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Presentation Requested: oral

Category: Evolution of the Interstellar Medium and Star formation over Cosmic Time

Question: Other

The nature of the ISM during the star - formation activity peak of the Universe

At redshift $z \sim 1-3$ the star-formation activity of the Universe reached its peak, after which it dropped towards its current day value. In the near future ALMA will allow us to observe atoms and molecules like [CII], CO and HCN for large groups of star-forming galaxies during this cosmic epoch. Such species are good tracers of the properties of the interstellar medium (ISM) of these galaxies and can possibly give understanding to the internal gas physics driving the large star-formation activity and to why the star-formation activity of the Universe decreased at lower redshifts. The most recent versions of cosmological models of galaxy formation explicitly include the detailed tracking of the atomic and molecular hydrogen content of galaxies and a more physically-motivated H₂-based star formation recipe. In this talk I will discuss predictions made by these models for the HI and H₂ content of galaxies. I will furthermore discuss how such models, in combination with radiative-transfer codes, can provide detailed predictions of the ISM properties for statistical sets of galaxies that can directly be observed with ALMA. We find that normal star-forming galaxies at $z=1.2$ and $z=2.0$ have much higher CO-excitation peaks than their local counterparts, indicative of much denser and warmer star-forming clouds. I will discuss the model predictions for the CO, HCN, [CII], [OI] and neutral carbon properties of typical star-forming galaxies at high-redshift, how this shapes our understanding of the gas physics driving the star formation, strategies to observe these predictions and how our model can be used for other purposes.