Tracing episodic accretion with NOEMA: FU Orionis-type stars and their millimeter environment

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FU Orionis-type stars (FUors) exhibit large peaks their disk accretion rates, accompanied by bright eruptions in the optical/IR regime [1]. This so-called episodic outburst phenomenon is proposed to be present during the evolution of all low-mass young stars and may play a definitive role in shaping the structure and chemistry of the disk and envelope. We are conducting a systematic investigation of FUors using NOEMA and ALMA, to map the envelope and disk densities, temperatures, morphology and dynamics, and compare the results to studies of quiescent young stars.

I will present NOEMA 3mm continuum and CO maps towards 14 northern FUors. We revealed diverse circumstellar morphologies with internally heated, circular envelopes, neighbouring sources, outflows, envelope rotation and large-scale shock fronts [2, 3] reaching a resolution of 2-4" (~1000 AU). The derived envelope masses and temperatures fall into the characteristic domains of both embedded Class I stars and more evolved Class II sources; this means that either the episodic outbursts are present during the entire early stellar evolution and can be triggered in a large variety of environments, or that FUors represent a special evolutionary phase between the two classes. Thus, FUor-outbursts may be the main driving force behind the transition into the T Tauri-phase.

Utilizing the PolyFiX correlator of NOEMA we may also shed light on the chemical characteristics and evolution inside FUor envelopes. We mapped the emission of several molecular species (e.g. SO, CN, CS, N_2H+, C_4H, HC_3N, HNCO, etc.) around FUors with single-dish resolution (all 14 targets) and with interferometric resolution towards (3 targets), allowing us to model the envelopes based on the observed abundances and to better understand the special chemistry affected by the harsh irradiation during the outbursts.

References

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