

P201a ALMA Observations of the Protostellar Binary System L1551 IRS 5: Resolving the Gas Motion inside the Hill Radii

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We will report ALMA results of the protostellar binary system L1551 IRS 5 in the 0.9-mm dust-continuum and  $C^{18}O$  (3–2) emission at an angular resolution of  $\sim 0.1$  arcsec. The 0.9-mm dust-continuum image reveals disks associated with the individual binary protostars, circumstellar disks (hereafter CSDs), as well as a disk surrounding the binary, circumbinary disk (CBD). The CBD exhibits a two spiral-arm feature, and each spiral arm connects to the CSD of each binary star. The  $C^{18}O$  (3–2) emission shows rotating and expanding motions in these spiral arms. Our numerical simulations reproduce the spiral feature and the expanding gas motion, which are caused by the gravitational torques from the binary. Our ALMA data also show transition from the CBD rotation to the individual CSD rotations around the inferred L2 and L3 Lagrangian points. Furthermore, between the binary stars a gas component with a linear velocity gradient passing through the L1 stagnation point is also found. The identified gas component and the velocity structure can be interpreted as a bridging gas stream that connects the two CSDs through the L1 point. These observed gas motions inside the Hill radii are also reproduced with our numerical simulations. In our presentation we will review these observed features along with our numerical simulations of the binary system.