

Uncovering QSO-driven outflows and galaxy assembly at cosmic Dawn with ALMA

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Abstract. I will present evidence of QSO-driven outflows in the early Universe, resulting from the stacking analysis of ALMA observations of the [CII] emission line for a sample of 50 QSOs at $z \sim 5 - 7$. The high sensitivity reached by our analysis allowed us to assess that very broad wings are on average present in the [CII] profile, and extend beyond velocities of 1000 km/s in systems with low and high SFR. Such wings are therefore tracing QSO-driven [CII] outflows, with associated mass outflow rates of $100 - 200 M_{\odot}/\text{yr}$. I will discuss how these outflows relate to those observed in lower- z AGNs and give an estimate of their spatial extent. Furthermore, I will focus on the high-resolution ALMA observation of a hyper luminous QSO at $z \sim 4.5$, revealing an exceptional overdensity with multiple companions as close as 2 kpc. These crowded surroundings, and the QSO host galaxy itself, are forming stars at a very high rate (hundreds of M_{\odot}/yr), suggesting that a significant fraction of the stellar mass assembly at early epochs might have taken place in the companions. I will discuss how the BH and host-galaxy masses are growing in this multi- source system, which likely represents the cradle of what would be a giant galaxy at $z = 0$.
