Star formation in high-redshift clumpy galaxies

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Abstract

Most of the massive star-forming galaxies from the cosmic peak of star formation have several giant star-forming clumps, of masses up to 10ˆ8-9 solar masses spanning around 1 kpc and forming stars at a rate of a few Msun/year. These structures do not seem to be transient features, and thus create an environment for star formation that is very different from that of local molecular clouds in terms of surface density, turbulence, star formation and feedback clustering.
I will show how that these structures may arise, either by violent disc instabilities in isolated gas-rich disks (Fensch & Bournaud 2021) and also mergers of moderately gas-rich galaxies (Calabro, Daddi, Fensch et al., 2019). In particular, I will show to what extent the too low gas fraction in galaxies from most cosmological simulations (e.g. FIRE, ILLUSTRIS-TNG) may lead to missing the formation of these clumps and the low sensitivity of clump formation to stellar feedback prescriptions.
Last, I will present an on-going PRACE project aiming at probing the density structure and turbulence cascade in these structures at the sub-parsec level, using a zoom-in method in isolated disk simulations to reduce the simulation memory footprint.

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