



# Gas and dust in a submillimeter galaxy at $z = 4.24$ from the Herschel ATLAS

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We report ground-based follow-up observations of the exceptional source, ID141, one the brightest sources detected so far in the H-ATLAS cosmological survey. ID141 was observed using the IRAM 30-meter telescope and Plateau de Bure interferometer (PdBI), the Submillimeter Array (SMA) and the Atacama Pathfinder Experiment (APEX) submillimeter telescope to measure the dust continuum and emission lines of the main isotope of carbon monoxide and carbon ([C I] and [C II]). The detection of strong CO emission lines with the PdBI confirms that ID141 is at high redshift ( $z=4.243 \pm 0.001$ ). The strength of the continuum and emission lines suggests that ID141 is gravitationally lensed. The width ( $\Delta V$  (FWHM)  $\sim 800$  km/s) and asymmetric profiles of the CO and carbon lines indicate orbital motion in a disc or a merger. The properties derived for ID141 are compatible with a ultraluminous ( $L_{\text{FIR}} \sim 8.5 \pm 0.3 \times 10^{13} \mu_L L_{\text{sun}}$ , where  $\mu_L$  is the amplification factor, dense ( $n \sim 10^4 \text{ cm}^{-3}$ ) and warm ( $T_{\text{kin}} \sim 40\text{K}$ ) starburst galaxy, with an estimated star-formation rate of  $(0.7 \text{ to } 1.7) \times 10^4 \mu_L M_{\text{sun}}/\text{yr}$ . The carbon emission lines indicate a dense ( $n \sim 10^4 \text{ cm}^{-3}$ ) Photo-Dominated Region, illuminated by a far-UV radiation field a few thousand times more intense than that in our Galaxy. In conclusion, the physical properties of the high- $z$  galaxy, ID141, are remarkably similar to those of local ultraluminous infrared galaxies.

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