Progetto tesi di dottorato in Fisica e Astronomia per XXXVIII Ciclo dell'Università di Firenze

Investigating the effects of the environment on the formation of stars and planets with spectroscopic surveys

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The properties of stars and of planetary systems, including their ability to host life, strongly depends on the environment where they form. The chemical composition of the parent cloud strongly influences planet formation and migration (e.g., Carter-Bond et al. 2013, Thiabaud et al. 2014). The dynamical interactions occurring during the early stages of stellar evolution and high energy radiation from massive stars may truncate or photoevaporate protoplanetary discs or trigger planet migration (Malmberg et al. 2011, Bate 2018, Concha-Ramirez et al. 2019). The *Gaia* space mission is revolutionizing our understanding of the star formation process. Most stars may not form in dense clusters (e.g., Ward et al. 2020) and planetary systems around stars formed in a low-density environment may have different properties of those formed in dense clusters (e.g., Winter et al. 2020).

In the next few years, we will carry out two spectroscopic surveys to investigate open issues in this field. In particular, we will use the new multi-object infrared spectrograph MOONS for the VLT to observe a sample of star forming regions younger than a few Myr with different masses, densities and galactocentric radii. We will determine the overall chemical and dynamical properties of these regions, and study the star to disc interactions of single young stellar objects down to very low stellar masses. We will use the new multi-object spectrograph 4MOST for the VISTA telescope to carry out the first unbiased survey of stars younger than 100 Myr within 500 pc. We will observe about 100,000 stars dispersed across the whole southern sky to trace the spatial and dynamical evolution of star forming structures as they disperse; quantify the local disk star forming rate and chemical inhomogeneity; vastly expand the numbers of identified young stars for exoplanetary studies; and provide huge coeval samples to improve young stellar evolutionary models.

The PhD student will be involved in both these ambitious projects. During the first two years, he or she will collaborate to several activities that are preliminary to the observations. Namely, the selection of the observed targets and the development of innovative software for the analysis of the data and of new tools for their interpretation. These software and tools will be initially tested on the spectra and the parameters derived from the Gaia-ESO Survey, that observed about 20 star clusters younger than 100 Myr. During the third year, the student will be involved in the analysis and interpretation of the first data coming from the two surveys carried out with MOONS and 4MOST.