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3D NLTE abundance of iron-peak and neutron-capture elements within GCE context

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One of the prime questions in Galactic archeology is how chemical elements formed in the universe. Whereas the past decades have focused on nucleosynthesis in single stars, more evidence is emerging in favour of exotic systems such as stripped massive binaries, magnetorotating supernovae (MRSNe) and compact binary mergers with GW detectors. In this study, for the first time, we explore constraints on Galactic chemical enrichment of iron-peak (Mn, Co, Ni) and neutron-capture (Sr, Y, Ba, Eu) elements using data calculated with novel 3D Non Local Thermodynamic Equilibrium (NLTE) models. These elements correspond to key iron-peak, 1st and 2nd s-process peaks, as well as r-process. We contrast the abundance trends for the calculated elements with galactic chemical evolution (GCE) model predictions and constrain the contribution of diverse sites to the nucleosynthesis of these elements. Among the most intriguing findings is the remarkable increase of [Ni/Fe] ratios in the metal-poor stars, accompanied by the well-known rise of [Co/Fe] ratios at low metallicities with decreasing [Fe/H], with values that are significantly [X/Fe] » 0 at [Fe/H] < -3. These trends could be explained either by a significantly non-standard IMF or a much greater contribution of electron-capture SNe (ECSNe) or hypernovae to the chemical enrichment of the galaxy.

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