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Exploiting large multiplex spectroscopic surveys of young clusters with neural networks

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Most of what we know of the first stages of stellar evolution and planet formation is derived from observations of young stars in the Solar Neighborhood, yet most stars and planetary systems form in clusters, and there is evidence that the Solar System itself formed in a clustered environment. In the last decades, we have progresed significantly in our understanding of star formation in clusters, mostly through photometric studies. VLT instruments have allowed us to start to probe spectroscopically the evolution of stars and star-disk interaction in clusters, especially the sensitivity and spectral coverage of MUSE is now allowing us to begin to probe the effect of cluster environment on disk accretion as well as photoevaporative winds in clusters. Understanding these processes is essential to assess disk survivability in clusters and their potential to form planetary systems. In this talk I will show the promise and limits shown by our VLT/MUSE programmes to study stellar photospheres and disk-star interaction in clusters, and will discuss the promise of WST in this field. One specific challenge that we have already encountered and addressed in our VLT/MUSE survey is the challenge of spectrally analyse samples composed of many thousand of spectra. For this purpose we developed a technique based on model-trained conditional Invertible Neural Networks. The use of these techniques will become essential with the next generation of spectrscopic surveyors, such as the WST. I will describe the methodology that we developed and the successes we obtained in the processing and analysis of large VLT/MUSE mosaics and the potential of extending this technique to future WST surveys.

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