

X01a **Surface density: a new parameter in the fundamental metallicity relation of star-forming galaxies**

橋本哲也、後藤友嗣 (国立清華大学)

Star-forming galaxies display a close relation among stellar mass, metallicity and star-formation rate. This is known as the fundamental metallicity relation (FMR), and it has a profound implication on models of galaxy evolution. However, there still remains a significant residual scatter around the FMR. We show here that a fourth parameter, the surface density of stellar mass, reduces the dispersion around the FMR. In a principal component analysis of 29 physical parameters of 41,338 star-forming galaxies, the surface density is found to be the fourth most important parameter. The new four-dimensional fundamental relation forms a tighter hypersurface that reduces the metallicity dispersion to 50% of that of the FMR. We suggest that future analyses and models of galaxy evolution should consider the FMR in a four-dimensional space that includes surface density. The dilution time scale of gas inflow and the star-formation efficiency can explain the observational dependence on surface density.