Astronomy in Focus - XXX
Proceedings IAU Symposium No. XXX, 2018
M. T. Lago, ed.

doi:10.1017/S1743921319004393

Radial elemental abundance gradients in galaxies from cosmological chemodynamical simulations

Fiorenzo Vincenzo and Chiaki Kobayashi

Centre for Astrophysics Research, University of Hertfordshire
College Lane, AL10 9AB, Hatfield, United Kingdom
emails: f.vincenzo@herts.ac.uk, c.kobayashi@herts.ac.uk

Abstract. Cosmological chemodynamical simulations are nowadays among the best tools to study how chemical elements are produced within galaxies, to reconstruct also the spatial distribution of the chemical elements as a function of time within different galaxy environments. Our simulation code includes the main stellar nucleosynthetic sources in the cosmos (core-collapse and Type Ia supernovae, hypernovae, asymptotic giant branch stars, and stellar winds from stars of all masses and metallicities). We present the predictions of our simulation for the evolution of the radial gradients of O/H, N/O and C/N in the gas-phase of a sample of ten star-forming disc galaxies, all characterised by very different star formation histories at the present time (see Figure 1). On average, our simulated disc galaxies show a clear inside-out growth of the stellar mass as a function of time, and more negative slopes of the radial gas-phase O/H versus radius at earlier epochs of the galaxy evolution; we predict negative slopes of N/O and positive slopes of C/N at almost all redshifts, because of the main secondary origin of N in stars, even though

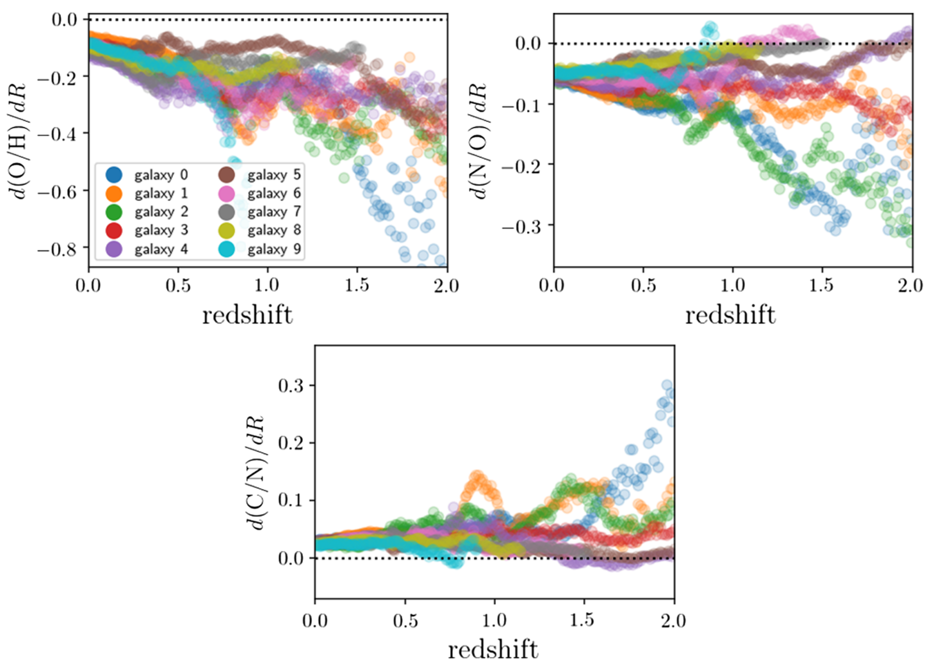

Figure 1. Redshift evolution of the slope of O/H, N/O and C/N versus radius in the gas-phase of our ten simulated disc galaxies, which are the same as in Vincenzo & Kobayashi (2018). From "galaxy 0" to "galaxy 9", the star formation history is concentrated towards later epochs. We only show the redshifts when the total galaxy stellar mass $M_\star > 1.0 \times 10^9$ M$_\odot$

the high-redshift simulation data are highly scattered because of the more turbulent conditions of the interstellar medium. Finally, we show that similar results are found with zoom-in simulations, where a spiral galaxy is re-simulated with a larger number of resolution elements. With zoom-in simulations, we study how stellar migrations (particularly old and metal-poor stellar populations migrating outwards) and radial gas flows are capable of influencing the galaxy chemical evolution at different galactic radii.

Keywords. galaxies: abundances, galaxies: evolution, ISM: abundances, hydrodynamics

---

Reference

Vincenzo, F., & Kobayashi, C. 2018, *MNRAS*, 478, 155