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Gamma-ray and conversion electron spectroscopy on irradiated targets

We propose to irradiate different targets in the ISOL bunker 2 to then perform off-line γ-ray and conversion e^- spectroscopy on the long-living isotopes (at least 30 min) created by the 35-70 MeV protons. After irradiation, the targets can be placed in measurement setups like the b-DS tape station outside the bunker where detailed spectroscopy can be performed.
We highlight two possible physics cases:

1- Lifetime measurements with fast-timing techniques for octupole deformation in actinide nuclei. Nuclei with static octupole deformation in nuclei are considered the best systems in which a possible EDM (electric dipole moment) can be searched, since the octupole deformation enhances the sensitivity to EDM by orders of magnitudes [1]. The predicted octupole deformation in nuclei close to 229Pa, ^{229}Th can help to reach the sensitivity needed to detect the EDM value predicted by the Standard Model.
Protons of 30-50 MeV on ^{232}Th targets induce (p,xn) reactions which will populate $^{227-229}$Pa ($t_{1/2}$=30min-1.55 days) with cross sections of around 50-60 mbarn. The $^{227-22}$9Th nuclei will be populated by beta decay of $^{227-229}$Pa, enabling the measurement of their excited state lifetimes using LaBr3 crystals and fast-timing techniques [2]. Similarly, irradiation of ^{231}Pa target will produce ^{229}U with a 10 mbarn cross sections. The ^{229}U nucleus will in turn decay into ^{229}Pa ($t_{1/2}$=58 min), allowing to study dipole and octupole strengths in one of the best candidates for EDM studies. It will in turn decay into ^{229}Pa Complementary high-resolution γ-ray spectroscopy can be performed the b-DS tape station measurement point to detect weak E3 branches to probe the octupole deformation. This activity is linked to a future research program aiming at measuring the electric dipole moment using octupole-deformed radioactive nuclei from SPES
Requirements: 232Th, ^{231}Pa 2-10 mg/cm^2 targets, possibilities to move irradiated targets quickly outside of the bunker. Proton current: 100 nA.

2- Search for β+ decay in ^{56}Ni for cosmochronometer physics. Several nuclei produced in astrophysical process can act as cosmochronometers helping to measure the time scales of certain astrophysical process. One such case is ^{56}Ni: it mainly decays by EC, however in cosmic rays this nucleus is foreseen to be fully stripped, thereby inhibiting its decay. The fact that it is not detected in cosmic rays has been attributed to a small (around 10-6) β+ decay branch [3]. ^{56}Ni can be produced with 70 MeV protons on a ^{58}Ni target with a cross section of 80 mbarn. The irradiated target will then be moved to the b-DS setup and in particular to the electron conversion measuring point equipped with the SLICES setup [4]. The weak decay branch will be searched employing triple e^+-γ(511keV)-γ(811 keV) coincidences to enhance selectivity.

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