Large-scale Turbulent Driving Regulates Star Formation in High-redshift Gas-rich Galaxies

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Abstract

We run simulations of a kiloparsec cube section of a galaxy with stellar feedback. We show that stellar feedback is sufficient to reduce the averaged star formation rate (SFR) to the level of the Schmidt-Kennicutt law in Milky Way-like galaxies but not in high-redshift gas-rich galaxies, suggesting that another type of support should be added. We investigate whether an external driving of the turbulence such as the one created by the large galactic scales could diminish the SFR at the observed level. We infer a turbulent forcing parallel to the plane of the galactic disk. When this forcing is applied in our simulations, the SFR within our simulations closely follows the Schmidt-Kennicutt relation. We found that the velocity dispersion is strongly anisotropic with the velocity dispersion alongside the galactic plane being up to 10 times larger than the perpendicular velocity.

Keywords: Star formation, Galaxy dynamics, Galaxy physics, Interstellar medium, Radiative transfer simulations, Magnetohydrodynamical simulations

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