Star Formation History in the Illustris TNG Simulation

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We processed the catalogue data for all snapshots of the Illustris TNG100 cosmological, gravo-magneto-hydrodynamical simulation [1], and collected every property of the galaxies formed at different redshifts. With this dataset we can statistically analyze parameters for galaxy samples at given redshifts, as well as trace sample parameters over the entire time range of the simulation.

Here we are focusing on the relation between Star Formation Rate (SFR) and gas metallicity (Ƶ) at different redshifts (z). Ƶ is the mass fraction of metals in all gas cells bound to the subhalo.

Figure 1

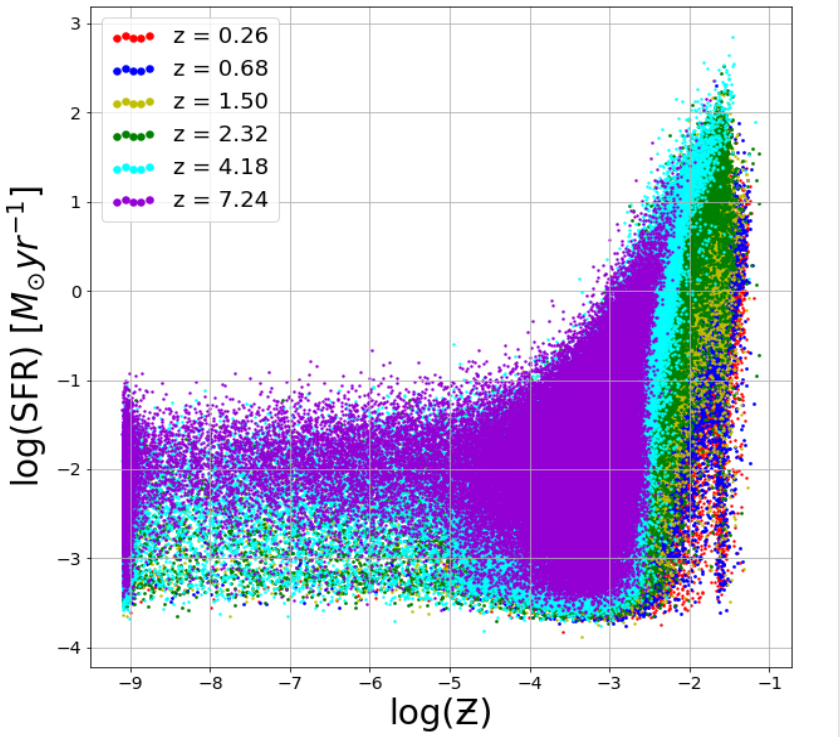

Figure 1 shows the relation between the star formation rate and metallicity for individual galaxies at different redshifts. The distribution changes towards higher metallicities with time, and towards higher star forming rates until around z ≈ 1.6, then this latter trend reverses.

Figure 2

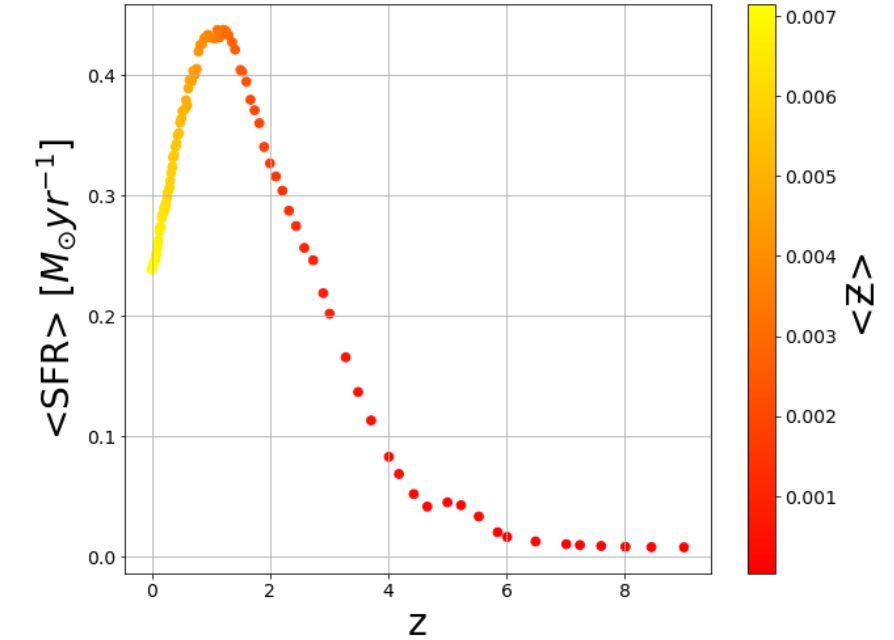

Figure 2 shows the relation between the mean star formation rate and mean metallicity at different redshifts. The cosmic trend of star formation rate can be seen with a bump after reionization starting at around z ≈ 6 [2], while the metallicity increases.

[1] Nelson et al (2018) 10.1093/mnras/stx3040, Springel et al (2018) 10.1093/mnras/stx3304, Marinacci et al (2018) 10.1093/mnras/sty2206, Naiman et al (2018) 10.1093/mnras/sty618, Pillepich et al (2018) 10.1093/mnras/stx3112

[2] Thélie et al (2022) A&A, 658 (2022) A139

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