Combining spectroscopic and photometric data to study how resolved (kpc-scale) substructures in galaxies govern their global physical properties

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Abstract

This talk is focused on the resolved physics of substructures in galaxies at kpc-scale and their relation with the global properties of the host galaxy using combined high resolution photometric data from the Hubble Space Telescope and very deep long exposure spectroscopic observations with the Keck telescopes. I use the optical and near-infrared data taken as part of the CANDELS project in the GOODS fields to perform pixel-by-pixel analysis of 120 galaxies at intermediate redshifts (out to z$\sim$1.3). The targets are selected to have disk-like morphologies and extended emission in the Keck/DEIMOS spectra. I produce resolved rest-frame (U-V) color, stellar mass and star formation rate surface densities, stellar age and extinction maps and profiles along the galaxies rotation axes. I develop a technique to identify blue and red regions within individual galaxies, using the rest-frame color maps. I quantify the spatial distribution and covering fraction of red and blue regions with respect to both redshift and stellar mass of the host galaxy, finding that the stronger concentration of red regions toward the centers of galaxies is not a significant function of either redshift or stellar mass. I also find that the covering fraction of the blue regions does not evolve strongly with redshift at the redshift range of this study. These findings imply that if the central bulge formation is due to migration of stellar clumps, it should have happened at higher redshifts. I discover that there is a tight correlation between the stellar mass and star formation rate of red and blue regions in galaxies, with the median of blue regions forming a tighter relation with a slope of 1.1 $\pm$ 0.1 and scatter of $\sim$0.2 dex compared to red regions with a slope of 1.3 $\pm$ 0.1 and a scatter of $\sim$ 0.6 dex. The blue regions show higher specific Star Formation Rates (sSFR) than their red counterparts with the sSFR decreasing since z $\sim$ 1, derived primarily by the stellar mass surface densities rather than the SFRs at a giver resolution element. Using the DEIMOS spectra, I model the optical nebular emission lines and construct the optical line ratio profiles diagnostic of gas phase metallicity (R23) and interstellar nebular dust extinction (Hα/Hβ). I find that the nebular dust extinction profile, inferred from Balmer decrement, is in agreement with the average stellar extinction derived from the resolved SED modeling. Using the R23 metallicity profiles I present, for the first time, the mass metallicity relation inside galaxies and its variation as a function of spatial position.