An ALMA multi-line survey of the interstellar medium of the redshift 7.5 quasar host galaxy J1342+0928

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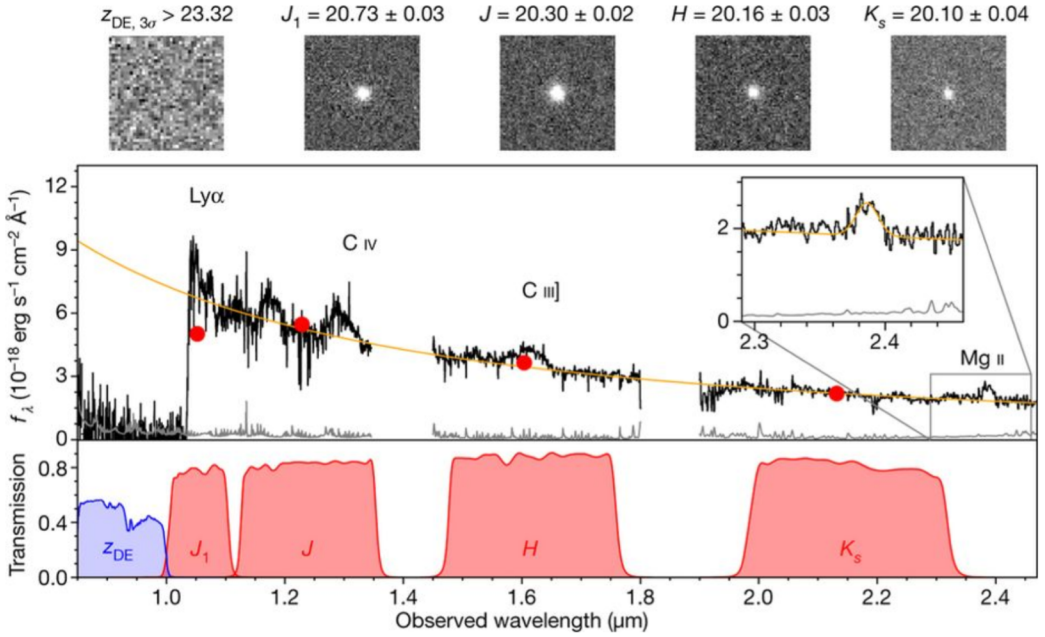
ULAS J1342+0928

- Quasar of the highest redshift (z = 7.54)
- $L_{bol} = 10^{13} L_{\odot}$
- $M_{SMBH} = 8 \times 10^{8} M_{\odot}$

ALMA Multi-line Targeting

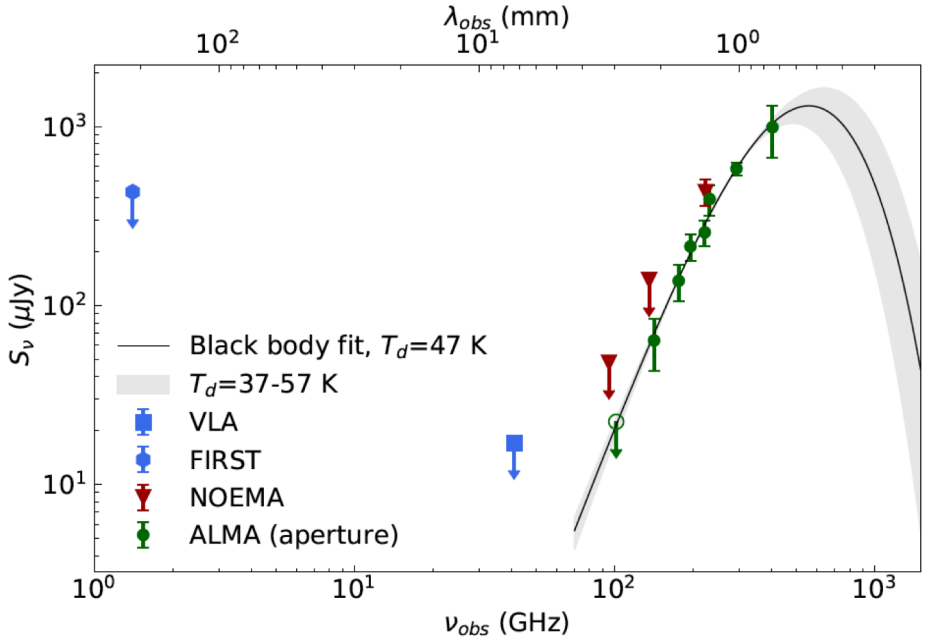
- 24 molecular and fine-structure lines
- eight different frequency located between 93.5 GHz (band 3) and 412 GHz (band 8) with effective bandwidth of 60 GHz

