R16b High angular resolution and high sensitivity millimeter-wave continuum imaging toward the NGC 253 starburst nucleus

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Millimeter wave observation at around 3 mm (100 GHz) is the optimum means for detecting thermal free-free emission (Bremsstrahlung) from starburst galaxies, this is because contamination by supernova remnant synchrotron emission and interstellar dust thermal emission is lower than that in other wavelengths. Photo-ionized gas generated by young massive stars is the major source of the free-free emission, and thanks to little interstellar absorption in millimeter wavelength, it is expected to be a powerful tool to illuminate dusty starburst regions and measure unattenuated star-formation rate.

We obtained a new ALMA 3 mm wavelength data set of NGC 253, a prototypal nearby starburst galaxy. A high angular resolution ($0.''5$ or 9 pc) and high sensitivity (< 100 μJy per beam) continuum map dissolves the emission into more than several spatially compact sources. The compact sources have low frequency (cm wavelengths) counterparts, which are detected in the previous studies by using VLA and ATCA. We find the 3 mm continuum fluxes of the compact sources agree well with expectation from cm-wave fluxes and spectral indices. This fact shows that dividing the compact sources into two subgroups, HII regions and supernova remnants, by radio continuum spectra works effectively. Consequently, it enables us to measure star-formation rate robustly and to estimate ionized gas properties.