Reconstructing the formation of massive galaxies from their SHARDS

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Abstract

One of the most widely researched topics in Extragalactic Astrophysics in the last decades is how the nearby galaxies morphologically classified as ellipticals formed their stars and assembled. In this context, we now have unequivocal observational evidences about the existence of a numerous population of massive galaxies which not only had assembled a considerable amount of stars ($\sim 10^{11}$ $M_{\odot}$) by z$\sim$2, but were already evolving passively by that time. These galaxies, the likely progenitors of nearby ellipticals, are also quite compact in comparison with local galaxies of the same mass. These results are mainly based on measurements designed to obtain stellar masses and sizes, and our estimations of these parameters are now quite robust. In order to advance in our understanding of the formation of nearby early-type galaxies, now we need a more secure determination of how exactly those high-z massive red galaxies formed and assembled their stellar mass in just 2-3 Gyr (z>2) in a compact structure. In other words, how was their Star Formation History and which are the properties (age, metallicity, dust content) of their stellar populations? And how could they end up with such high masses and small sizes? In this talk, we will present our results about the SFH of massive galaxies at z=1–3 and their structural evolution down to z$\sim$0 based on the deepest spectrophotometric data ever taken. These data were gathered by the Survey for High-z Absorption Red and Dead Sources (SHARDS), a ESO/GTC Large Program aimed at obtaining R$\sim$50 optical spectra of distant galaxies in the GOODS-N field. Our data are ideal to carry out detailed and robust stellar population and environmental studies down to very faint magnitudes (27 AB mag). We will present 2 main results: 1) the precise characterization of the stellar ages, star formation timescales, and the IMF of red and dead galaxies at z>1 and their progenitors at higher redshifts; and 2) the constraints imposed by our data (jointly with those from other large surveys) about the interplay between the SFH, environment, and the structural assembly of massive galaxies at 0<z<3.