Study of proton drip line nuclei above Z = 50

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The heaviest N=Z nucleus accessible is probably ^{100}Sn. Nuclei above that with N~Z are difficult to access in fusion reactions due to the fact that available beams and targets are neutron rich. Studies have been carried out which approach N=Z and the proton drip line. Indeed ground state proton and alpha decay are known near mass 110. To date most of the studies of these neutron deficient nuclei are limited to the determination of energy levels and simple decay schemes.

Study of nuclei near N=Z and the drip line will allow the predictions of nuclear models to be tested in a new regions of nuclei, where the neutron to proton ratio is different. To date there are very few transition strength (matrix element) determinations in these nuclei. Such measurements are a more exact test of the predictions of nuclear models than energy levels. These nuclei may also be expected to be a test of the effects of the ^{100}Sn magic number, the effects of neutron-proton pairing and octupole effects which are expected near mass 110. For nuclei further from Z=50 the effects of the onset of deformation close to the drip line can also be studied.

At GSI it will be possible to use fragmentation reactions to make these nuclei at a rate that it should be possible, through Coulomb excitation, to measure B(E2) strengths. A fractional cross section in the 10^{-5} – 10^{-6} range should allow such measurements to be carried out. Using EPAX and considering the fragmentation of ^{112}Sn, ^{120}Te, ^{124}Xe, ^{130}Ba, ^{136}Ce and ^{144}Sm it should be possible to access tin isotopes as light as ^{104}Sn with sufficient yield to make measurements. The exact fragmentation beam would be chosen after consultation with machine experts. The measurements would be made at a Coulex target with the fast beam following the FRS. An array of Ge detectors (RISING) will be needed. Calculations show that other nuclei near the drip line can also be made with similar cross sections for most isotopic chains. For example in the fragmentation of ^{144}Sm nuclei around ^{124}Ce and ^{126}Nd are populated. These nuclei are deformed. The low energy of the gamma-rays from the low lying levels could be a problem in relation to the background generated by the high energy beam.

In summary it is proposed to study near drip line nuclei above Z=50 to measure B(E2) values through Coulomb excitation. Cross section calculations show that new regions of nuclei can be access through this method.