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Chemical evolution of neutron-capture elements

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The field of chemical evolution of galaxies is key to understanding the origin and distribution of neutron-capture elements, able to provide insights into the astrophysical sites responsible for heavy-element nucleosynthesis, as well as the mechanisms that govern their dispersal throughout galaxies. In this review talk, I will present both past and recent advancements in this field. By integrating observational constraints from metal-poor stars, Galactic and extragalactic surveys, and theoretical nucleosynthesis models, I will discuss the relative contributions of different astrophysical sites to the enrichment history of heavy elements. While the s-process is generally associated with asymptotic giant branch stars and rotating massive stars, the astrophysical origin of the r-process is still debated. Neutron star mergers are considered a key site for producing heavy neutron-capture elements, but their long merger timescales and low observed rates raise questions about whether they alone can explain r-process enrichment in galaxies. Some rare classes of core-collapse supernovae, such as magneto-rotational supernovae or collapsars, have been proposed as additional sources, though their role remains uncertain. By comparing state-of-the-art Galactic Chemical Evolution models with observational data, in this talk I will highlight key uncertainties (including the timescales and relative contributions of different nucleosynthesis sites) and future directions in the field, providing a comprehensive perspective on how neutron-capture elements shape the chemical evolution of the Universe.

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