X09a Resolved Kennicutt–Schmidt Law as Seen from COMING

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A log-linear relation between gas and star formation rate (SFR) surface densities in galaxies is known as Kennicutt–Schmidt (K-S law). Though the K-S law has been studied extensively, it still remains as a heuristic law. This is 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 about 100 nearby galaxies by using the data of COMING, a Nobeyama Radio Observatory 45 m Legacy Project, together with *GALEX* (ultraviolet), *WISE* (mid-infrared), and VLA (21 cm line) images. We note that how to estimate the slope of the log-linear relation is of vital importance. Actually this issue has introduced unnecessary confusion in the studies of the K-S law, since there has been no unique way to make a linear fit data with significant noise as well as the intrinsic dispersion. To address this problem, we introduced a Gaussian mixture model with the expectation–maximizaiton (EM) algorithm. This enables to separate nuisance noise and physically meaningful data objectively by statistical estimation. We found that the SFR surface density is approximately proportional to that of the molecular gas, but with a slightly steeper slope than previous studies. In contrast, the SFR does not have a significant correlation to the atomic gas, leading to a nonlinear relation as the K-S law for total gas in logarithmic scale. We report these results and suggestions to the evolution of galaxies.