Odd Neutron Species

The decay of the odd neutron species is characterized by the appearance of several isomer pairs. In order to understand these it may be best to review the manner of addition of two odd particle orbitals in deformed nuclei. Since, in deformed nuclei, there is a common reference axis (the major elliptical nuclear axis) for both particles, the projection of the angular momentum of the particles on this axis will have to add as parallel ($\Sigma=1$) or antiparallel ($\Sigma=0$). In Fig. 3 we can see the sum rules for this addition in deformed nuclei; in the case of odd-odd nuclei they yield the well known Gallagher-Moskowski rule.

As an example of the above, we see in Fig. 4 the levels observed by Katori and Friedman[3] in ^{242}Am by use of the ^{243}Am(d,t) ^{242}Am reaction. These fit into three pairs of rotational bands whose base angular momentum (Ω) values are completely described by $\Sigma=0$ and $\Sigma=1$ bands of either the $\frac{1}{2}+$ [631], $\frac{5}{2}+$ [622] and $\frac{1}{2}-$ [501] neutron adding to the $\frac{5}{2}-$ [523] proton according to our rules.

In addition to the angular momentum values two other characteristics of the $\Sigma=0$ and $\Sigma=1$ bands in odd odd deformed nuclei can be seen in Fig. 3. The energy splittings of the $\Sigma=0$ and $\Sigma=1$ bands can be calculated by use of a variety of particle-particle interactions. These all yield, in general, a splitting of about 75 KeV, which is about the amount observed experimentally. In addition, the bands all occur at an excitation energy close to that of the various single neutron excitation energies in neighboring, isotonic, even proton, odd neutron nuclei. In Fig. 4 the excitation energies of the neutron single particle levels[4] in ^{241}Pu are shown for comparison with those of the corresponding $\Sigma=1$ and $\Sigma=0$ bands in ^{241}Am.