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FIR emission-line luminosities to infer ISM physical properties

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The conditions under which the cold gas of galaxies evolves are not well known at higher redshift. The best way to understand cold gas is by studying the interstellar medium (ISM) of galaxies at different cosmic times. Far-infrared (FIR) emission lines are powerful tools for understanding the various phases of the ISM in galaxies. With this in mind, we have combined the cosmological EAGLE hydrodynamical simulations with a physically motivated multi-phase ISM model to estimate FIR emission lines. We post-process the smoothed-particle hydrodynamics data and decompose it into different ISM phases: HII regions, dense molecular gas, neutral atomic gas, and diffuse ionised gas. In our previous work, Ramos Padilla et al. (2021), we focus on the [C II] emission line at 158 microns at the local Universe. Now, we estimate eight important FIR lines, including [O I], [O III], [C II], [N II] and [N III] emission lines from z=0 to z=6. Using these FIR line luminosities we check the importance of different physical conditions in the simulated galaxies. We found that ratios like [C II]/[O III] and [N II]/[O I] help characterise the metallicities and specific star formation rates across cosmic time. Finally, we present a user-friendly webpage so other researchers can infer the physical properties of the ISM using the information from FIR line emissions.

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