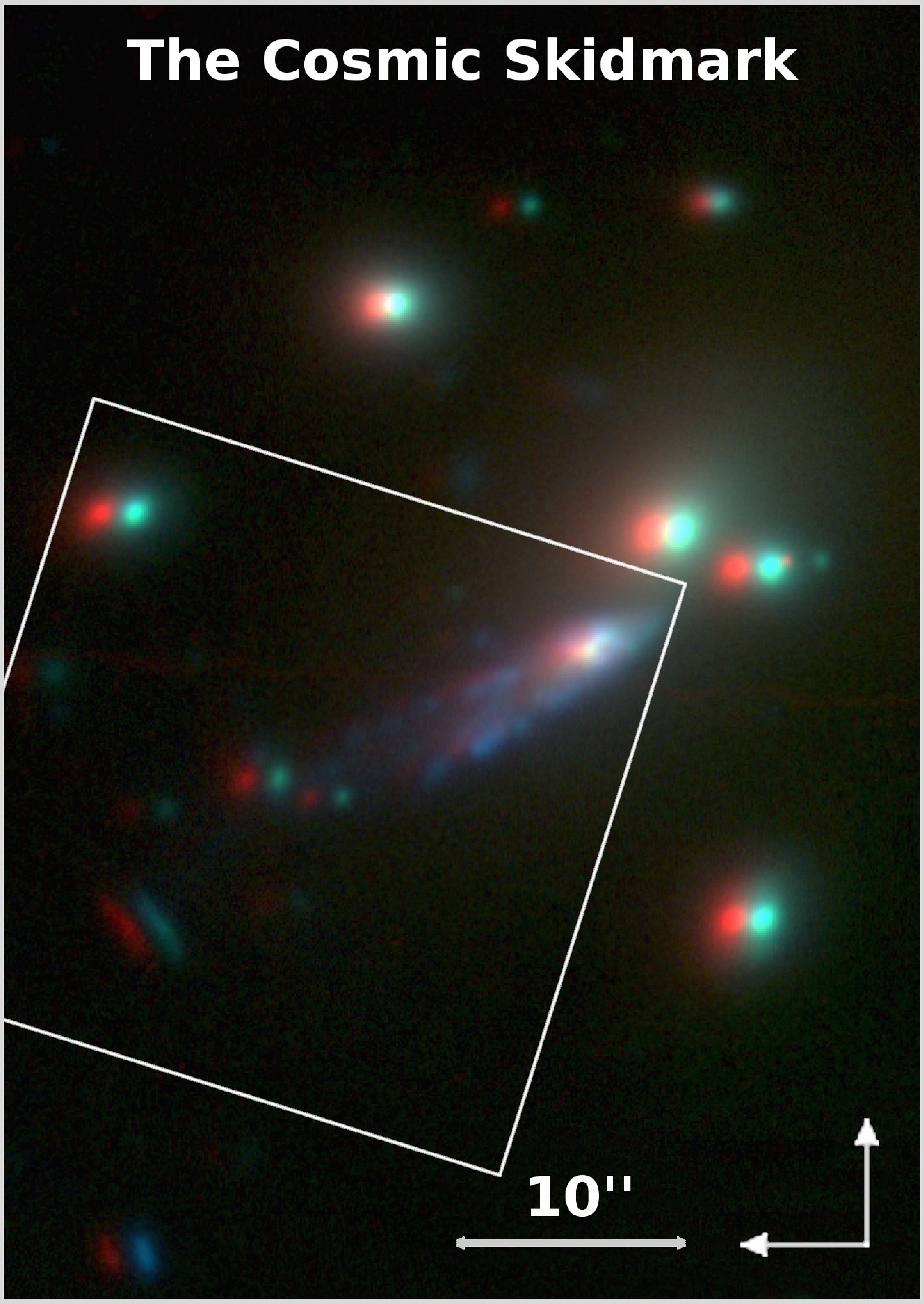
The study of galaxy populations reveals clearly bimodal properties such as morphology (Driver et al. 2006), star formation rates (Kauffmann et al. 2006) and the colour-magnitude distribution (Baldry et al. 2006). The origin of this dichotomy appears to be driven mainly by galaxy environment (Dressler et al. 1997); compared to those in the low-density field, spiral galaxies in clusters exhibit suppressed star formation, smaller cold-gas reservoirs and gaseous disk truncation of their (Boselli & Gavazzi 2006).

