SF2A 2025
A. Siebert, K. Baillié, M. Béthermin, F. Cantalloube, E. Josselin, N. Lagarde, J. Malzac, J. Richard, L. Selliez, O. Venot (eds)

THE MILKY WAY SIGNATURE OF SPIRAL ARMS THROUGH THE AGES

M. Barbillon[1], A. Recio-Blanco[1], E. Poggio[2], P. A. Palicio[1], E. Spitoni[3], T. Tepper-García[4], P. de Laverny[1], G. Cescutti[5] and J. Bland-Hawthorn[4]

Abstract. From the spatial distribution of elements in galaxies, it is possible to pinpoint the physical processes that govern galaxy formation and evolution. In my first paper Barbillon et al. (2025), using the General Stellar Parametrizer from Spectroscopy (*GSP-spec*) data from the Radial Velocity Spectrographe (RVS) of Gaia released in the last DR3, we aim at understanding the impact of the spiral arms structure on Galactic chemical evolution, detecting their signatures in other stellar abundances than metallicity, like calcium and magnesium. More generally, we explored radial and azimuthal chemical variations in the disc.

In a circle of 4 kpc diameter around the Sun, we have produced 2D chemical abundance maps in the Galactic disc for two α-elements and for different samples of young and old giant stars. These maps, based on the $[Ca/Fe]$ and $[Mg/Fe]$ abundances, show evidence of considerable radial and azimuthal inhomogeneities, which are accompanied by metallicity fluctuations (Poggio et al. 2022). Moreover, the observed inhomogeneities in α-abundances at once for young and old populations, are spatially coherent with the literature contours of the spiral arms (Poggio et al. 2021; Palicio et al. 2023). Our understanding of the disc chemical trends is changing from a simplistic 1D radial view to a more complete 2D perspective combining radial trends, azimuthal tendencies, and small-scale variations. In the global picture that is emerging, the stars within the spiral arms are globally 1) more metal-rich and calcium-rich, 2) more $[Ca/Fe]$-poor and $[Mg/Fe]$-poor, than the stars in the inter-arms regions. This work can be interpreted in the light of the 2D chemical evolution model of Spitoni et al. (2023), and extend to zoom-in (Dubois et al. 2021) or idealised galaxies simulations (Tepper-García et al. 2024) where we are crossing simulations and observational data in order to refine our understanding of the spiral arm structures and the way to study them. Using different methods, we can trace the spiral arms signatures in simulations and track the evolution of the spiral arms stars. Over several Gyrs, between 10 and 20% of the stars born in the spiral arms are still present. It calls into question the age of the stellar populations with which we could study spiral arms and confirm the abundances *Gaia* observations.

Keywords: Galaxy: disc - Galaxy: evolution - Galaxy: structure - Galaxy: abundances - Galaxy: kinematics and dynamics

[1] 96 Bd de l'Observatoire, 06300 Nice, UMR Lagrange
[2] Via Osservatorio, 20, 10025 Pino Torinese TO, Italy, INAF
[3] Via Giambattista Tiepolo, 11, 34131 Trieste TS, Italy, INAF
[4] Physics Rd, Camperdown NSW 2050, Australia, SIfA
[5] Sezione di Trieste, via Valerio 2, 34134 Trieste, Italy, INFN

