Gas Dynamics in High-Redshift Galaxies

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Galaxies change their appearance through cosmic time due to gas accretion, gas consumption through star formation and black hole growth, feedback, and interaction with other galaxies. These physical processes are commonly reflected in the dynamical structure of the interstellar medium in galaxies, making studies of their gas content, dynamics and excitation throughout the history of the universe a key topic in modern astronomy. I will present some of the most recent progress in studies of the cold, predominantly molecular interstellar medium back to the first billion years after the Big Bang. These studies show that, due to an order of magnitude higher gas content relative to present-day disk galaxies, their high-redshift counterparts exhibit enhanced star formation activity. This trend is largely responsible for the steep increase in the cosmic volume density of star formation towards early epochs. This higher gas content is also responsible for the emergence of massive, kiloparsec-scale, so-called "maximum" starbursts at high redshift, which are likely driven by major, "wet" mergers of gas-rich disk galaxies. These findings are typically based on high-resolution interferometric observations of the molecular gas in distant galaxies, which are enabled by powerful new instruments such as the Karl G. Jansky Very Large Array (VLA) and the Atacama Large (sub-)Millimeter Array (ALMA).