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Constraining r-process nucleosynthesis using ^{129}I and ^{247}Cm in the early Solar system

A recent study by Côté et al. (2021) has shown that ratio of the observed abundances of short-lived radioisotopes ^{129}I and ^{247}Cm in the early solar system (ESS), that are almost exclusively produced by *r*-process, can be used to directly constrain the "*last*" *r*-process source that contributed before the formation of the Solar system due to fact that these two isotopes have almost identical half-lives. This conclusion is critically based on the result that the ^{129}I and ^{247}Cm in the ESS come from one single *r*-process event. We study the evolution of ^{129}I and ^{247}Cm along with reference isotopes ^{127}I and ^{235}U at the Solar location using the turbulent gas diffusion formalism. We find that when 2-3 different *r*-process sources that are equally frequent but have distinct ^{129}I/^{247}Cm production ratios are considered, the ^{129}I and ^{247}Cm in the ESS do not come entirely from a single major event but get contributions from at least two more minor contributors. This has a dramatic effect on the evolution of the ^{129}I/^{247}Cm ratio, such that the measured ESS value in meteorites does not necessarily correspond to that of the "*last*" major *r*-process event and consequently cannot be used to constrain it. We also find that the requirement of concordance of the observed ^{129}I/^{127}I and ^{247}Cm/^{235}U ratio in the ESS has a major impact on the distribution of the ^{129}I/^{247}Cm ratio in the ESS. We find that when the concordance criteria is taken into account, important constraints on the properties of *r*-process sources that were operating during the formation of the Solar system can still be made using the observed value of ^{129}I/^{247}Cm ratio in the ESS.

Length of presentation requested

Oral presentation: 17 min + 3 min questions

Please select between one and three keywords related to your abstract

Chemical Evolution

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Chemical Evolution: the Milky Way

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