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(Zoom) Study of $\nu p-$ Process Nucleosynthesis in Core Collapse Supernovae via ^{56}Ni(d,p) Reaction

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Understanding the origin of elements in our universe is inevitable for modern nuclear physics. It is known that neutron-deficient stable isotopes, referred to as $p-$nuclei, are synthesized through the p-process triggered by photo-disintegration in supernovae. One of the major issues that remain unresolved is the anomalously large abundances for certain lighter $p-$nuclei in current astrophysical scenario, such as ^{92,94}Mo and ^{94,96}Ru. A new scenario to account for the production of lighter $p-$nuclei is the neutrino driven rapid-proton capture (νp) process, which is predicted to occur in the core collapse supernovae. While the $\nu p-$process has been well-understood theoretically for the past decade, large uncertainties remain due to the lack of experimental data, especially for the neutron capture rate of the most critical waiting point in the $\nu p-$process: ^{56}Ni, which has a long β decay lifetime of 6 days and thus dominates the abundance of heavier $p-$nuclei. Since direct determination of the reaction cross section of ^{56}Ni$(n,p)^{56}$Co is challenging, we have applied the surrogate method instead by measuring the (d,p) reaction. The experiment was performed at OEDO-SHARAQ beamline at RIBF, RIKEN. The secondary ^{56}Ni beam was produced by projectile fragementation of ^{78}Kr, purified by BigRIPS separator and energy-degraded by OEDO. Recoiled protons were measured to establish the missing mass spectroscopy. Decay channels were identified by measuring projectile-like nuclei transporting through the high-resolution spectrometer SHARAQ. In this presentation, details of the experiments and preliminary results will be presented.

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