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Conditional Invertible Neural Networks for enhanced analysis of young, low-mass stars in Trumpler 14: Classical vs. Deep learning methodologies

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Low-mass stars account for the majority of the stars formed in star-forming regions and about half of the total stellar mass. Living longer than massive stars, low-mass stars still remain in the early phases of stellar evolution even when massive stars are dead and provide important information for studying stellar evolution and planet formation.
The spectral classification of stars is the most fundamental step in understanding stellar systems. Correctly characterizing the stellar parameters is essential because it significantly influences the interpretation of stellar ages and masses on the H-R diagram and further analysis of the stellar system.
In this talk, we will present our recent works on a conditional invertible neural network (cINN) as a novel method to estimate stellar parameters (effective temperature, surface gravity, extinction, and veiling factor) of young, low-mass stars from their optical spectra. The advantage of our network is not only the time-efficient nature of the machine learning technique but also that it can overcome instrumental limitations (low spectral resolution) and methodological limitations of the classical classification method.
After pretesting the applicability of cINN in the study of low-mass stars by using template stars, we utilise our tool to analyse about 2000 young, low-mass stars in Trumpler 14 in the Carina Nebula Complex, observed with VLT/MUSE. We compare stellar parameters measured by our cINN with literature values measured from the same data by using the classical template fitting method. We will also talk about the degeneracy between stellar parameters and the importance of considering veiling on the stellar classification.

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Session Classification: Past and future multiwavelength all-sky surveys