However, the product of even this reaction is some half dozen neutrons short of the objective of $N = 184$ (although P. Möller et al. (60) suggest that this spherical shell is pushed down to $N = 178$). A closer approach to $N = 184$ might be achieved by using $^{254}_{99}Es$ as a target, but this is hampered because it is presently available in very limited (microgram) quantities. An interlaboratory group in the United States (Berkeley-Livermore-Los Alamos-Oak Ridge) is proposing that this nuclide be produced in larger amounts (40 μg) for this purpose (61).

More recent calculations (60, 62) suggest that there should be stabilizing, deformed nuclear shells (or subshells) at lower neutron numbers, such as $N = 162$. Some of the above described attempts to synthesize element 110 were designed to reach a neutron number near such a subshell. However, an attempt by Hulet et al. (63) to detect the alpha-decay of $^{272}108$ ($N = 164$) as the electron capture daughter of $^{272}109$ ($N = 163$), produced in the reaction $^{254}_{99}Es$ ($^{22}_{10}Ne$, 4n) was unsuccessful, leading to the conclusion that the stability is less than anticipated. Similarly, M. Schädel et al. (64) failed to detect $^{266}107$ ($N = 159$) in the reaction ^{254}Es (^{16}O, 4n).

The effects of a rather distinct deformed shell at N = 152 were clearly seen (65) as early as 1954, in the alpha-decay energies of isotopes of californium, einsteinium, and fermium. In fact, a number of authors (66) have suggested that the entire transuranium region is stabilized by shell effects with an influence that increases markedly with atomic number. Thus, the effects of shell structure lead to an increase in spontaneous fission half-lives of up to about 15 orders of magnitude for the heavy transuranium elements, the heaviest of which would otherwise have half-lives of the order of that for a compound nucleus (10^{-14} s or less) and not of milliseconds or longer, as found experimentally. This gives hope for the synthesis and identification of several elements beyond the present heaviest (element 109) and suggests (66) that the peninsula of nuclei with measurable half-lives may extend up to the "Island of Stability" at $Z = 114$ and $N = 184$ (or $N = 178$).

Reflections

Serious research on the transcurium elements is, with some exceptions, performed by scientists working at, or with connections to, large laboratories with extensive facilities--in the United States, the national laboratories (Argonne National Laboratory, Lawrence Berkeley Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory); in Europe, the Gesellschaft für Schwerionenforschung (GSI) in the Federal Republic of Germany, and the international laboratories, the Joint Institute for Nuclear Research, Dubna, USSR, and the European Institute for Transuranium Elements, Karlsruhe, FRG. (There are, of course, other laboratories that are making important contributions.) However, the potential of the transuranium field is so large that there is a need for even more specialized facilities. It is the author's dream that in the future--perhaps the distant