

Exceptional ALMA look at the anatomy of a luminous quasar host

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The first ALMA observation of the nearby quasar PDS 456 ($z=0.184$) was designed to obtain the highest resolution map ever taken of the molecular gas in a hyper-luminous quasar. With a bolometric luminosity of 2×10^{47} erg/s (\sim Eddington luminosity) it can be regarded as the local counterpart of the quasars shining at $z \sim 2$, i.e. the peak of quasar luminosity density.

We are able to reveal in unprecedented detail (i.e., $0.2 \text{ arcsec} \sim 600 \text{ pc}$) the distribution of the molecular gas around a very powerful AGN and probe the relationship between nuclear and host galaxy properties at the brightest end of the luminosity function.

The most noticeable result is the discovery of a molecular outflow in PDS 456, which also shows the undisputedly most powerful, persistent, X-ray ultra-fast ($0.25c$) wind discovered so far. This allows us to get new insights on how multi-phase AGN-driven outflows expand outwards. Interestingly, the CO outflow exhibits a very complex, unusual morphology with a compact, sub-kpc component and a $\sim 3 \text{ kpc}$ extended, very diffuse approaching one. Finally, multiple gas-rich companions are visible around $\sim 20 \text{ kpc}$ from PDS 456 supporting the merger-driven scenario for high-luminosity quasars.

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