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Precise abundances of Mg and neutron-capture elements in the Milky Way: chemodynamical relations using Gaia data and chemical evolution models

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The abundance of alpha and neutron-capture elements provide an important fossil signature in Galactic archaeology for tracing the chemical evolution of the Milky Way stellar populations. The combination with the astrometry and photometry from the Gaia data releases allow us to build an accurate time evolving chemodynamical picture of the Galaxy with unprecedented detail. We employ the automated abundance estimation procedure GAUGUIN, developed in the Gaia/RVS analysis pipeline, for deriving precise Mg, Eu and Sr abundances for stars observed by the ESO spectrographs HARPS (R ~ 115000), FEROS (R ~ 48000) and UVES (R ~ 40000), and parametrised within the AMBRE Project. With respect to the precise Mg abundances, we interpret the Galactic disc evolution by using Gaia astrometric measurements and estimating ages and dynamical properties for 366 main sequence turn-off (MSTO) stars in the solar neighbourhood. We measure a steeper [Mg/Fe] gradient compared to literature values, and observe the appearance of a second chemical sequence in the outer disc, 10-12 Gyr ago, populating the metal-poor low-[Mg/Fe] tail, leading to a chemical discontinuity. Our data favour the rapid formation of an early disc that settled in the inner regions, followed by the accretion of external metal-poor gas -probably related to a major accretion event such as the Gaia-Enceladus/Sausage one- that may have triggered the formation of the thin disc population and steepened the abundance gradient in the early disc. A direct comparison with chemical evolution models also indicate that the infall in the inner Galactic regions was chemically enriched whereas a primordial infall should have formed the outer regions. On the other hand, we derive heavy element abundances (r-/s- process elements as Sr and Eu) for a sample of 778 Milky Way stars, homogeneously characterised using Gaia data, to chemically and dynamically identify potential accreted stellar populations and study their different signatures with respect to the in-situ population in the Galaxy.

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