Project title: Chemical Evolution of the Milky Way in the Era of Large Galactic Surveys

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In the last few years a great deal of stellar abundances has become available thanks to large Galactic spectroscopic Surveys such as Gaia-ESO (Gilmore et al. 2012), APOGEE (Majewski et al. 2017) and GALAH (De Silva et al. 2015) providing data for thousands of stars in all the Milky Way components : halo, thick disk, thin disk and bulge. At the same time, detailed chemical evolution models (e.g. Grisoni et al. 2017;2018, Matteucci et al. 2019;2020, Spitoni et al. 2019;2020) , taking into account stellar nucleosynthesis , supernova and nova progenitors as well as gas flows (in, out and radial gas flows) are trying to interpret the observed abundance patterns relative to a large number of chemical elements. From this comparison one can infer important constraints on stellar nucleosynthesis (stellar yields) and on the timescales of formation of the various Galactic components. The most common interpretation of the [X/Fe] vs. [Fe/H] plots (where X is any chemical element) is the “time-delay” model which takes into account the stellar producers of each single element and their lifetimes (Matteucci, 2012).

In the present project the PhD student will learn how to model the chemical evolution of the Galaxy by using a computer code already tested in many previous papers and applying different model approaches to the study of the evolution of the four main Galactic components. These approaches include different assumptions about gas accretion and gas outflow as well as the connection between the formation of the four components (e.g. halo-bulge, halo- thick disk, thick-thin disk). The work will start from already suggested scenarios such as the two-infall (Chiappini et al. 1997), three-infall (Micali et al. 2013) and parallel (Grisoni et al. 2017) scenarios and will eventually allow us to choose the best of them or suggest a new one. The chemical evolution code can follow the evolution in time and space of more than 40 chemical species (H, D, He, Li, C, N, O, alpha-elements, Fe, Fe-peak-elements, Cu, Zn, s- and r-process elements). From the study of the [X/Fe] ratios of the largest possible number of chemical species, it will be possible to impose constraints on the formation and evolution of the Galactic components.

References

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