The redshift evolution of the colour-magnitude (CM) distribution into a progressively pronounced "red sequence" (Bower et al. 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** (Stott et al. 2007) within cluster environments.

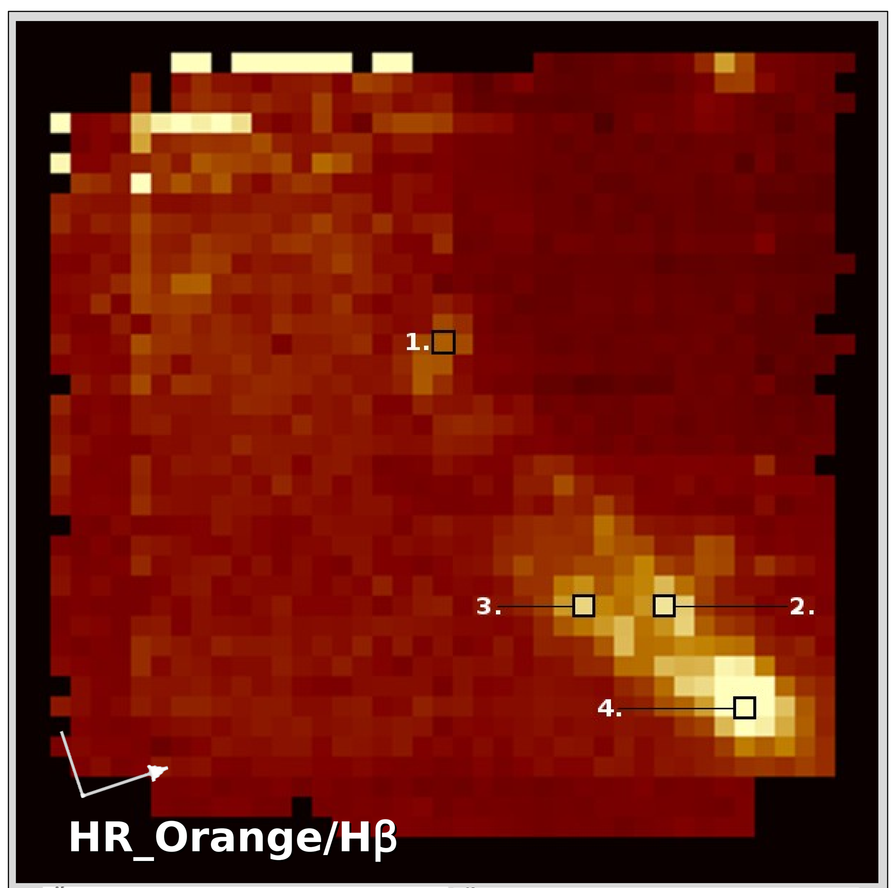
The SDSS spectroscopic catalogue provides a 3''-diameter fiber spectrum centred on the Cosmic Skidmark's core (red circle in bottom image) but also includes light from the blue component of the target. The spectrum shows a clear 4000Å break associated with early-type galaxies, but also strong [OII] (λ_{obs}4420Å), Hβ (λ_{obs}5767Å), [OIII] (λ_{obs}5883Å) and Hα (λ_{obs}7788Å) line emission (equivalent widths 30Å, 4Å, 6Å and 26Å respectively).

