## X22a Big Three Dragons: Molecular Gas in a Bright Lyman-Break Galaxy at $z = 7.15$

橋本拓也[1], 井上昭雄[2], 菅原悠馬[2,3], 札本佳伸[2,3], 藤本征史[4], Knudsen K. Kirsten[5], 松尾宏[3], 田村陽一[6], 山中郷史[7], 播金優一[8,9], 久野成夫[1], 小野宜昭[8], Salak Dragan[10]. (所属先: [1]筑波大学, [2]早稲田大学, [3]NAOJ, [4]コペンハーゲン大学/DAWN, [5]チャルマース工科大学, [6]名古屋大学, [7]鳥羽商船高等専門学校, [8]東京大学, [9]ロンドンカレッジ大学, [10]北海道大学

We report ALMA Band 3 observations of CO(6-5), CO(7-6) and [C I](2-1) in B14-65666 ("Big Three Dragons"), one of the brightest Lyman-Break Galaxies at $z > 7$ in the rest-frame ultraviolet continuum, far-infrared continuum, and emission lines of [O III] 88 $\mu$m and [C II] 158 $\mu$m. None of CO(6-5), CO(7-6) and [C I](2-1) are detected, whose $3\sigma$ upper limits on the luminosities are about 50 times fainter than the [C II] luminosity. Based on three methods of i) [C II] luminosity and a [C II]-to-$H_2$ conversion factor reported in local metal-poor dwarf galaxies, ii) a dust mass and metallicity-dependent dust-to-gas mass ratio, and iii) a dynamical mass estimate, we obtain the molecular gas mass ($M_{\rm mol}$) to be $(0.05 - 11) \times 10^{10}$ $M_\odot$, which is consistent with its upper limit inferred from the non-detection of mid-$J$ CO and [C I](2-1). Albeit with large uncertainty in $M_{\rm mol}$, we estimate a high molecular gas-to-stellar mass ratio ($\mu_{\rm gas}$) of $0.65 - 140$ and a short gas depletion time ($t_{\rm dep}$) of $2.5 - 550$ Myr, which are broadly consistent with extrapolations of $\mu_{\rm gas}$ and $t_{\rm dep}$ as functions of redshift, specific-star formation rate, and stellar mass as reported in previous studies. The short $t_{\rm dep}$ partly reflects the starburst nature of the target, likely to be induced by a major-merger event. B14-65666 can be an ancestor of a passive galaxy at $z \gtrsim 4$ if no gas is fueled from outside the galaxy.