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New techniques for probing nuclear shape around A=70

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The presence of large shell gaps at N=Z=34 and 36 at both oblate and prolate shape has long been predicted to
lead to a coexistence of shapes in this region. Recent results are beginning to challenge whether such oblate shapes can indeed be located. We present two complementary approaches to investigating such shape coexistence. The first is the reorientation effect in low energy Coulomb excitation, a well-established technique
which has been reinvigorated by the availability of intense radioactive beams. We discuss this in the context of
70Se where a Coulomb excitation experiment using MINIBALL at REX-ISOLDE has shown that this nucleus has a
weakly-deformed prolate shape for the first 2+ state, in contrast to the oblate shape suggested by many theories.
The second approach is the previously neglected impact of shape changes on Coulomb energy differences in isospin multiplets. In investigating the latter, we have focussed on the properties of odd-odd N=Z nuclei in the
A=70-80 region, and have devised the new technique of recoil-beta-tagging. This makes use of the high energy positrons emitted in the decay of odd-odd N=Z nuclei as a tag at the focal plane of the recoil separator RITU at
the University of Jyvaskyla. In this manner, we have extended knowledge on the excited states of 74Rb and discovered the location of the T=1 states in 78Y for the first time. Coulomb energy differences (CED) may then be
evaluated for the T=1 pairs: 70Br/70Se, 74Rb/74Kr, 78Y/78Sr. While, in general, for sd and fp-shell T=1 pairs, the CED trend uniformly increases as a function of spin, the behaviour of the A=70-80 pairs is rather different. In
particular, the trend for A=78 is flat and near-zero, while the A=70 trend strongly decreases as a function of spin.
A simple treatment within the deformed liquid drop model shows that such a dramatic effect on the Coulomb energies can be well-explained for A=70 if 70Br and 70Se are evolving from weakly-deformed prolate to strongly-
deformed prolate as a function of spin. The combination of this analysis and the Coulomb excitation result strongly questions the presence of oblate shapes in the light selenium nuclei. Ideas for the continuation of both of
these complementary experimental techniques in answering questions relating to nuclear shape will be presented. It is a pleasure to acknowledge the strong contribution of colleagues in the MINIBALL and REX-ISOLDE
collaborations and in the RITU-GAMMA group at the University of Jyvaskyla.

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