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The Scorpius-Centaurus OB association: A benchmark for star and planet formation

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Abstract

Star formation is a fundamental process that impacts many fields of astrophysics, from the formation and evolution of planets to galaxies. Understanding how star formation begins, propagates through molecular clouds, halts, and impacts its surroundings are fundamental questions in astrophysics. The solar neighborhood, particularly the Scorpius-Centaurus (Sco-Cen) OB association, offers a unique opportunity to investigate these questions with unprecedented precision and resolution. I divided my talk in two blocks.

First, I presented the most recent cenusus of Sco-Cen, resolving many new intricate substructures [7, 8]. Star formation began at the inner part of the OB association and sequentially propagated towards the outkirts along four cluster chains: Corona Australis, Lower Centaurus Crux, Upper Scorius, and TW Hydrae. A detailed analysis of the kinematics of these cluster chains hints that stellar feedback had an important role in their formation [5, 6, 3]. Sco-Cen shares a common origin with a large family of star clusters (α Per), a kiloparsec-scale star formation event active over the past 60 Myr [9]. The new populations identified in Sco-Cen at different evolutionary stages are crucial for studies of disk and planet formation [4].

Second, I presented an innovative methodology to measure the timescale of the gas-embedded phase by comparing stellar ages derived with two independent methods: kinematics (dynamical tracebacks, evaporation ages) and evolutionary models (isochrone fitting, lithium) [2]. In this new framework, the dynamical-traceback "clock" initiates when a stellar cluster or association begins to expand after expelling most of the gas, while the isochronal "clock" initiates earlier when most stars form. Measuring this difference accurately and understanding its variations across different environments provides new information on the impact of local conditions and stellar feedback on the formation and dispersal of star clusters. Currently, precise kinematic ages are only possible in the immediate solar vicinity (< 200 pc) [1]. The improved astrometry of Gaia DR4 combined with new large spectroscopic surveys like WEAVE, 4MOST, and SDSS will be crucial to extending this study to further regions and more extreme environments.

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