Detection of an Ultra-bright Submillimeter Galaxy behind the Small Magellanic Cloud

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Recent advances in millimeter (mm) and submillimeter (submm) continuum observations provide a chance to investigate the extreme star formation activity in the early Universe via observations of submm-bright galaxies (SMGs). To reveal detail properties of the SMGs, strong gravitational lensing magnification by foreground galaxies are helpful. We searched candidates of strongly lensed-SMGs using the wide-field and high sensitivity submm continuum data toward the Small Magellanic Cloud (SMC) at 1.1 mm wavelength.

Continuum observations at 1.1 mm toward the SMC were performed with the AzTEC camera [1] mounted on the ASTE telescope [2]. We investigated an 1.21 deg^2 field which has very weak contamination by the thermal dust emission. The noise level is ~7 mJy beam^{-1}, which is sufficient to detect ultra-bright part of SMGs ($S_{1.1\,\mathrm{mm}} > 35$ mJy) over 5σ significance.

As a result of the investigation, we found a candidate of a ultra-bright SMG denominated as MM J01071-7302 (hereafter MMJ0107). The 1.1 mm flux density of MMJ0107 is 43.3±8.4 mJy, making it one of the brightest SMGs found in AzTEC/ASTE 1.1 mm continuum observations. We estimate the photometric redshifts and far-infrared luminosity by the spectral energy distribution (SED) fittings of four galaxy templates. Figure 1 shows the result of fitting. The fluxes of MMJ0107 from optical to millimeter wavelength data are well-fitted by the SED templates. This result reveals that MMJ0107 has the redshift of 1.4–3.9 and the far-infrared luminosity of $(0.3-2.2)\times10^{14}\,\mu\mathrm{L}_\odot$ (μ is the magnification factor by gravitational lensing), which corresponds to the star formation of 5600–39,000 $\mu\mathrm{M}_\odot\,\mathrm{yr}^{-1}$, suggesting that MMJ0107 is a highly magnified lensed SMG.

This study demonstrates that a high-redshift galaxy can be reasonably separated from foreground objects through multi-band photometry. Further investigation in existing mm/submm data taken toward nearby galaxies and Galactic star-forming regions allows us to find more ultra-bright SMGs, and helps to reveal the detail properties of the SMGs.

Our result was published in the Astrophysical Journal Letters [3].

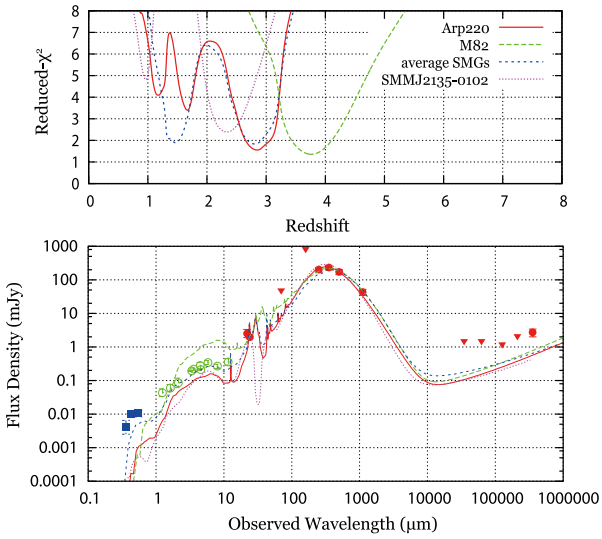

Figure 1: Result of SED fitting. Top: the reduced-χ^2 value of each template SED fittings with redshift. Bottom: the photometric data points of MMJ0107 and template SEDs that minimize the -χ^2.

References

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