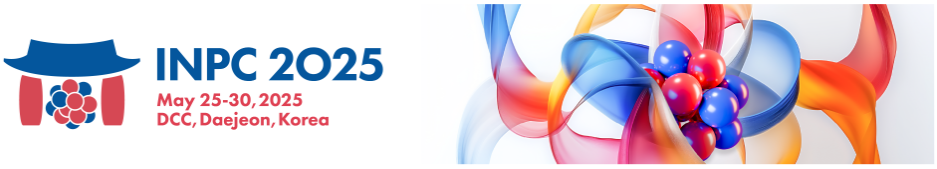

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Mystery of decay acceleration of nuclear cosmochronometer 176Lu

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A mete-stable isotope 176Lu has been used as a nuclear cosmochronometer for evaluating the ages of formation of parent bodies of meteorites and mantle-crust formation of planets and asteroids. However, there have been two critical problems. First, the measured values of the half-life of 176Lu are in the wide range of (3.5-4.1)x10^10 y. Second, the half-life values obtained from by analysis of some meteorites such as angrite and eucrites are much shorter than the values obtained from the other meteorites and terrestrial rocks. This suggests a unknown process that accelerates decay of 176Lu. For the mechanism, decay acceleration through an isomer with a half-life of 3.7 h excited by (gamma, gamma') reactions from extremely high-flux unknown gamma-ray sources near the solar system. Recently, we have measured the most accurate value of the half-life of 176Lu using a method independent of the uncertainties in the previously used methods. This result has verified the possibility of the decay acceleration in some meteorites. We have proposed decay acceleration by high energy neutron irradiation generated by high-energy cosmic-rays. To demonstrate this process, we have measured decay of the isomer of 176Lu using neutrons with MeV energies generated by high power laser. This method has an advantage that the generated energy spectrum is similar with that of the cosmic neutrons. In addition, the Hayabusa 2 project give us samples from the Ryugu asteroid, which isotopic abundance may give a hint to explore the origin of the decay acceleration. We discuss our results and perspective for the mystery concerning 176Lu.

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