X72a Utilizing a Dust and Chemical Evolution Model with MCMC to Derive the Physical Conditions of Dust Clumps in High-z Galaxies

加納龍生, 名古屋大学

Dust plays a pivotal role in the evolution of galaxies, affecting key physical attributes such as the spectral energy distribution (SED) and the history of star formation. In this work, we propose a detailed model that integrates both dust and chemical evolution to compute the SEDs of galaxies. Although our model is successful in reproducing the SEDs of nearby galaxies, applying it to high-redshift galaxies (z $\tilde{}$ 8) necessitates theoretical adjustments due to variations in galaxy properties.

To tackle this challenge, we made revisions to our SED model to improve its alignment with the observations of distant galaxies. Specifically, we modeled the molecular clouds surrounding young stars (referred to as clumps) as spherical structures. Given that high-redshift galaxies are typically more compact, the density within these clumps is expected to be higher than local. To capture this, we applied a different scaling for the clump radius than that of the overall galaxy and increased the dust number density within the clumps.

To refine the model parameters and achieve the best fit with observed SEDs, we implemented the Markov Chain Monte Carlo (MCMC) method. This approach allowed us to systematically explore the parameter space and perform highly reproducible simulations that are in good agreement with observations. Our findings suggest that high-redshift galaxies have substantially higher dust number densities, leading to more intense dust emission compared to nearby galaxies.