B10a Formation, Evolution, and Revolution of Galaxies by SKA

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Formation and evolution of galaxies have been a central driving force in the studies of galaxies and cosmology. Recent studies provided a global picture of cosmic star formation history. However, what drives the evolution of star formation activities in galaxies has long been a matter of debate. The key factor of the star formation is the transition of hydrogen from atomic to molecular state, since the star formation is associated with the molecular phase. This transition is also strongly coupled with chemical evolution, because dust grains, i.e., tiny solid particles of heavy elements, play a critical role in molecular formation. Therefore, a comprehensive understanding of neutral–molecular gas transition, star formation and chemical enrichment is necessary to clarify the galaxy formation and evolution.

Here we present the activity of SKA-JP galaxy evolution subWG. Our activity is focused on three epochs: $z \sim 0, 1$, and $z > 3$. At $z \sim 0$, we try to construct a unified picture of atomic and molecular hydrogen through nearby galaxies in terms of metallicity and other various ISM properties. Up to intermediate redshifts $z \sim 1$, we explore scaling relations including gas and star formation properties, like the main sequence and the Kennicutt–Schmidt law of star forming galaxies. To connect the global studies with spatially-resolved investigations, such relations will be plausibly a viable way. For high redshift objects, the absorption lines of H I 21-cm line will be a very promising observable to explore the properties of gas in galaxies. By these studies, we will surely witness a real revolution in the studies of galaxies by SKA.