X50a Detailed Analysis of the Resolved Kennicutt–Schmidt Law with COMING

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Kennicutt–Schmidt (K-S law), a log-linear relation between gas and star formation rate (SFR) surface densities in galaxies, is one of the most fundamental heuristic laws with respect to the evolution of galaxies. However, the physical mechanism behind it remains unsolved, mainly because it takes much time for a radio imaging, which is necessary for the estimation of gas surface densities, and then it is difficult to obtain homogeneous dataset for many galaxies.

We examined the K-S law resolved to 1 kpc scale for 104 nearby galaxies by using the data of COMING, a Nobeyama Radio Observatory 45 m Legacy Project. To make a linear fit data with significant noise as well as the intrinsic dispersion, we introduced a Gaussian mixture model with the expectation–maximization (EM) algorithm. Thanks to this method, we could make an anatomy of the spatially resolved K-S law as two completely distinct components: molecular gas having a slope unity, and atomic gas basically following the saturation column density vertically. This first result was reported as X09a at 2020 ASJ Autumnal Meeting. In this presentation, we present further results from a detailed analysis. We newly developed a method to judge the reliability of the parameter estimation for each object. In addition, we show a loose metallicity dependence of saturation column density of the atomic gas, which is consistent with a theoretical prediction.