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High-mass star formation triggered by collision between CO filaments in N159 West in the Large Magellanic Cloud

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The Large Magellanic Cloud has been the subject of star formation studies for decades due to its proximity to the Milky Way (50 kpc), a nearly face-on orientation, and a metallicity (0.5 solar) similar to that of galaxies at the peak of star formation in the universe (z$\sim$2) (Kaufman et al. 1999; Wolfire et al. 2010). N159, located south of the massive star formation region 30 Doradus, is the most intense molecular cloud as shown by the brightest 12CO (3-2) source in the LMC. Numerical simulations show turbulent gas becomes filamentary and dense cores are formed at the intersection of colliding filaments; this leads to triggered star formation. Our ALMA observations (PI: Fukui) cover a region of 20 pc x 25 pc at a spatial resolution of 0.2

pc x 0.3 pc. We measure the molecular cloud complexes in 12CO (1-0), 13CO (1-0), 13CO (2-1), and CS (2-1) lines. We use ratios of the CO lines to constrain the physical conditions (T and n) of the molecular gas in the N159 photodissociation region. The high resolution of ALMA provides information of the physical structure of the photodissociation region for the first time. We see filamentary structures and, for the first time outside our galaxy, detect outflows of 10-20 km/s associated with young stellar objects (YSOs). Typical length of each filament we observe is 5-10 pc long and 0.5-1.0 pc wide. We compare the molecular gas distribution to the known YSO population in order to understand star formation. The conditions in the photodissociation region gives us information about the environment in which YSOs are born.

REFERENCES

Kaufman M. J., Wolfire M. G., Hollenbach D. J., Luhman M. L., 1999, ApJ, 527, 795
Wolfire M. G., Hollenbach D., McKee C. F., 2010, ApJ, 716, 1191