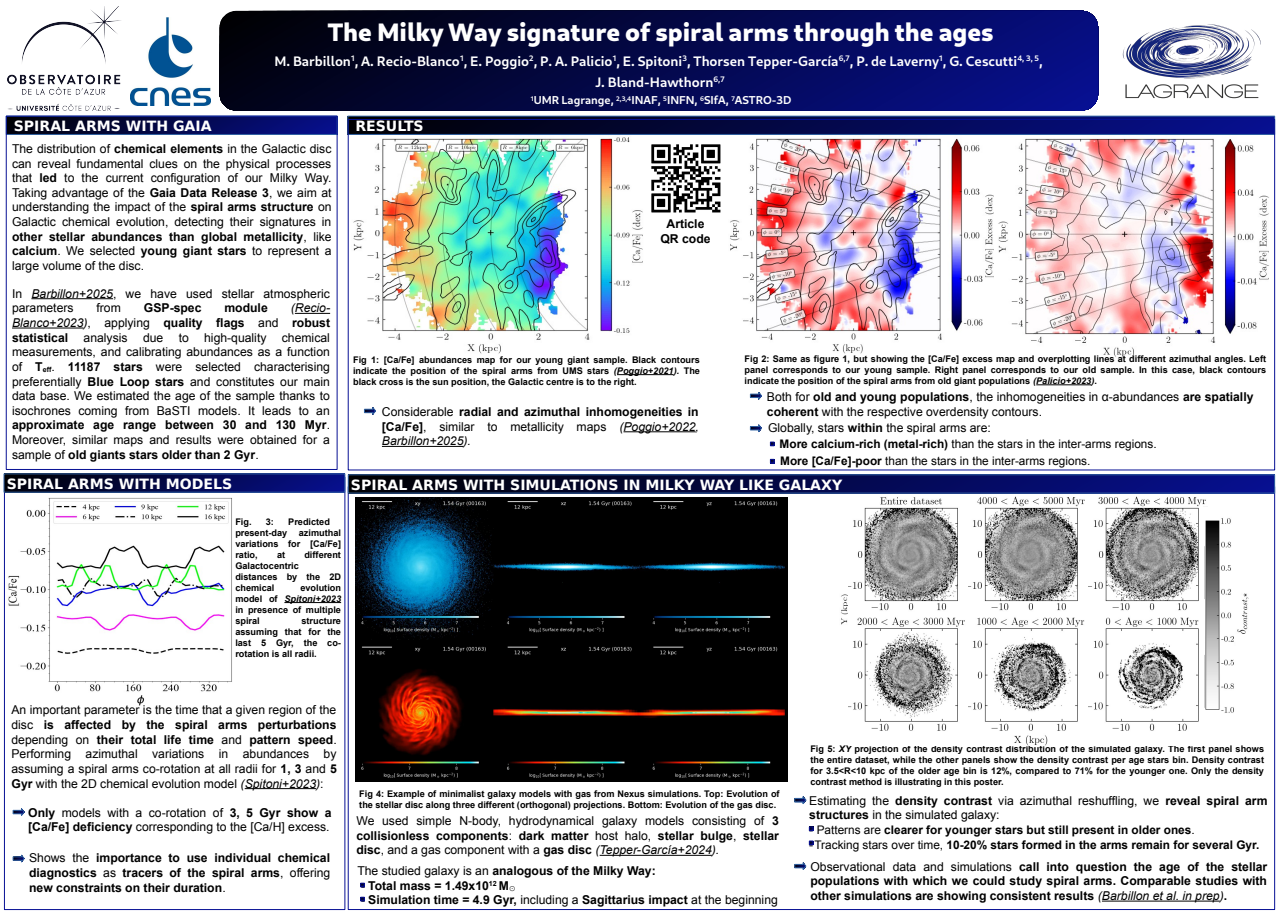

Fig. 1. Poster of my work about spiral arms in the Milky Way through *Gaia* observations and different simulations.

Thank you to the organizers of the SF2A 2025!

References

Barbillon, M., Recio-Blanco, A., Poggio, E., et al. 2025, A&A, 693, A3
Dubois, Y., Beckmann, R., Bournaud, F., et al. 2021, A&A, 651, A109
Palicio, P. A., Recio-Blanco, A., Poggio, E., et al. 2023, A&A, 670, L7
Poggio, E., Drimmel, R., Cantat-Gaudin, T., et al. 2021, A&A, 651, A104
Poggio, E., Recio-Blanco, A., Palicio, P. A., et al. 2022, A&A, 666, L4
Spitoni, E., Cescutti, G., Recio-Blanco, A., et al. 2023, A&A, 680, A85
Tepper-García, T., Bland-Hawthorn, J., Vasiliev, E., et al. 2024, MNRAS, 535, 187