Evolution at the edge: cold molecular CO(1-0) gas in the halos of high-z radio galaxies

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Abstract

To understand how hierarchical merging, gas accretion and feedback mechanisms drive early galaxy evolution, it is crucial to study the properties of cold molecular gas −the raw ingredient for star formation− in active galaxies at high redshifts. I will present result from an imaging-survey of cold molecular CO(1-0) gas in proto-cluster radio galaxies at $z \sim 2$, covering many hundreds of hours of observations at the Very Large Array and Australia Telescope Compact Array. We find tantalizing evidence that a large fraction of the CO(1-0) emission in high-z radio galaxies does not follow the bulk of the star formation. Instead, cold molecular gas is often spread on scales of many tens of kpc across the IGM in the halo environment. This may potentially provide direct observational evidence of predicted cold-flow accretion at high-z. In several cases, we find CO(1-0) emission just beyond the brightest edge of the radio source, indicating that jet-induced feedback can also play an important role in the cooling or formation of molecular halo gas. I will discuss how our results may shed a light on how these massive high-z proto-cluster radio galaxies will evolve into present-day giant central-cluster ellipticals. This project also highlights the crucial role of "intermediate-frequency" 20-50 GHz radio receivers in the ALMA/SKA era if we want to fully understand the important role of the cold IGM in the early evolution of the Universe.