Z112a Connecting molecules with the others in cosmological simulations

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Cosmological simulations are often used to study the formation and evolution of galaxies, of which advantage is that all information is accessible. Namely, one can easily obtain three-dimensional distribution and kinematics of stars, gas and even invisible components such as dark matter. It is still, however, challenging to simulate molecular gas such as H_2 and CO since their formation and dissociation are closely related to various physics such as dust grains and radiation fields in interstellar space where the gas densities are generally higher than those resolved in the simulations. We therefore develop a novel post-processing method to compute abundances and emissions from molecular gas. Our approach is based on (i) utilising data of cosmological simulations, (ii) modelling physical properties of gas clouds and (iii) adopting a chemical radiative transfer code to the clouds. As a result, we find that our method can reproduce observations of the mass-luminosity relation and the luminosity function for CO(1-0) light at redshift $z = 0$ using the IllustrisTNG simulation.

The synergy of ALMA/Subaru corresponds to combining different components in a galaxy, such as molecular gas from ALMA and stars from Subaru. It is often, however, difficult to physically interpret the combined results. This study aims to provide data sets that can be used to understand the connection of molecules with the other components in galaxies. Also, the mock observations based on our model are expected to be used for a wide variety of future observations such as feasibility estimations and tagging molecules to stars.