

EARLY UNIVERSE

Out of perspective

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Increasing evidence suggests that the faintest galaxies at redshifts $z > 6$ appear to be unexpectedly compact, comparable to the size of a globular cluster. Indeed, this finding implies that a single compact star cluster dominates these galaxies. Why would only a single region of a galaxy collapse into a star cluster? Sylvia Ploeckinger and collaborators show that, in high-redshift low-mass galaxies, the radiation of a single young stellar cluster is sufficient to ionize the entirety of the gas in its host galaxy and effectively disrupt the formation of additional stellar nurseries.

In order to understand how radiative feedback from a young massive cluster (YMC) influences its surroundings, Ploeckinger et al. first performed analytical calculations of the depth of neutral gas that can be ionized by a cluster's stars, given the YMC's mass, metallicity and the properties of the initial mass function. The authors find that for a homogeneous gaseous medium and galaxies of mass $< 10^{10.5} M_{\odot}$, practically all gas can be ionized by a single YMC. The story is more complicated when the medium is clumpy, as in that case self-shielding of the gas becomes important.

To calculate the exact effects of the YMC's emission, Ploeckinger et al. also use a one-dimensional radiative transfer code. They find that while metallicity is not a crucial factor, high dust content in the galaxy significantly reduces the fraction of the total gas that the YMC can ionize. At $z > 6$, galaxies are indeed expected to be dust-poor and therefore the results of Ploeckinger et al. offer a straightforward explanation of both the compactness of these far-away low-mass galaxies and the dominance of a single stellar cluster.

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