FAUST III. Misaligned rotations of the envelope, outflow, and disks in the multiple protostellar system of VLA 1623$-$2417

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We report a study of the low-mass Class-0 multiple system VLA 1623AB in the Ophiuchus star-forming region, using H^{13}CO$^+$ ($J=3-2$), CS ($J=5-4$), and CCH ($N=3-2$) lines as part of the ALMA Large Program FAUST. The analysis of the velocity fields revealed the rotation motions on a wide range of scales in the envelope and the outflows (about 2000 au down to 50 au). We further investigated the rotation of the circum-binary VLA 1623A disk as well as the VLA 1623B disk.

We found that the minor axis of the circum-binary disk of VLA 1623A is misaligned by about 12 degrees with respect to the rotation axis of the large-scale outflow and the envelope. In contrast, the minor axis of the circum-binary disk is parallel to the large-scale magnetic field according to previous dust polarization observations, suggesting that the misalignment may be caused by the different directions of the envelope rotation and the magnetic field.
The outflow rotation shows a constant angular momentum with a mean specific angular momentum of about 100 au km s^{-1}.
The launching radius is estimated to be $5-16$ au, suggesting that the outflow is launched from the VLA 1623A1 disk rather than the circum-binary disk.
Furthermore, we detected for the first time a velocity gradient associated with rotation toward the VLA 16293B disk. The velocity gradient is opposite to the one from the large-scale envelope, outflow, and circum-binary disk. The origin of its opposite velocity gradient is also discussed.

References

[1] Ohashi et al. submitted to ApJ