man, reported the production of the same isotope of 106. At the same conference a collaboration between researchers from Dubna and Lawrence Livermore reported producing an unexpectedly long-lived isotope of 106. (See the accompanying news story.)

Elements 107 and 109 have been credited to Darmstadt, and no one has publicly objected. The TWG also gives "major credit" for 108 to the Darmstadt researchers, because their evidence can stand alone whereas the Dubna experiment is convincing only when combined with some cross-section measurements made at Darmstadt. The Darmstadt group feels that it deserves sole credit for $Z = 108$ but is committed to going along with the conclusions of the working group.

Assigning names

Since the TWG report appeared, only the GSI researchers have proposed names, for elements 107 through 109. They struck an interesting compromise to fulfill their obligation to make some kind of joint proposal with Dubna for element 108: In essence, they would let the Russians have one name out of the three they proposed—but it would not be the one for element 108. Specifically, the GSI group members proposed for element 107 the name nielsbohrium, one of the names that the Dubna group had picked for another element (105); for element 108, they put forth the name hassium, after the Latin name for the state of Hesse, where GSI is located; and for 109 they chose meitnerium. So far attempts to broker a compromise on the names for elements 104 and 105 have failed.

The IUPAC has not yet recommended any names. In fact, at an IUPAC meeting in Lisbon in August, there was some pressure for the International Commission on Inorganic Nomenclature not to make any recommendations concerning names at this point. One group putting pressure on the commission is the Committee on Inorganic Nomenclature of the American Chemical Society. Paul Karol of Carnegie Mellon University, who serves on that committee, asserts that some members of the US nuclear chemical community are disturbed by the findings of the TWG and by the absence of a nuclear chemist in the group.

The TWG is standing firmly behind its conclusions. A letter from the TWG follows the comments by the three research groups in the August issue of *Pure and Applied Chemistry*. Stressing that its members had no vested interest in the outcome of its deliberations and that each had devoted long hours of study to the subject, the group declares that it does not intend to engage in point-by-point rebuttals of the objections raised by Ghiorso and Seaborg. The TWG states that "after detailed examination of all the criticisms from Berkeley we do not find it necessary in any way to change the conclusions of our report."

—Barbara Goss Levi

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EXPERIMENTS FIND A RELATIVELY LONG-LIVED ISOTOPE OF ELEMENT 106

There's more to research on heavy elements than simply producing them. Recent experiments continue to explore their properties. In a welcome collaborative effort, researchers from the Joint Institute for Nuclear Research in Dubna, Russia, and from the Lawrence Livermore National Laboratory announced at the Actinides '93 Conference in Santa Fe, New Mexico, in September that they had produced an isotope of element 106 that emits an alpha particle with a particularly low energy within a decay time between 10 and 30 sec. That's long compared with the lifetimes of microseconds to milliseconds that are more typical of the elements at the upper end of the periodic table.

The long-lived isotope, $^{266}106$, is still not as stable as the nuclides expected to populate the long-sought "island of stability," which should exist around atomic number $Z = 110$ and neutron number $N = 180$, according to the most recent calculations. Because of nuclear shell effects, some nuclides in that mass region are expected to live more than a thousand years. But forming nuclei in the region is still a formidable challenge.

Some recent theories have predicted that short of the island of stability, there might be what Rayford Nix of Los Alamos National Laboratory calls a "rock of stability." The important feature of the theories is the inclusion of deformed nuclear shape, that is, an average potential energy surface that is deformed and that gives rise to new shell structure. Calculations incorporating such deformed shells indicate that the potential energy surface contains a dip that stabilizes the nucleus against decay by alpha emission or by spontaneous fission, especially for $Z = 108$ and $N = 162$.

The Dubna–Livermore collaboration, led by Yuri Lazarev and Ronald Lougheed, set out to check that prediction. The group was not able to reach the particularly favorable isotope, $^{270}108$, but it could produce two nearby isotopes of element 106 by bombarding a curium-248 target with neon-22 projectiles accelerated at Dubna's U400 cyclotron. The researchers found six decay chains that they attributed to the alpha decay of the isotope $^{266}106$ and the subsequent spontaneous fission of its daughter nuclide. Their identification was based on establishing genetic links between those decays. The data are consistent with an alpha-decay lifetime between 10 and 30 sec and a branching ratio for spontaneous fission about equal to or less than 0.5. Another new alpha-decaying isotope produced by the Dubna–Livermore team, $^{265}106$, also shows a halflife on the order of a second.

Two sets of calculations based on the deformed-shell model have indicated that $^{266}106$ should have a relatively long halflife. The observed values agree much more closely with the theoretical calculations of a group from the Soltan Institute for Nuclear Studies in Warsaw, Poland, led by Adam Sobiczewski, than with those of Peter Möller and Nix at Los Alamos. Nix comments that the approaches of the two groups differ only in details and that lifetime estimates can be off by many orders of magnitude. In any case, the longer life of this isotope should facilitate measurements of its other properties.

—Barbara G. Levi ■