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"Using time to map space" with the North-PHASE Legacy Survey

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Abstract

North-PHASE stands for *"Periodicity, Hot spots, Accretion Stability and Early evolution in young stellar clusters in the northern hemisphere"* and it is a 5-year (2023-2028) Legacy Survey at the Javalambre Observatory. Using time-resolved, multi-cadence, multiwavelength, large field data, it can unveil structures and processes in young stars at the relevant scales for inner planet formation, while also studying the connection between stars, their formation history, and their clusters, independently of astrometry. North-PHASE is unique *'using time to map space'*, covering thousands YSO for a statistical study of their variability and the physical processes to which it is linked.

North-PHASE follows 6 young clusters (Tr37, CepOB3, NGC2264, IC348, IC5070, NGC1333) over 5 years, obtaining multi-band, time-resolved data for 4.5k+ stars down to 0.3 $M_{\odot}$. Its 6 filters (SDSS griz, Halpha, u-band) give us advantage over other surveys, being key to distinguish the complex processes that affect YSO variability (e.g. accretion, extinction by circumstellar matter, hot and cold spots) and measuring accretion. The observed timescales allow us to connect these processes to physical structures in the YSO and their disks, allowing us to map stellar properties as well as to distinguish variability types for statistically-significant samples of YSO, thus peering into the physics of magnetospheric accretion, inner disk evolution, and stellar activity. The large FoV covers entire clusters, including their outskirts, which enables us to study not only YSO evolution vs age and stellar mass, but also the role of cluster environment and initial conditions in stars, disks, and their outcomes, independently of the astrometry.

In this poster, we present the results from the first year of observations, and what the legacy of North-PHASE will be in the fields of star formation, young stellar objects, stellar variability, and the use of time measurements to track what is beyond direct resolution.

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