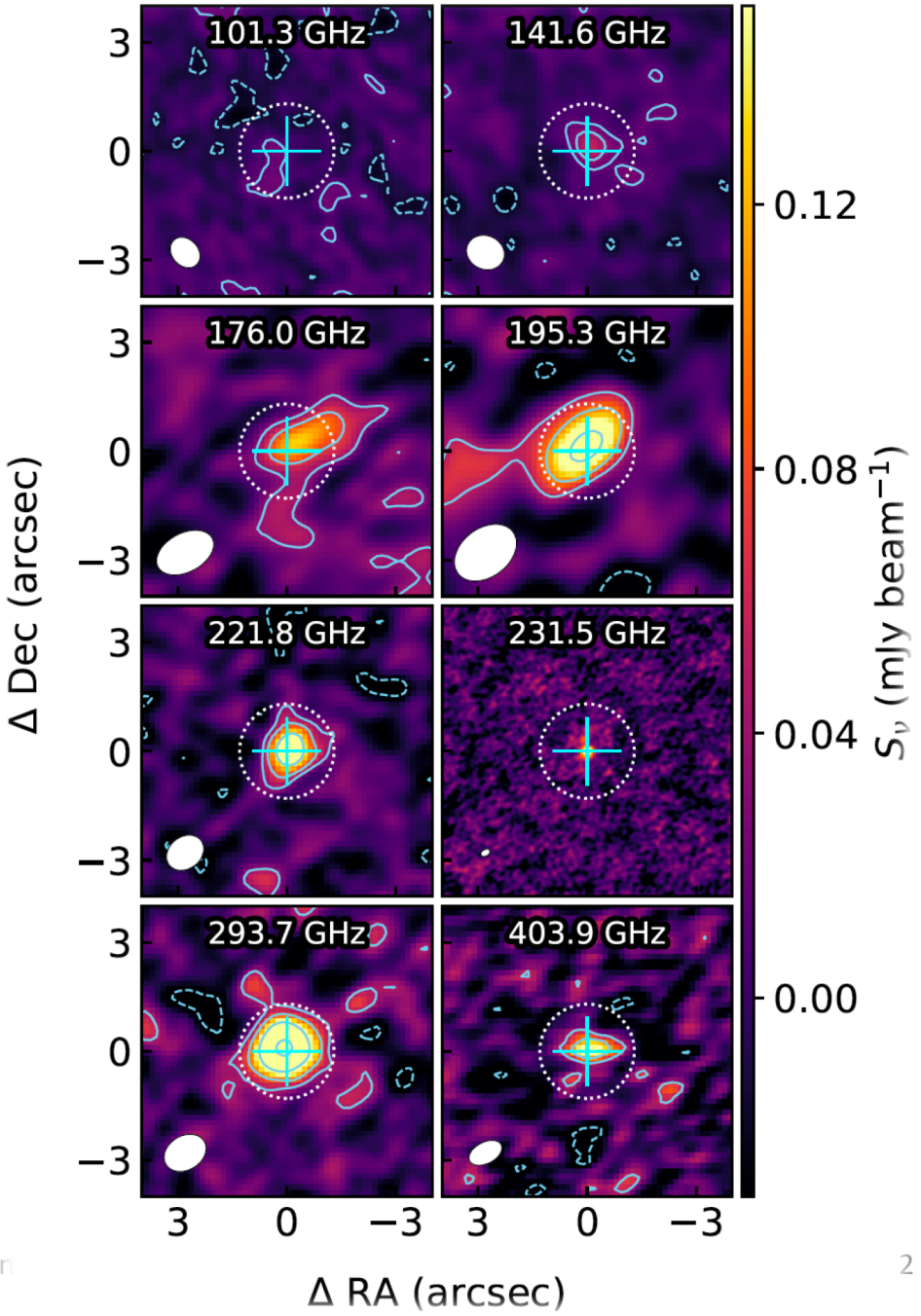


Banados et al. 2018, Nat.