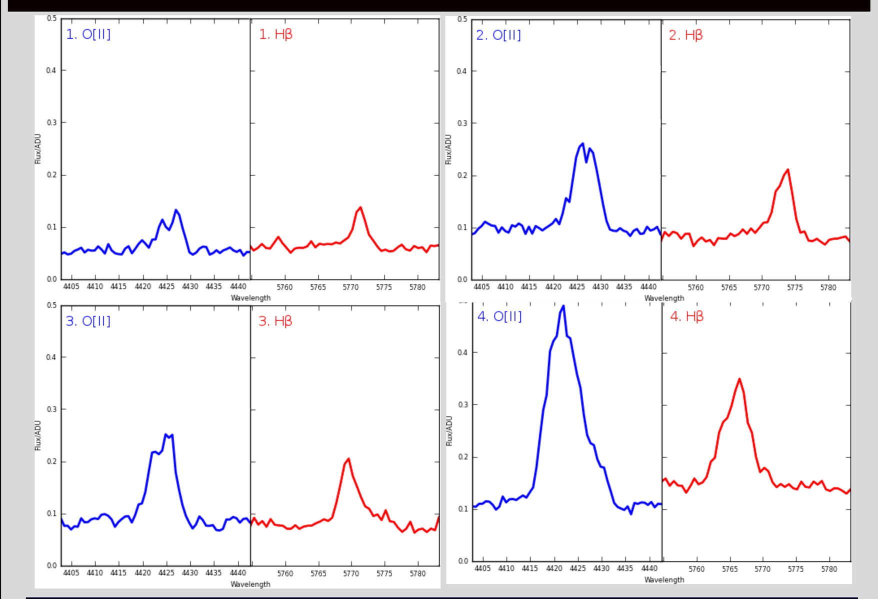


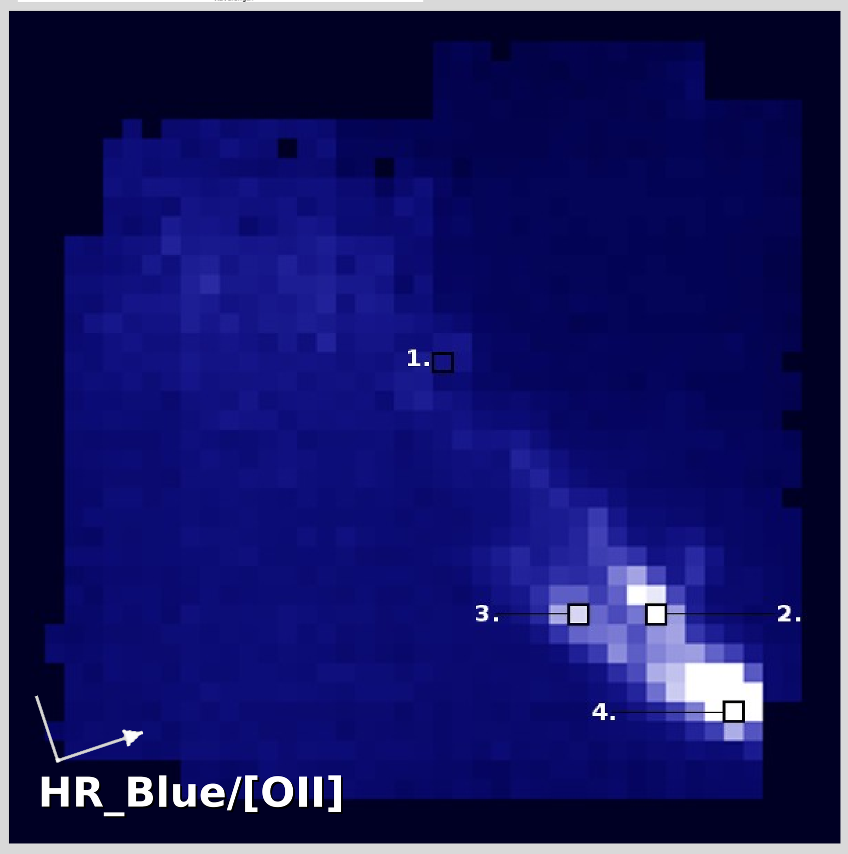
From measured equivalent widths, we determine a mean SFR based on their H- and [OII]-derived calculations (using the Kewley et al. 2004 and Kennicutt et al. 2009 relations). Determining that the SDSS fiber covers the entire galaxy without significantly sampling the background, an SFR surface-density of $\log_{10}$SFR=-1.9Myr^{-1}kpc^{-2} is estimated. This is used to determine the required sensitivity our ALMA Cycle 2 observations must reach to trace the H_2 gas.



