velocity-separated by SHIP from the $^{209}_{83}Bi$ + $^{58}_{26}Fe$ reaction. After implantation of the complete fusion reaction product in a detector, an 11.1 MeV α-particle decay was detected, followed 22 ms later by a detected alpha-particle of 1.14 MeV energy, followed 13 s later by a spontaneous fission. A possible sequence for this decay is shown in Figure 24. The 1.14 MeV alpha-particle is assumed to result from a decay in which only part of the alpha-particle energy was deposited in the detector. Such a yield corresponds to a formation cross section of $\approx 10^{-35}$ cm^2. In a second experiment in 1988 two more time-correlated decay sequences similar to the first event were found (50). The combined results of both experiments give a value of the half-life of $3.4^{+6.1}_{-1.3}$ ms for $^{266}109$ and a production cross section of 10^{+10}_{-6} picobarns. No name has been suggested for element 109.

Element 110

Y. T. Oganessian et al. (51) in 1987 reported the production in the reaction of $^{44}_{20}Ca$ with ^{232}Th, with a cross section of 8 picobarns, of a 9 ms spontaneous fission activity, which they assigned to an isotope of element 110 (possibly $^{272}110$). A similar activity was also produced, and so assigned, in the reaction of $^{40}_{18}Ar$ with $^{235-236}_{92}U$. The evidence is not sufficient to assign an atomic number. An attempt (52) by a GSI team to observe this activity from the reaction of ^{40}Ar with ^{235}U, using SHIP, led to negative results. Additional exhaustive attempts (52) by a GSI team to produce and identify element 110 by the reaction $^{208}_{82}Pb + ^{64}_{58}Ni \rightarrow ^{271}110 + 1n$ have also led to disappointment. A. Ghiorso (53) is attempting another approach through the reaction $^{209}_{83}Bi + ^{59}_{27}Co \rightarrow ^{267}110 + 1n$, using a rebuilt version of SASSY (Small Angle Separating System) (54), a gas-filled on-line recoil separator, to separate and identify the expected product. An electrostatic separator device, called "VASILISA," has been built at Dubna (55) for the separation of heavy-ion beams from reaction products of complete nuclear fusion reactions.

Heavier elements?

Considerations by theoretical physicists, beginning more than 20 years ago, led to the prediction that there should be an "Island of Stability" in a region of spherical nuclei at or near atomic number 114 (eka-lead) and neutron number 184, which hopefully might be reached by bombardment of heavy target nuclei by heavy ions. There have been more than 25 publications describing futile efforts to reach this region of "Superheavy Elements" (56, 57). The efforts, by both the Dubna group (58) and the collaborative work of the GSI-Berkeley-Los Alamos-Mainz-Bern-Göttingen groups (59) have used the promising approach of bombarding $^{248}_{96}Cm$ with $^{48}_{20}Ca$ projectiles to produce a product such as $^{294}116$ (N = 178), but these comprehensive experiments have also yielded negative results.