P109a Multiple Asymmetric Infalling Filaments Discovered in a Class 0 Protostar

Yao-Lun Yang, RIKEN

Infall is a critical process in star formation. Protostars gain most of their mass while embedded within dense envelopes via gravitational collapse. Conventional theories of infall, such as the "inside-out" collapse, consists of an axisymmetric envelope whose kinematics governed by gravity and pressure support. This theoretical framework is rather simple despite that other theoretical studies include the effect of other physical processes, such as rotation. Hydrodynamical simulations, on the other hand, often show filamentary structures during the collapse at all scales from molecular clouds to protostars. While such filaments are ubiquitous detected at cloud scale, observations of the infalling streams connecting cores to protostars are challenging. Using ALMA, we find multiple filaments within 1000 au of a Class 0 protostar, BHR 71 IRS 1. These filaments show distinctive kinematics and morphology compared to the CO emission that traces the outflows, suggesting possible nature of infalling streamers. Furthermore, a ballistic infall model can reproduce the morphology of these filaments. In this presentation, I will discuss the morphology and kinematics of these filaments. I will also compare the kinematics of these filaments against the infall model constrained in a previous study using radiative transfer modeling. If these filaments are indeed infalling, BHR 71 IRS 1 would be the first protostars known to have multiple infall streamers within a few thousands au scale.