X05a A study of the [O III]88μm and [C II]158μm emission in a $z = 7.2$ galaxy

Yi Ren, Yoshinobu Fudamoto, Akio K. Inoue, Yuma Sugahara, Tsuyoshi Tokuoka (Waseda U.), et al.

Far-infrared fine-structure emission lines are important tools for the study of galaxies existing within 1 Gyr after the Big Bang. Inoue et al. (2016) reported a 5.3σ detection of the [O III]88μm emission and a non-detection of the [C II]158μm emission from a $z = 7.2$ galaxy, SXDF-NB1006-2, using ALMA. As a result, the mean value of the [O III]/[C II] luminosity ratio is higher than that in local dwarf galaxies. However, Carniani et al. (2020) used additional dataset with a lower angular resolution and reported a 4.1σ detection of [C II]158μm emission in SXDF-NB1006-2, suggesting that the [O III]/[C II] luminosity ratio is consistent with local dwarf galaxies. In this work, we analyzed a new [O III]88μm dataset with a higher angular resolution to study the detailed structure of the emission in SXDF-NB1006-2. The [O III]88μm emission shows a clumpy structure with three components enclosed in the 2σ contour of the signal obtained from the previous dataset, while another signal locates outside the contour, which is hard to conclude if it is a real signal or not. *JWST* will observe the optical [O III] emission lines of this galaxy and will confirm or refuse the clumpy structure of the ionized gas. For [C II]158μm, we also analyzed both the datasets used in previous works and a new dataset obtained from the REBELS large program whose angular resolution is similar to that analyzed by Carniani et al. (2020). As a result, only a $\sim$3σ with a size smaller than the beam size can be seen near the center of the moment 0 map made by the concatenated data of those three datasets, suggesting a non-detection of the [C II]158μm emission. Finally, we gained an [O III]/[C II] luminosity ratio similar to or even higher than Inoue et al. (2016).