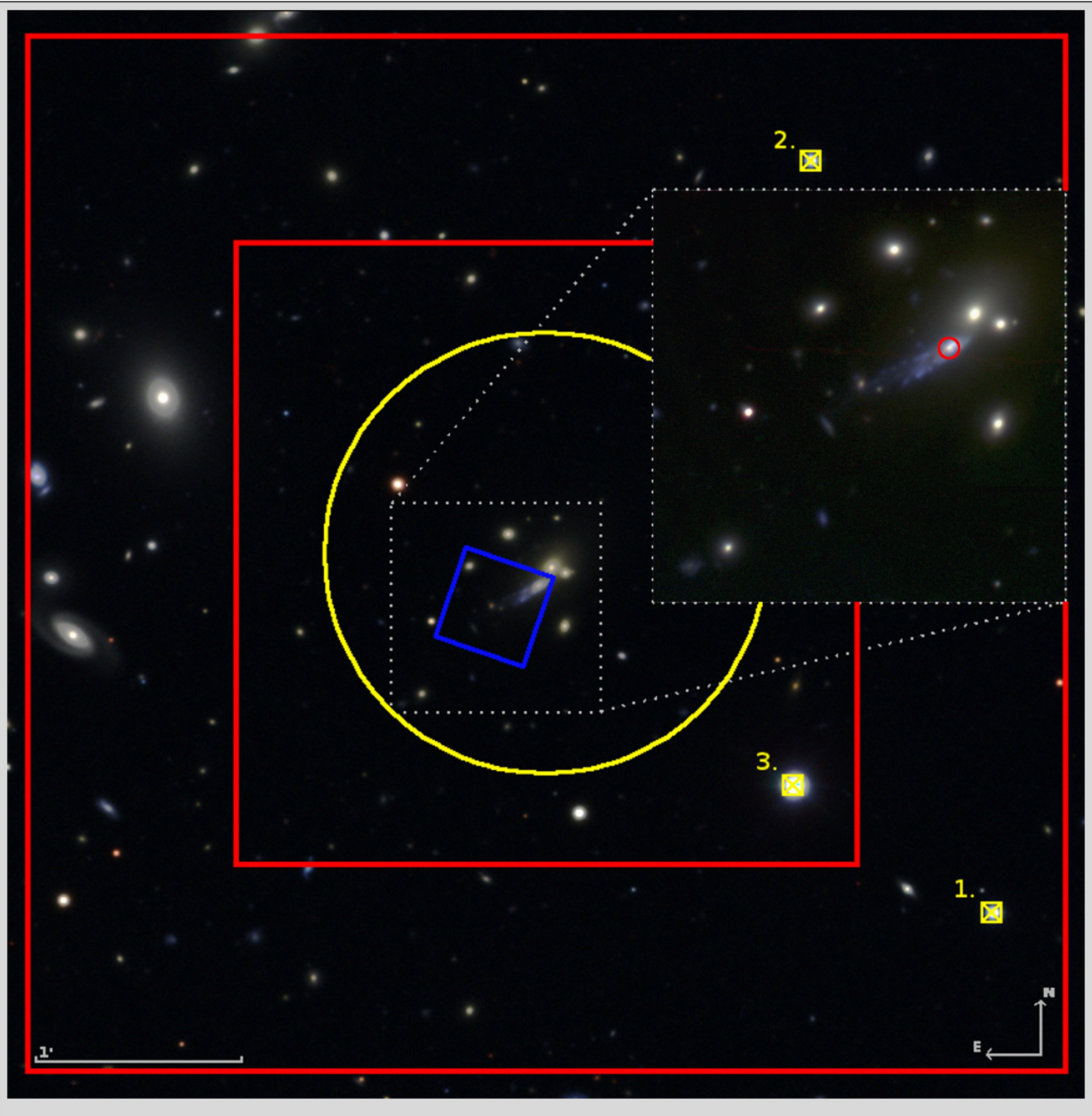
SOAR Adaptive Module (SAM) LGS *gri*-composite 3D anaglyph conversion of the Cosmic Skidmark along with the VIMOS/IFU FOV. The cometary plume, strongly star-forming, extends for ~50kpc.







Deep VLT/VIMOS IFU data provides a truly 3D measurement of the target, and permits spectral identification of three key star formation indicators ([OII],[OIII],Hβ). We find clear SF evidence throughout the plume, tracing out the dual-tail structure alluded to in the optical imaging. Detailed kinematic analysis will appear in Murphy et al. (2014)



Our Cosmic Skidmark investigation will consist of three datasets. Preliminary wide-field *gri*-band Magellan IMACS photometry (*left*) was followed up with deep (7hrs) *griz*-band SOAR Adaptive Module (SAM; Tokovinin et al. 2004) photometry. This LGS instrument achieved 0.61"(0.57") median g(i)-band seeing in a 3'x3' FOV indicated by the smaller red square.

