Witness of Gas Infall and Outflow in the Young Starburst Dwarf Galaxy NGC 5253

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The nearest (d=3.8 Mpc) young nuclear starburst, NGC 5253, is arguably the best laboratory for understanding the star-formation process at the very early stage of a starburst. NGC 5253 is a compact blue dwarf galaxy, hosting several young clusters with ages ranging between <2.5–50 Myr and experiencing a few bursts in a short period. In the center of the galaxy, there is a deeply embedded radio compact (1–2 pc size) HII region excited by 4700 O stars. It is powered by two massive ($\sim 3\times 10^6\,M_\odot$) and young (~3.5 Myr) super stellar clusters (SSCs) separated by 0.″3 (correponding to ~6 pc).

We present ^{12}CO(2–1) observations towards the dwarf galaxy NGC 5253 using the Submillimeter Array (Fig. 1; [1]). The data shows that a large amount of molecular gas is located in the central ~200 pc starburst region, physically associated with two young super stellar clusters (SSCs). The molecular gas traced by ^{12}CO(2–1) is elongated along the minor axis (dust lane) of the galaxy and its kinematics suggest that there is an inflow of molecular gas to the direction of the central SSCs, as is also observed in HI gas at a larger scale. Due to their correlation in spatial and velocity domains, the central SSCs were likely formed from molecular gas in the nucleus. We compare the ^{12}CO(2–1) with available H_2 1–0 S(1) data, and show that while the relatively cold gas traced by ^{12}CO(2–1) is distributed along the dust lane, the warm gas traced by H_2 1–0 S(1) is associated with the central HII region and other star-forming regions. Interestingly, a cavity in the H_2 1–0 S(1) emission is found to be spatially correlated with a Hα shell. This Hα shell may trace a bipolar outflow from the central SSCs and the H_2 1–0 S(1) gas the shocked gas by the outflow encountering the surrounding quiescent gas. We calculate molecular gas inflow rate of $\sim 2\,M_\odot\,\mathrm{yr}^{-1}$, star formation rate of 0.3–0.5 $M_\odot\,\mathrm{yr}^{-1}$, and an ionized gas outflow being emitted from the SSCs with a rate of $(5\text{–}25)\times 10^{-3}\,M_\odot\,\mathrm{yr}^{-1}$.

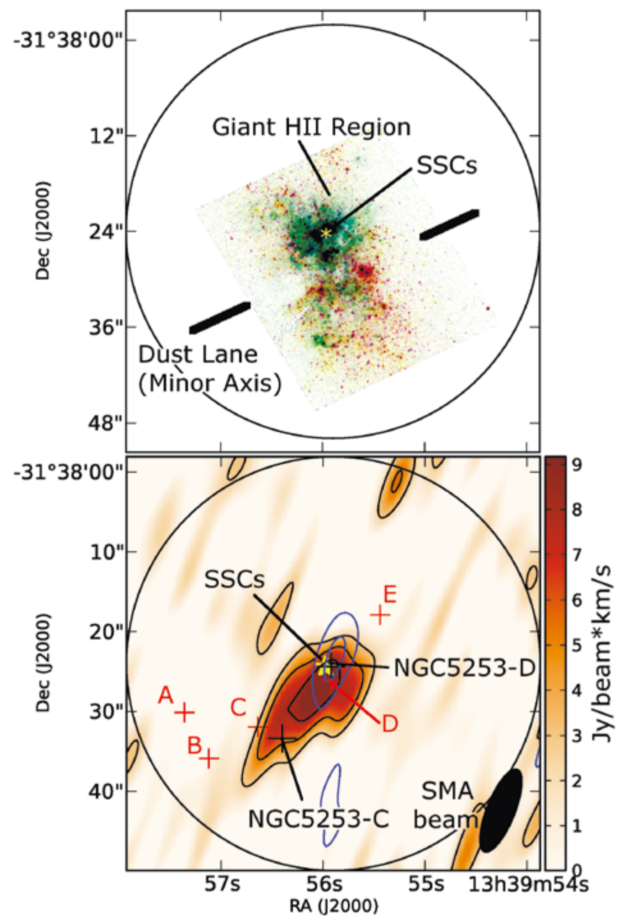

Figure 1: Top) The three-color composite image of *HST/ACS F300W* (blue), *F658N* (Hα; green), and *F814W* (red) images. The field of view of the SMA observations is shown as a circle. Bottom) The SMA CO(2–1) map of NGC 5253 in color scale and black contour. The blue contours correspond to the 230 GHz continuum emission. The yellow star corresponds to the two massive and young SSCs. The black crosses are the two identified giant molecular clouds in this study. The synthesized beam size of the SMA observations is shown at the right bottom corner.

Reference

[1] Miura, R. E., et al.: 2015, *PASJ*, **67**, 1.