Contribution ID: **30** Type: **Poster**

# Investigating massive star formation with ALMAGAL: clump fragmentation statistics, compact source catalog and evolution of the core population

The physical mechanisms behind the fragmentation of high-mass dense clumps into compact star-forming cores and the properties of these cores are fundamental topics that are heavily investigated in current astrophysical research. The ALMAGAL survey (Molinari et al. 2025, A&A, in press) provides the opportunity to study this process at an unprecedented level of detail and statistical significance, featuring high-angular resolution 1.38 mm ALMA observations of 1013 massive dense clumps at various Galactic locations. These clumps cover a wide range of distances ($\sim 2-8$ kpc), masses ($\sim 10^2-10^4\,\mathrm{M}_\odot$), surface densities ($0.1-10$ g $\mathrm{cm}^{-2}$), and evolutionary stages (luminosity over mass ratio indicator within $\sim 0.05-450\,\mathrm{L}_\odot/\mathrm{M}_\odot$).
In this contribution (based on Coletta et al. 2025, A&A, in press), I present the catalog of compact sources obtained with the *CuTEx* algorithm from continuum images of the full ALMAGAL clump sample combining ACA-7m and 12m ALMA arrays, reaching a uniform high median spatial resolution of $\sim 1400$ au (down to $\sim 800$ au). In detail, I characterize and discuss the revealed fragmentation properties and the estimated physical parameters of the core population. The ALMAGAL compact source catalog includes 6348 cores detected in 844 clumps (83% of the total), with a number of cores per clump between 1 and 49 (median of 5). The estimated core diameters are mostly within $\sim 800-3000$ au (median of 1700 au). Core temperatures were assigned based on the $L/M$ of the hosting clump; estimated core masses range from 0.002 to $345\,\mathrm{M}_\odot$ (complete above $0.23\,\mathrm{M}_\odot$), and exhibit a good correlation with the core radii ($M \propto R^{2.6}$). Furthermore, I discuss the variation in the core mass function (CMF) with evolution as traced by the clump $L/M$, finding a clear, robust shift and change in slope among CMFs within subsamples at different stages. This important finding suggests that the CMF shape is not constant throughout the star formation process, but rather it builds (and flattens) with evolution, with higher core masses reached at later stages. Moreover, all cores within a clump appear to grow in mass on average with evolution, while a population of possibly newly formed lower-mass cores is present throughout. The number of cores increases with the core masses, at least until the most massive core reaches $\sim 10\,\mathrm{M}_\odot$.
Such statistically robust results favor a clump-fed scenario for high-mass star formation, in which cores form as low-mass seeds, and then gain mass while further fragmentation occurs in the clump.

**Primary author:** COLETTA, Alessandro (Istituto Nazionale di Astrofisica (INAF))

**Co-authors:** MOLINARI, Sergio (INAF - Istituto di Astrofisica e Planetologia Spaziale); SCHISANO, Eugenio (Istituto Nazionale di Astrofisica (INAF)); TRAFICANTE, Alessio (Istituto Nazionale di Astrofisica (INAF)); ELIA, Davide Quintino (Istituto Nazionale di Astrofisica (INAF)); BENEDETTINI, Milena (Istituto Nazionale di Astrofisica (INAF)); MININNI, Chiara (Università degli Studi di Firenze - INAF); SOLER PULIDO, Juan Diego (Istituto Nazionale di Astrofisica (INAF)); SANCHEZ-MONGE, Alvaro (Institute of Space Sciences (ICE, CSIC)); SCHILKE, Peter (Universitaet zu Koeln); BATTERSBY, Cara (University of Connecticut); Mr FULLER, Gary (University of Manchester, Univ. Koln); Mr BEUTHER, Henrik (Univ. Heidelberg); Mr ZHANG, Qizhou (Cambridge); BELTRAN SOROLLA, Maria Teresa (Istituto Nazionale di Astrofisica (INAF)); Ms JONES, Beth (Univ. Koln); KLESSEN, Ralf (Universität Heidelberg, Zentrum für Astronomie, Institut für Theoretische Astrophysik, Albert-Ueberle-Str. 2, 69120 Heidelberg, Germany); Mrs WALCH, Stephanie (Univ. Koln); FONTANI, Francesco (Istituto Nazionale di Astrofisica (INAF)); AVISON, Adam; BROGAN, Crystal; CLARKE, Seamus; HATCHFIELD, Perry; HENNEBELLE, Patrick (CEA Paris-Saclay); HO, Paul (ASIAA - Institute of Astronomy and Astrophysics, Academia Sinica); HUNTER, Todd; JOHNSTON, Katherine; KLAASSEN, Pamela; KOCH, Patrick; KUIPER, Rolf; LIS, Dariusz; LIU, Tie; LUMSDEN, Stuart; MARUCCIA, Ylenia (Istituto Nazionale di Astrofisica (INAF)); MOLLER, Tobias; MOSCADELLI, Luca (Istituto Nazionale di Astrofisica (INAF)); NUCARA, Alice (INAF-IAPS); RIGBY, Andrew; Dr RYGL, Kazi (Istituto Nazionale di Astrofisica (INAF)); SANHUEZA, Patricio; VAN DER TAK, Floris; WELLS, Molly; WYROWSKI, Friedrich; DE ANGELIS, Fabrizio (INAF-IAPS); Mr LIU, Scige"John (Istituto Nazionale di Astrofisica (INAF)); AHMADI, Aida; BRONFMAN, Leonardo; LIU; SU; TANG, Ya-Wen; TESTI, Leonardo (Dipartimento di Fisica e Astronomia, Università di Bologna); ZINNECKER, Hans

**Presenter:** COLETTA, Alessandro (Istituto Nazionale di Astrofisica (INAF))

**Session Classification:** Session 1b