

P121a Protostellar Outflows in the Perseus Molecular Clouds

Yichen Zhang, Nami Sakai, Aya Higuchi (RIKEN), Ana Lez-Sepulcre (IRAM), Yoko Oya, Muneaki Imai (U. Tokyo), Takeshi Sakai (U. Electro-Comm.), Yoshimasa Watanabe (U. Tsukuba), Kento Yoshida (U. Tokyo), Bertrand Lefloch, Cecilia Ceccarelli (IPAG), Satoshi Yamamoto (U. Tokyo)

We present the initial results of the ALMA band 6 chemical survey towards the protostellar sources in the Perseus Molecular Cloud. The targets are selected to be Class 0 and I sources with bolometric luminosities $L > 1 L_{\odot}$ and envelope masses $M_{\text{env}} > 1 M_{\odot}$. The survey reveals rich outflow phenomena, traced by multiple molecular tracers, including SiO, CS and CCH. Among the 34 sources we have analyzed so far (sources in the NGC 1333, L1448 and L1455 regions), we are able to identify 18 outflows, divided into four categories based on their chemical characteristics: 1) highly collimated SiO jets surrounded by narrow CS outflows; 2) highly collimated SiO jets and CS outflows significantly wider than the SiO jets; 3) extended CS outflows without SiO jet; 4) base of outflow cavities traced by CS and/or CCH. We found that the opening angle of the outflow increases with the evolution of the protostar indicated by the bolometric temperature or the luminosity to envelope mass ratio. We also found that the four categories identified above follow the evolutionary sequences, with the SiO outflow only seen in the earliest stage, while the later stage outflows only seen in CCH or CS. Besides the change of outflow morphology and chemical conditions with evolution, we will also discuss their correlations with other properties of the protostellar sources.