Contribution ID: **38** Contribution code: **CC05** Type: **Talk**

CO(7-6) and [C I](2-1) survey in z>6 quasars

Monday, January 5, 2026 10:25 AM (15 minutes)

High-redshift (z
$gtrsim6$) quasars are signposts of the earliest supermassive black holes and intense star formation, offering key laboratories for black hole–galaxy evolution at cosmic dawn. While far-infrared studies revealed large dust reservoirs and strong [C II] emission, the physical condition and molecular gas content of their interstellar medium (ISM) remain uncertain.
We present sensitive ALMA Band 3 observations of the redshifted CO(7–6) and \C I emission lines and the underlying dust continuum in a sample of 18 quasars at $z \sim 6$. We detect CO(7–6) in 15/18, \C I in 6/18, and continuum in 13/18 sources. Line luminosities and continuum fluxes are used to estimate molecular gas masses from CO, \[C I], and dust, and to investigate ISM excitation through line ratios with photodissociation region (PDR) and X-ray dominated region (XDR) modeling. Gas masses derived from different tracers are consistent within a factor of a few, and a hierarchical Bayesian cross-calibration of all four tracers yields per-source $M_{\rm H_2}$ and global conversion factors. The observed line ratios reveal a wide range of ISM excitation conditions, displaying signatures of compact, intense star formation and/or enhanced dust opacity (with a possible AGN continuum contribution). PDR models indicate high gas densities ($n > 10^{4\tilde{}}{\rm cm}^{-3}$) and strong radiation fields ($G_0 \sim 10^3$–10^4), while the deviations from these predictions suggest that a composite PDR+XDR scenario provides a more complete description of the ISM in these luminous quasars. These results demonstrate the power of multi-line diagnostics in revealing the excitation and structure of the cold ISM in early quasar host galaxies, and highlight the need for joint analysis of CO, [C I], [C II], and dust emission to fully characterize star formation and AGN-driven heating at cosmic dawn.

Author: Mr XU, Fuxiang (Peking University)

Presenter: Mr XU, Fuxiang (Peking University)

Session Classification: Contributed talks

Track Classification: CC05: Galaxies, AGNs, Black Holes and Cosmology