The star forming galaxy HerBS-89a at z=2.95 and its gas inflow

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This poster presents HerBS-89a, a luminous star forming galaxy at z=2.95 lensed by a single foreground source. Drawn fromthe *Herschel* Bright Sources sample [3], HerBS-89a was observed by NOEMA at low and high (~0.5 arcsec) angular resolution [1,2].

We report the detection of a series of molecular lines, including very broad ^{12}CO(9-8) and $H_2O(2_{02}\text{-}1_{11})$ with FWHM~1200 km/s, the three fundamental transitions of the molecular ion OH^+, namely $(1_1\text{-}0_1)$, $(1_2\text{-}0_1)$, $(1_0\text{-}0_1)$ and the molecular ion $CH^+(1\text{-}0)$ seen in absorption, and few others.

The NOEMA data are complemented by *Hubble Space Telescope* (HST) and Gran Telescopio Canarias (GTC) imaging that reveal the foreground lensing galaxy in the optical/near-infrared. In addition, JVLA ^{12}CO(1-0) observations allow us to derive the molecular gas mass of HerBS-89a and to anchor its CO spectral line energy distribution.

Lens modeling permits to reconstruct the dust continuum and molecular emission lines geometry and kinematics in the source plane, down to a scale of ~800 pc. The source-plane reconstructions do not clearly distinguish between a one-component and a two-component scenario, but the latter, which reveals two compact rotating galaxies that are likely merging, more naturally accounts for the broad line widths observed.

HerBS-89a is a powerful star forming system with a molecular gas mass of M(mol) ~ 2×10^{11} $M_\odot$ and an infrared luminosity L(IR) ~ 4.5×10^{12} $L_\odot$, yielding a star formation rate SFR>600 $M_\odot$/yr and a depletion timescale τ (depl) ~ 3.5×10^8 years.

The OH^+ and CH^+ absorption lines, which trace low (~100 cm^{-3}) density molecular gas, all have their main velocity component red-shifted by ΔV~100 km/s relative to the global CO reservoir. We argue that these absorption lines trace a rare example of gas inflow toward the center of a galaxy, indicating that HerBS-89a is accreting gas from its surroundings.

References (Cambria 10 pt, bold face, aligned to the left)

[1] Berta, S., et al., A&A, 646, A122 (2021)
[2] Neri, R., et al., A&A, 635, A7 (2020)
[3] Bakx T., et al., MNRAS, 473, 1751 (2018)