

Z109a Detection of a CO emission line counterpart of a $z = 3.3$ damped Ly α system

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The origin of high H I column density systems in the intergalactic medium called damped Ly α systems (DLAs) is a longstanding issue in extragalactic astronomy. Searching for the optical counterparts of DLAs is difficult due to the brightness of QSOs to which the DLAs are found on the sight-line (Krogager et al. 2017). Recently, the advent of ALMA is revolutionizing the field. Neeleman et al. (2017, 2019) have reported detections of [C II] emission as well as dust continuum of the counterparts of $z \sim 4$ DLAs. CO emission from $z \sim 2$ DLA counterparts has also been detected (Neeleman et al. 2018).

Here we report the results of ALMA Band 3 observations for CO(4-3) emission from a DLA at $z = 3.335$. The target DLA was found on the sight-line to a Lyman break galaxy (LBG) at $z = 3.6$ in the SSA22 field in our spectroscopic campaign for LBGs selected by deep imaging data of Subaru/Suprime-Cam (Mawatari et al. 2016). We detected two significant emission lines in the ALMA data cube with a peak S/N > 6. One (6.3σ) is identified on a foreground galaxy with a photometric redshift of $z = 1.1$ and the emission is likely to be CO(2-1). The other (9.6σ) does not have any continuum counterpart both in S-Cam and ALMA data. The velocity difference from the Ly α at $z = 3.335$ is very small ($+100 \text{ km s}^{-1}$) if the emission line is CO(4-3). The spatial separation from the DLA sight-line is $8''.7$ corresponding to 65 physical kpc if the emission is located at $z = 3.3$. We will discuss the origin of the emission line and a Subaru/FOCAS IFU follow-up plan.