

**The KMOS/VLT revolution: rotation curves, metallicities, dust extinction and galaxy formation and evolution with hundreds of galaxies at  $0.8 < z < 2.23$**

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**Abstract:** By conducting very large 5-10 deg<sup>2</sup> narrow-band surveys to search for emission-line sources with WIRCam/CFHT and WFCAM/UKIRT, we have found thousands of individual distant H $\alpha$  emitters at  $z=0.8$ , 0.84, 1.47 and 2.23. These are ideal samples to study the metallicities, dust extinction and rotation curves of star-forming galaxies and how these have evolved from the peak of the star-formation history ( $z\sim 2.5$ ) till today. By using KMOS (a second-generation VLT instrument that is starting observations at the end of 2013), the student will be able to gain unprecedented detailed information on a large sample of galaxies. KMOS, with its 24 Integral Field Units (IFUs) allows to target up to 24 galaxies at the same time, obtaining an image and a near-infrared spectrum for each pixel. This is a unique opportunity to map the distribution and intensity of star formation, dynamics and metallicity on  $\sim 4$  kpc scales and address: (i) What is the fraction of primitive disks, spheroids and mergers; (ii) Is the distribution of star formation at high- $z$  more centrally concentrated than comparably luminous/turbulent galaxies at  $z\sim 0$ ? and iii) Are chemical abundance gradients weaker or stronger than local spiral galaxies and do those change with time? Answers to these questions using our well selected samples will address whether stellar mass assembly at  $z\sim 1-2$  is dominated by secular isolation or via merger-induced growth and will provide some of the strongest tests/constraints to the most sophisticated models of galaxy formation and evolution. By selection, all of the targets have known H $\alpha$  fluxes and all are sufficiently bright so their resolved properties can be recovered and the survey efficiency will be  $\sim 100\%$ .

One unique aspect of this project is that there are significant over-densities in the very large samples of H $\alpha$  emitters, and thus, with KMOS, the student will be able to confirm and characterise the high redshift structures, derive accurate metallicities, measure the mass-metallicity relation, obtain Balmer decrement extinctions and identify AGN for a sample of hundreds of H $\alpha$ -selected galaxies and investigate if the environment plays a role in setting these galaxy properties. This project's approach is unique: not only will it advance our knowledge at  $z=2.2$ , 1.47, 0.8 with robust, H $\alpha$  selected samples that can be built very quickly and used to access evolution, but it will also unveil any dependence on environment of SFRs, dust extinction, metallicities, and AGN fraction for the first time even at  $z > 2$ .

**Facilities:** VLT/KMOS, VLT/SINFONI, ALMA, CFHT/WIRcam, Subaru/FMOS