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Cosmic rays as a feedback agent in primordial galactic ecosystems

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Star-forming galaxies are known to have been abundant at redshifts above z˜6, and recent observations have revealed examples of high redshift primordial galaxies with evolved stellar populations and complex star-formation histories (SFHs) spanning into the first 250 Myr after the Big Bang. In these systems, intense bursts of star-formation appear to be interspersed with sustained periods of strong quenching, however the processes underlying this evolutionary behaviour remain unclear. Unlike in later epochs, galaxies in the early Universe would co-evolve with their circumgalactic halo as a relatively isolated ecosystem. Although the intense star-formation bursts may be fuelled by gaseous inflows from the cosmic web, circumgalactic flows would connect to a galaxy's internal environment, allowing for recycling of matter, energy and particles. Thus, the mechanisms that could bring about the downfall of star-formation in these early galaxies are presumably intrinsic, with feedback processes associated with intense bursts of star-formation likely to play an important role. In this talk, I will discuss how cosmic rays are likely to be an important agent to deliver this feedback, and show how they can account for the SFHs inferred from recent observations of these systems. Moreover, I will discuss how signatures of cosmic ray induced quenching may be accessible in young starbursts and possible lower-redshift isolated analogues.

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