The Molecular Distributions in the Outflow of L1527

T. Fujita,[1] Y. Oya,[1] N. Sakai[2], and S. Yamamoto[1]

[1]*Department of Physics, The University of Tokyo, Japan*
[2]*RIKEN Cluster for Pioneering Research, Japan*

We observed the CS (*J*=3-2), H_2CO ($2_{1,1}$-$1_{1,0}$), c-C_3H_2 ($2_{2,0}$-$1_{1,1}$), and SO (3_4-2_3) lines toward the low-mass protostellar core L1527 in Taurus. L1527 has an almost edge-on envelope/disk structure extending along the north-south direction and a bipolar outflow blowing along the east-west direction [1,2]. In this observation, we utilize the advantage of a relatively large field of view in Band 4, and delineated the extended outflow.

The CS emission clearly shows the outflow extending along the east-west direction (Fig. 1). The edges of the outflow are prominent. This distribution can be approximated by a parabola whose axis is tilted from the east-west direction by 6° (P.A.96°). To investigate the velocity structure of the outflow, we prepared position-velocity (PV) diagrams along the line perpendicular to the outflow axis (Fig. 2). In Fig. 2, an elliptic feature is seen, which likely traces the outflow cavity wall. Also, this elliptic feature is found to expand as an increasing distance from the protostar. This represents the expanding motion of the outflow.

On the other hand, the c-C_3H_2 line mainly traces a component extending along the north-south direction, which likely represents the envelope gas (Fig. 3). The H_2CO line traces both the outflow and the envelope. In the outflow, the H_2CO and CS distributions are similar to each other. Meanwhile, the SO emission shows some blobs on the parabolic shape. The intensity of SO blobs does not always correlate with those of H_2CO and CS. Hence, the SO blobs seem to trace local shocks in the outflow. Such a local shock can heat dust grains, which may lead to evaporation of SO. This would be related to the previous report that SO evaporates near the centrifugal barrier of the envelope due to an accretion shock [1].

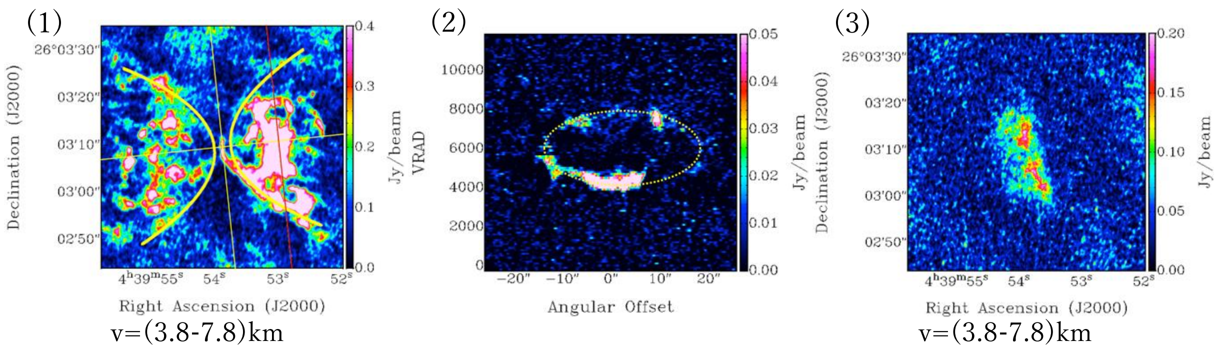

Figure: (1) The moment 0 map of the CS (*J*=3-2) line. (2) The PV diagram of the CS line. The position axis is prepared along the red line shown in Fig. (1). (3) The moment 0 map of the c-C_3H_2 ($2_{2,0}$-$1_{1,1}$) line.

References

[1] N. Sakai et al., 2014, Nature, 507, 78.
[2] Y. Aso et al., 2017, ApJ, 849, 56.