

Reduction of ^{146}Sm - ^{142}Nd chronology in the early solar system

Sunday, 8 September 2024 12:00 (15 minutes)

The ^{146}Sm , as an extinct p-process isotope, plays an irreplaceable role in the time-line construction of the early solar system (ESS) and the geochemical tracing via its α decay to ^{142}Nd . However, the measured half-life of ^{146}Sm is still debated, which can result in a large uncertainty in the initial ^{146}Sm abundance in the ESS and subsequent dating of planetary events after the birth of the Sun. In this study, this half-life is reported to be 64.2 ± 10.1 million years based on a comprehensive analysis via both the state-of-the-art techniques on the α decay process and the local extrapolation from neighboring isotopes. More importantly, this procedure is actually regardless of the α -daughter potential, convincing a model-independent half-life of ^{146}Sm . The initial $^{146}\text{Sm}/^{144}\text{Sm}$ ratio of $0.0094 - 0.0003 + 0.0005$ at 4568 Ma, corresponding to the formation of solar system, is then determined, further leading to a reduced timescale for various planetary silicate mantle differentiation events of the ESS, paving the way for a calibrated ^{146}Sm - ^{142}Nd chronometer in future studies of nucleosynthesis, earth and planetary astrophysics.

Primary author: QIAN, Yibin (Nanjing University of Science and Technology)

Presenter: QIAN, Yibin (Nanjing University of Science and Technology)

Session Classification: Theoretical Nuclear Physics for Astrophysics