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Properties of high redshift passive galaxies: number density and contribution to the cosmic star formation history (Emiliano Merlin)

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We search the five CANDELS fields for passively evolving a.k.a. "red and dead" massive galaxies in the first 2 Gyr after the Big Bang. By means of top-hat star-formation histories, to model an early and abrupt quenching of the activity, we fit the observed photometric data using a demanding probabilistic approach to single out only very reliable passive candidates. Using libraries of models without (with) spectral lines emission, we end up with 102 (42) candidates, including one at $z_{CANDELS} = 6.7$, starting from a total of more than 20,000 $z > 3$ sources in the five fields. This implies a minimal number density of $1.73 \pm 0.17 \times 10^{-5}$ ($7.03 \pm 1.10 \times 10^{-6}$) Mpc^{-3} for $3 < z < 5$. We compare these numbers with those from the outputs of five last generation hydrodynamical cosmological simulations, finding a reasonable agreement at $z < 4$ (provided we pay attention to wisely estimate mass and SFRs in the models), while tension remains at earlier epochs. Finally, we compute the contribution to the global universal Star Formation Rate Density of the high-redshift passive galaxies during their previous phase of activity, finding that they potentially account for $\sim 5 - 10\%$ of the total star formation at $3 < z < 8$, despite being only $\sim 0.5\%$ of the total in number.
The overall picture is that the assembly of the stellar content of galaxies, and consequently the thermal and chemical evolution of the cosmos, are heavily influenced by the extreme but short activity of these kind of sources. The next generations of observational facilities (JWST, ELT, WFIRST, Euclid) will propel a quantum leap forward both in data quality, reducing the photometric uncertainties while increasing the depth of the observation over a wide range of wavelengths, and in statistical reliability of the results, going from the current few tens of thousands to billions of galaxies to analyze; I will present an example of how JWST will be a game changer in the determination of their properties and ubiquity.

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