Z106a ALMA Reveals the Internal Structure in a z $\sim$ 3 Submillimeter Galaxy

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Submillimeter Galaxies (SMGs) are extremely active star-forming galaxies that are predominantly found in the early universe. The star formation rate (SFR) of the brightest SMGs can exceed 1000 $M_{\odot}\mathrm{yr}^{-1}$, and it is an order of magnitude larger than the SFR of star-forming galaxies in the nearby universe. Understanding the nature of SMGs is important for revealing the formation and evolution of galaxies (e.g., mass acquisitions by galaxy collisions or accretion along large-scale structure). The detailed star formation process and spatial distribution within SMGs are beginning to be resolved by ALMA in recent years. As a pilot study using ALMA, we have been observing three of the brightest unlensed SMGs at high-resolution to investigate in detail where and how the stars form in the galaxy.

In this talk, we report recent 0.″05 (370 pc) dust continuum observation of AzTEC-8 at z = 3.2 obtained using the ALMA/Band6 (211-275 GHz) and Band7 (275- 370 GHz). Our analysis reveals that AzTEC-8 has a strong central concentration with an average SFR surface density of $\Sigma_{\mathrm{SFR}} = 2643\ M_{\odot}\mathrm{yr}^{-1}\mathrm{kpc}^{-2}$. We also identify an isolated clump (size $\sim 0.05\,\mathrm{kpc}^2$) located at about 1 kpc from the center in AzTEC-8 which shows a very high value of $\Sigma_{\mathrm{SFR}} = 316\ M_{\odot}\mathrm{yr}^{-1}\mathrm{kpc}^{-2}$. In addition, we compare the effective radius (1284 pc) obtained from modeling by GALFIT and other bright star-forming galaxies. Finally, synergetic Subaru/HSC observations will allow us to uncover the relationship between the large scale cosmic structure, the feeding process, and the formation of SMGs. Such a detailed comparison across different wavelengths is envisioned in the future.