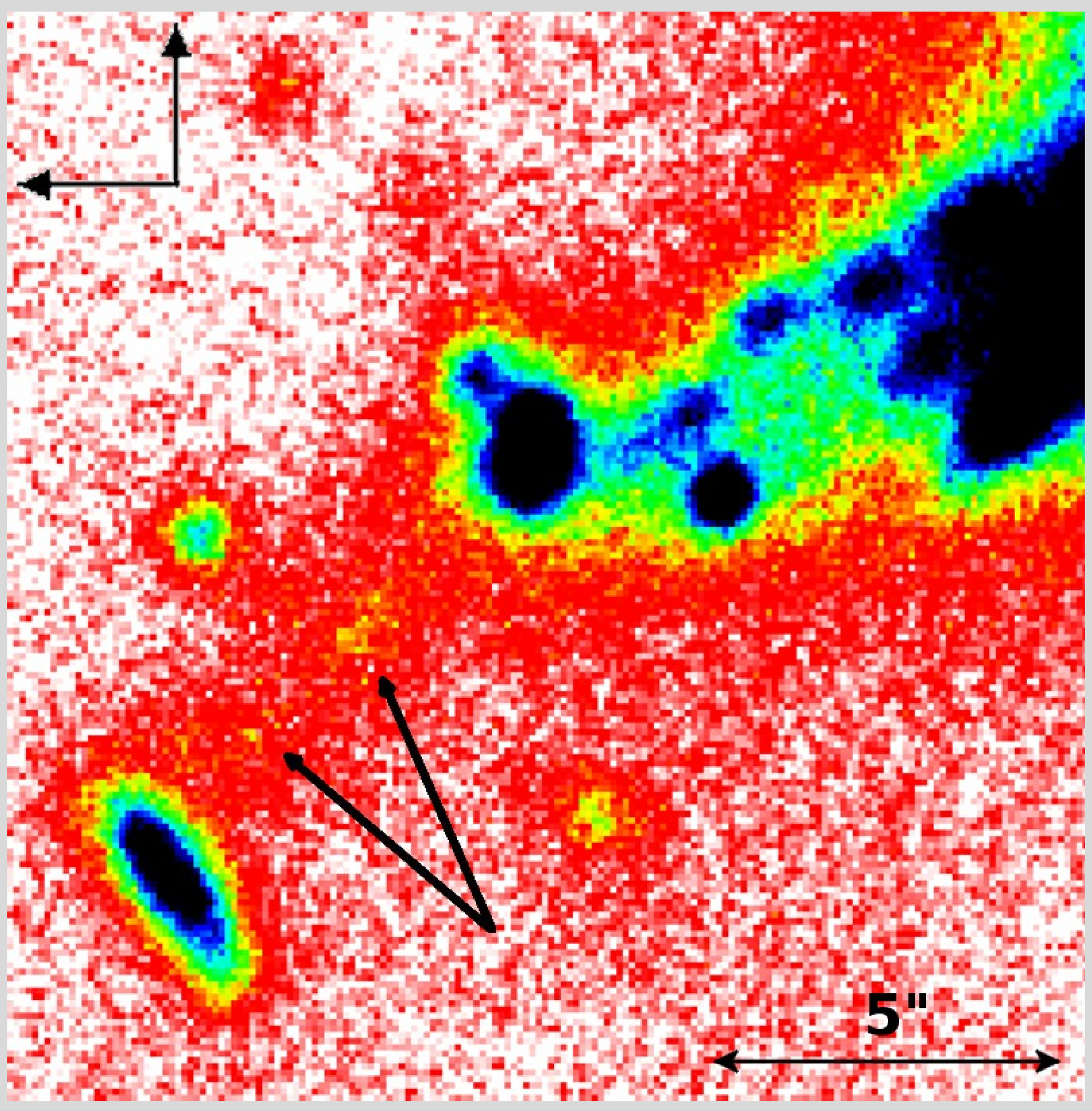
We compliment this with 14hrs of VLT/VIMOS IFU data covering 3837Å--7430Å rest-frame with a spaxel resolution of 0''.67x0''.67 and a 27''x27'' FOV indicated by the blue square (see also main image).

Finally, we await a 3hr ALMA Band 3 scan within the yellow circle to measure CO(1-0) and CN(1-0) tracers of neutral gas reservoirs potentially fuelling the sites of strong star-formation.

Close inspection of the deep g-band SAM data reveals a number of small galaxies and clumps clustered downstream at the tail-end of the plume.

These galaxies may have interacted with the Skidmark and been subsequently disturbed by it's rapid passage through the group. The g-r colours of these "roadkill" galaxies are consistent with the group red sequence, suggesting they may be at a similar redshift.

Of particular interest is the diffuse (g~25.2mag/arcsec^2, 3σ) flux shown and seen stretching between two brighter sources. The two faint sources arrowed are located in the ideal environment to form tidal dwarf galaxies (Duc & Renaud 2013), and have spatial scales of 2h^{-1}kpc-4.5h^{-1}kpc.



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