UNVEILING THE NATURE OF THE “GREEN PEA” GALAXIES: OXYGEN AND NITROGEN TENSOR ABUNDANCES

Ricardo O. Amorín, Enrique Pérez-Montero & J. M. Vílchez
Instituto de Astrofísica de Andalucía (IAA-CSIC, Granada-Spain)

ABSTRACT: We have investigated the oxygen and nitrogen chemical abundances in extremely compact star-forming galaxies (SFGs) with redshifts between ~0.11 and 0.35, popularly referred to as “green peas” (GPs). Direct and strong-line methods sensitive to the N/O ratio applied to their Sloan Digital Sky Survey (SDSS) spectra reveal that the systems are genuine metal-poor galaxies, with mean oxygen abundances ~0.087 solar. At a given metallicity these galaxies display systematically larger N/O ratios compared to normal galaxies, which can explain the strong difference between our metallicities measurements and the previous ones. While their N/O ratios follow the relation with stellar mass of local SFGs in the SDSS, we find that the mass-metallicity relation of the GPs is offset more than 0.3 dex to lower metallicities. We argue that recent interaction-induced infall of gas, possibly coupled with a selective metal-rich gas loss, driven by supernova winds, may explain our findings and the known galaxy properties, especially some common compactness, and disturbed optical morphology. The “green pea” galaxy properties seem to be uncommon in the nearby universe, suggesting a short and stage-like evolution of their formation. These galaxies may allow us to study in great detail many processes, such as starburst activity and chemical enrichment, under physical conditions approaching those in galaxies at higher redshifts.

RELATION BETWEEN STELLAR MASS, METALLICITY AND THE N/O RATIO

We measured the emission-line fluxes from SDSS DR5 spectra for the TV SFG green peas. A size-dependent trend is seen among the GPs with Cardamone et al. (2009). Moreover, our results show that the N/O abundance in the GPs is systematically higher than in the main sample.

RESULTS: The green peas are a genuine population of metal-poor (Z ≈ 0.2 Z⊙) starburst galaxies.

REFERENCES AND ACKNOWLEDGEMENTS


Some models (e.g., Finlator & Davé 2008) show that in highly concentrated (typical sizes < 3 kpc) low-mass galaxies, such as the Green Peas, galactic winds induced by their large SSFR are strong enough to escape from their weak potential wells, diminishing the impact of their star formation activity. In particular, future assessment of the H I gas properties and the star-formation efficiency of GPs, as well as the behavior of their gas yields with mass compared with results of chemical evolution, will shed new light on the putative interaction and the role of star formation.

We conclude that recent interaction-induced infall of gas, possibly coupled with a selective metal-rich gas loss, driven by supernova winds, may explain our findings and the known galaxy properties, especially some common compactness, and disturbed optical morphology. The “green pea” galaxy properties seem to be uncommon in the nearby universe, suggesting a short and stage-like evolution of their formation. These galaxies may allow us to study in great detail many processes, such as starburst activity and chemical enrichment, under physical conditions approaching those in galaxies at higher redshifts.