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Finding Young Stars in the Noise: A Multi-Wavelength Detection and Classification Algorithm for Young Stellar Objects

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Young Stellar Objects (YSOs) range from the beginning of star formation (protostars) up until the beginning of the main sequence (T Tauri stars). By looking at the inception of the formation process, we can gain insight into stellar evolution, star-forming regions and their structures, and the motion of stars and surrounding matter. Using the Orion star-forming complex as a primary testing ground, we build an algorithm designed to detect YSOs and their evolutionary subclasses in arbitrary regions of the sky. The algorithm combines near-infrared photometry from 2MASS, soft X-ray detections from eROSITA DR1, astrometric measurements from Gaia DR3, MIST isochrones, and mid-infrared photometry from AllWISE and, where available, Spitzer SEIP. Mid-infrared YSO selection follows the Koenig & Leisawitz (2014) and Gutermuth et al. (2009) schemes, with Spitzer taking priority over WISE when classifiable data are available. Candidate populations from infrared, X-ray, and Gaia branches are merged and assessed using complementary youth indicators. Across six independent star-forming clouds, the final mid-infrared classifier recovered approximately 82% of YSOs with sufficient photometry for classification. For Class 0/I protostars, conditional recovery reached 69.8%, while classification agreement among recovered protostars and Class II sources was approximately 95%. Most missed protostars were limited by catalogue availability or unclassifiable photometry rather than colour-selection failure. These results demonstrate both the effectiveness of literature-based infrared classification when suitable data are available and the importance of combining complementary youth diagnostics to construct a portable, all-sky YSO-selection algorithm.

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Yes

What is your career level?

MSc

Which keyword describes the area of focus of this talk?

Stars & stellar clusters

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