SINS: the high-redshift galaxy Spectroscopic Imaging survey in the Near-IR with SINFONI

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Abstract

While it has become clear in recent years that most of the baryonic mass in galaxies was put in place by redshift $z \sim 1$, the details of how the mass was assembled — and how this mass assembly depended on galaxy mass, type, and environment — remain unclear. Detailed spatially-resolved studies of individual galaxies are crucial to adress this issue, specifically to better understand the physics of the baryonic processes that drive galaxy formation and evolution, and to set key observational constraints for cosmological simulations. Such studies have now become possible with the adaptive-optics (AO) assisted near-IR integral field spectrometer SINFONI at the VLT, and other similar instruments at large ground-based telescopes.

I will present the results of our on-going program of near-IR imaging spectroscopy of high redshift galaxies with SINFONI: the "SINS" survey. To date, we have observed about 30 high redshift sources selected in a variety of ways. Our SINFONI data provide spatially-resolved information on the dynamics, stellar populations, metallicities, and ionization state of the gas on typical resolved scales of $4 - 5$ kpc from rest-frame optical spectral diagnostics (Hα, [NII], [OIII], [OII], Hβ emission lines, and continuum emission). I will discuss the characteristic kinematics and morphologies of galaxies in our samples, their nature (rotating disks versus mergers), and the implications of our results on the baryonic content and on the dynamical and stellar evolutionary state of the galaxies. I will further highlight high resolution SINFONI observations of a $z = 2.38$ galaxy from AO-assisted observations, giving — on scales of ~ 1.6 kpc — the most detailed view so far of the gas kinematics and morphology in a $z \sim 2$ system. Our results are showing galaxy formation and evolution in unprecedented detail, opening up a new avenue of observational cosmology.