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A movie of accretion/ejection of material in a high-mass YSO in Orion BN/KL at radii comparable to the Solar System

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Around high-mass Young Stellar Objects (YSOs), outflows are expected to be launched and collimated by accretion disks inside radii of 100 AU. Strong observational constraints on disk-mediated accretion in this context have been scarce, largely owing to difficulties in probing the circumstellar gas at scales 10-100 AU around high-mass YSOs, which are on average distant ($>$ 1 Kpc), form in clusters, and ignite quickly whilst still enshrouded in dusty envelopes. Radio Source I in Orion BN/KL is the nearest example of a high-mass YSO, and only one of three YSOs known to power SiO masers. Using VLA and VLBA observations of different SiO maser transitions, the KaLYPSO project (http://www.cfa.harvard.edu/kalypso/) aims to overcome past observational limitations by mapping the structure, 3-D velocity field, and dynamical evolution of the circumstellar gas within 1000 AU from Source I. Based on 19 epochs of VLBA observations of $v = 1, 2$ SiO masers over $\sim$2 years, we produced a movie of bulk gas flow tracing the compact disk and the base of the protostellar wind at radii $<$ 100 AU from Source I. In addition, we have used the VLA to map 7mm SiO $v = 0$ emission and track proper motions over 10 years. We identify a narrowly collimated outflow with a mean motion of 18 km/s at radii 100-1000 AU, along a NE-SW axis perpendicular to that of the disk traced by the $v = 1, 2$ masers. The VLBA and VLA data exclude alternate models that place outflow from Source I along a NW-SE axis. The analysis of the complete (VLBA and VLA) dataset provides the most detailed evidence to date that high-mass star formation occurs via disk-mediated accretion.

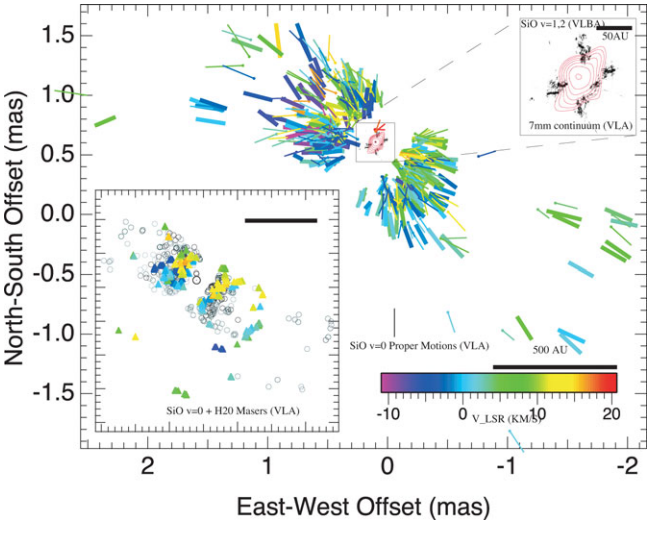

Figure 1. Disk/outflow in Orion Source I. *Main Frame)* Proper motions of SiO v=0 maser spots (*color arrows*) (4 VLA epochs over 10 years) identify a collimated, NE-SW oriented outflow (v_{mean} $\sim$18 km/s, R $\sim$100-1000 AU). *Top Right Inset)* VLA 7mm continuum emission (*red contours*) identifies an ionized disk around Source I (R $\sim$50 AU). SiO v=1,2 maser emission (VLBA) (*black image*) traces a wide-angle, bipolar wind that emanates from the ionized disk. *Bottom Left Inset)* 1.3 cm water masers (VLA) overlies regions of SiO v=0 emission.