Direction des Sciences de la Matière
IRFU
Service d'Astrophysique

Soutenance de thèse du Service d'Astrophysique

THE EARLIEST PHASES OF THE FORMATION OF HIGH-MASS STARS IN CYGNUS-X

Timea CSENGERI

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14h00

Despite of playing an important role in the galaxy's energy budget, high-mass stars are relatively poorly understood, especially concerning the earliest phases of their formation. There are currently two debated theoretical scenarios describing the formation of high- mass stars, a quasi-static, monolithic collapse scenario versus a highly dynamical, cluster-forming view. Since high-mass stars have an important feedback on their environment, they quickly erase the initial conditions of their formation. Therefore to distinguish, which processes govern their formation, these earliest stages must be studied. The aim of this thesis work is to confront observations of the earliest stages of high-mass star-formation in Cygnus-X to these two models.

The first part of the thesis focuses on a high angular-resolution follow-up study of a sample of Massive Dense Cores (MDCs), which were selected from an unbiased survey of dense cores in Cygnus-X. Their sizes and masses make them perfect targets to host high-mass star- formation and a systematic study of their fragmentation properties reveals a population of high-mass protostars with some of them being precursors to OB-type stars. A study of high-density tracers allows to trace the kinematic properties of the mass-reservoir of the cores, which is confronted to theoretical models. I show that the mass reservoir of these high-mass protostellar fragments forms coherent structures, with systematically organized spatial morphology and velocity pattern. These structures are then interpreted as organized flows of dense gas, whose velocity shears imply short dynamical time- scales altogether favoring a dynamical evolutionary scenario.

To complement this systematic work, the second part of the thesis focuses on the highest density region in the Cygnus-X complex from large (~1pc) to small (~0.01 pc) scales. The kinematic properties of the DR21 filament point towards a filament being in global collapse and reveal the importance of gravity and induced dynamical processes, such as sub-filaments, which may provide a replenishment of material at supersonic velocities. A high angular-resolution follow-up of the most active star-forming site of this filament shows a hierarchical site of star-formation of the ~7000 Msol clump associated with DR21(OH). This site gave recently birth to high-mass stars as indicated by hot-core and maser emission. On the other hand two infrared-quiet MDCs within the clump seem to be in an earlier stage of evolution, allowing to study the sequence of star-formation leading to the birth of a rich cluster with high-mass stars. A high level of dynamics is seen within the cold, dense gas and star-formation is likely to be continuous with a replenishment of material from large- scale filamentary structures.

Vous êtes cordialement invités au pot qui suivra la soutenance de thèse.