A plethora of information on the ISM condition in the most quasar host

ULAS J1342+0928: Dust Continuum



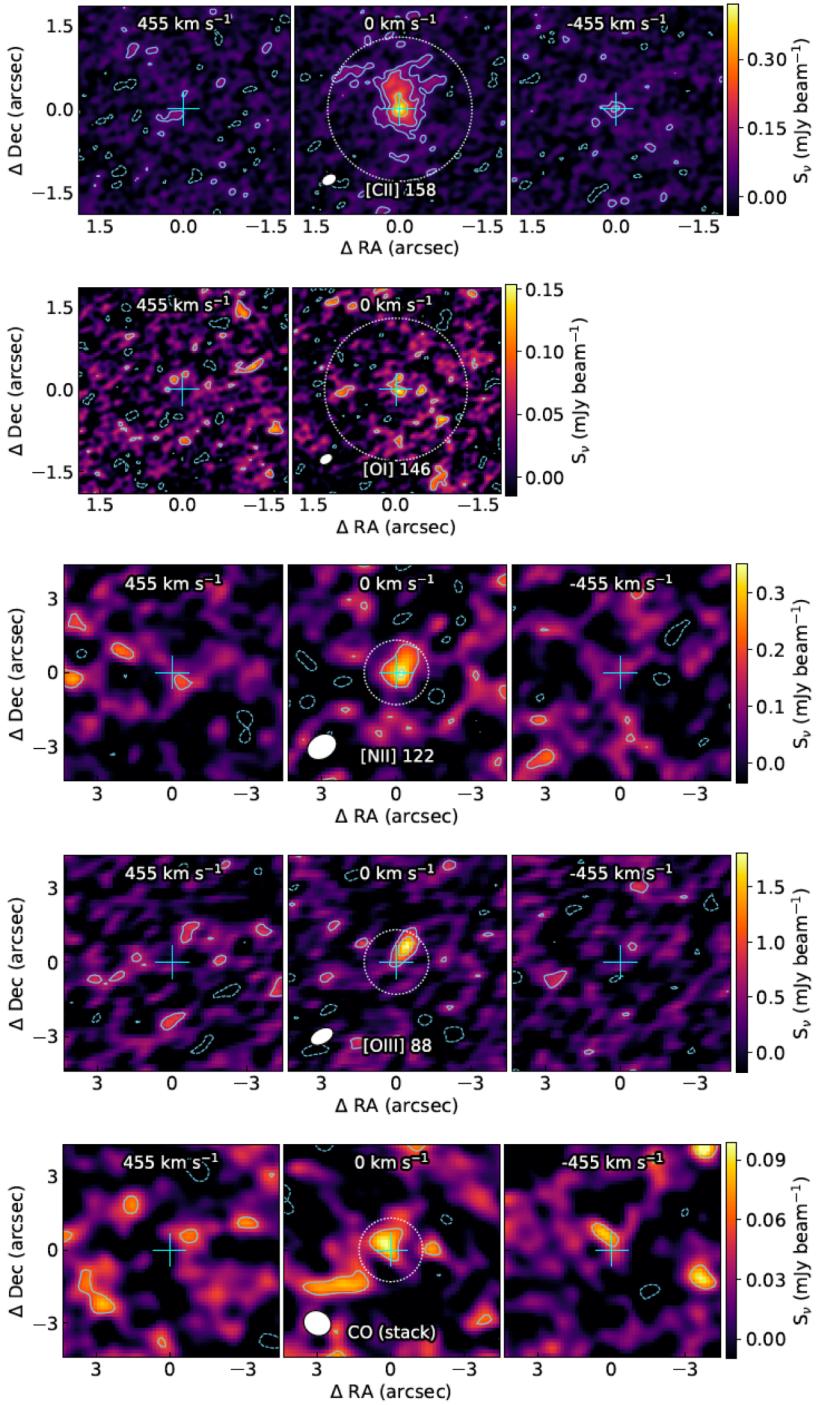


- $M_{dust} = (0.35 \pm 0.02) \times 10^8\ M_\odot$
- $L_{TIR} = (1.5 \pm 0.3) \times 10^{12} L_\odot$, ULIRG
- $SFR = 150 \pm 30 M_\odot yr^{-1}$

arXiv:1906.08569, accepted for publication

ULAS J1342+0928: Emission Lines

- Low gas density $\lesssim 5\times10^{4}cm^{-3}$ & Strong radiation fields $\gtrsim 10^{3}G_0$ ($G_0 = 1.6\times 10^{-3}erg\ cm^{-2}\ s^{-1}$) for PDR, (from line ratios)
- High electron densities for HII region, $n_e > 180\ cm^{-3}$, ~16% of hydrogen in ionized form (from N++ lines)
- Low gas-to-dust ratio < 100 (from CO and SLED)
- Highly enriched: $Z_{gas} = 1.3^{+0.3}_{-0.1}Z_{\odot}$ (680 Myr after the BB) (from [OIII] 88/[NII] 122)



[CII] 158 Brightest, Meger?

[OI] 146

[NII] 122

[OIII] 188

CO stack

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