MNT reactions at ion catcher facilities - a new way to produce and study heavy neutron-rich nuclei

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Heavy neutron-rich nuclei play a key role in the formation of the third abundance peak in the astrophysical rapid neutron capture process. Producing very neutron-rich isotopes that are heavier than fission fragments is a big experimental challenge, because the conventional methods (fragmentation, spallation and fusion) preferably produce neutron-deficient nuclei. Multi-nucleon transfer reactions (MNT), with energies above the Coulomb barrier, between medium-heavy to heavy beams and heavy targets have been suggested and investigated as a possible alternative method. The nuclides produced in MNT reactions can be thermalized in gas-filled stopping cells and delivered as cooled high quality beams to decay, laser and mass spectrometry experiments. In this way their ground and isomeric state properties can be studied in high precision measurements. The method has been pioneered at the KISS experiment at RIKEN, Japan. In experiments at IGISOL, Finland and the FRS Ion Catcher, Germany, we will perform broadband measurements of the reaction products, with the aim to improve the understanding of the reaction mechanism and determining the properties of the ground and isomeric states of the produced nuclides. First results and plans for approved experiments will be presented.