

Extremely Low Molecular Gas Content in the Vicinity of a Red Nugget Galaxy at $z = 1.91$

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近傍の最も重い銀河は $z > 2$ で星形成を終了している模様

⇒ Hi-z massive銀河はコンパクトな形状(近傍の同じ質量のものに比べて1/5以下のものもある)

⇒ size-evolution? dry merger?

⇒ でもそれを起こすsatelliteは十分でない?

GDS24569@ $z=1.19$

- $M^* = 1e11 M_{\text{sun}}$ passive galaxy
- compact, $r_{\text{eff}} = 0.5 \text{ kpc}$
- $M^* > 1e7.2 M_{\text{sun}}$ のsatelliteなし
 - 周囲の天体がすべてaccreteしてもサイズは5倍: 近傍の典型的なものに比べて半分のサイズ
- ガスがaccreteしてサイズ成長した?

ALMA Band-5観測

- [CI]輝線
- $\sim 1''$ resolution
- FoV=300kpc

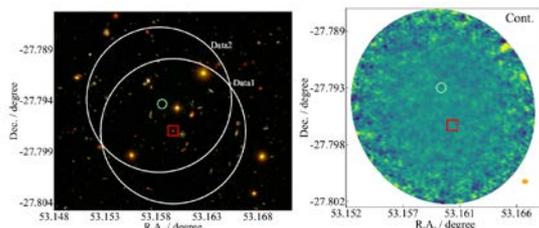


Figure 1. (Left): Pseudo RGB image (F169W+F814W+F435W) of HST of the observed field. The two ALMA pointings are overlaid (Data1 and Data2; white circles). The target, GDS24569, is centered in the image (red square). The position of the tentative detection found in Data2 (Sec. 3.2.2) is also shown (green circle), while no optical/IR counterpart is found at the position. (Right): Dust continuum map, created by collapsing the entire frequency range of the combined data cube. The coordinates of the objects in the left panel are indicated with the same symbols. No continuum emission is detected near the position of GDS24569. The beam size is shown at the bottom right (orange ellipse).

- No continuum
- 4σ peak at 1200km offset?
- $M_{\text{H}2} < 1.5e9 M_{\text{sun}}$

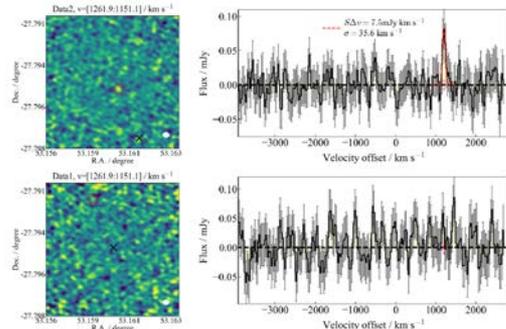


Figure 4. (Top): Tentative line detection at $v \sim 1200 \text{ km/s}$ in Data2 is shown (left panel; red circle) in the velocity integrated map (centered on its pointing). The position of GDS24569 is also shown (black cross). The beam size is shown at bottom-right (white ellipse). The Gaussian fit to the tentative line is overlaid in the extracted spectrum (right panel; red dashed line). (Bottom): Same as above but for Data1. No significant flux excess is seen at the velocity (red dashed line).

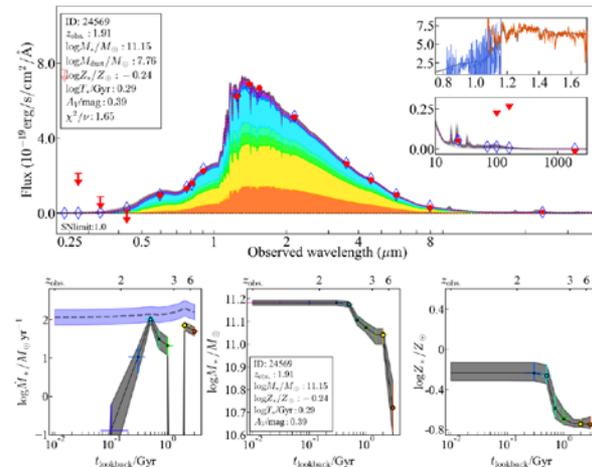


Figure 5. (Top): Spectral energy distribution (SED) of GDS24569. Broadband photometry (red points for detection and arrows for upper limits) from rest-frame UV to FIR (inset at right middle) and NIR grism spectra (inset at right top; red and blue lines for G141 and G102, respectively) are included. Flux contribution from each lookback time is shown with different colors (filled regions), whereas the best-fit total flux is shown with a dashed line (purple, with uncertainty in gray). (Bottom): Star formation rate (left), mass accumulation (middle), and metallicity evolution (right) histories of GDS24569. Colors of symbols at each lookback time correspond to those of spectral templates in the SED plot above. The star formation rate of the star-forming main sequence for a given stellar mass at each lookback time (Speagle et al. 2014) is shown in the left panel (dashed line with blue hatch).

Opt-IR SED Fitting

- gsf (ver 1.4)
- multiple (10) components : age=0.01–3 Gyr
- Calzetti (2000) extinction
- Dust emission template (Drain+Li 2007)

⇒ 0.5Gyr前で星形成はほぼ終了

⇒ $M_{\text{dust}} = 1e7.8 M_{\text{sun}}$ (24umにあるexcessから)

⇒ $M_{\text{dust}}/M^* \sim 1e-6$: 他のstacking観測ともconsistent

Quenching mechanismは?

- $M_{\text{gas}}/M_{\text{sun}} < 1\%$
- SED fittingから想定されるpeak SFRは $\sim 100 M_{\text{sun}}/\text{yr}$: $z > 2$ で見ついているcompact star formation galaxy相当
- Last starburstは0.5Gyr前で、mergerの痕跡もない、周りにgas clumpもない
 - ⇒ 星形成のみでガスを使い切ったか
 - ⇒ たとえばAGNによるpositive feedbackが効いた?
 - : compact passive galaxyのほうがAGN割合が高い

一天体だけなので、強い主張は難しいが