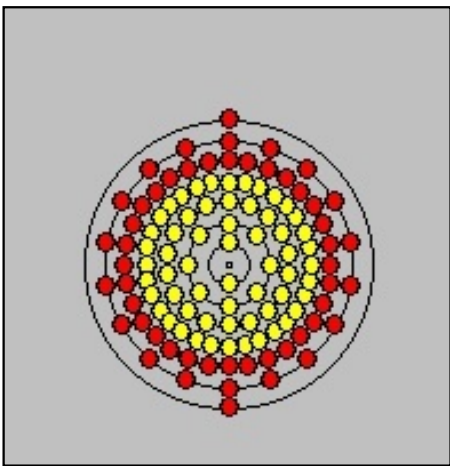


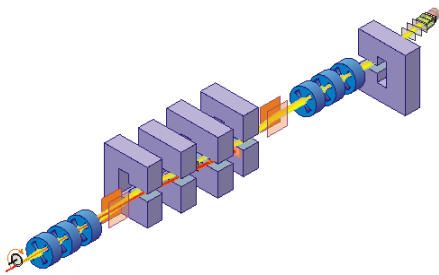
<u>Zn</u>	<u>Cd</u>	<u>Hg</u>	<u>Uub</u>	<u>Uhb</u>	<u>Bub</u>
30	48	80	112	162	212

Ununbium

Symbol	Uub
	eka- hydrargyrum eka-mercury, eka-Hg Radioactive Artificially Produced
Atomic Number	112
Relative Atomic Mass $^{12}\text{C} = 12.0000$	[285] PDF
Significant Atomic Mass	287 Neutrons 175
Atomic Radius pm	-
First Ionisation Energy kJ mol^{-1}	-
Electronegativity	-
Density kg m^{-3}	-
Molar Volume cm^3	-
Thermal Conductivity $\text{W m}^{-1} \text{K}^{-1}$	-
Melting Point K	-
Boiling Point K	-
Phase at Room Temperature	Expected to be a Solid
Number of Isotopes	7
	<p>277 Uub 0.7 ms 278 Uub ? 281 Uub ? 282 Uub 0.9 ms 283 Uub 3.8 s 284 Uub 0.1 s 285 Uub 29 s</p>
Inner + outer Shells	4 + 3 = 7
Inner + outer Orbitals	60 + 52 = 112
Filling Orbital	7s ²
Ground State Electron Configuration	[Rn] 5f ¹⁴ 6d ¹⁰ 7s ²
Ground State Electron Configuration with free Orbitals (n= 6)	
	0,0,0,0,0,6

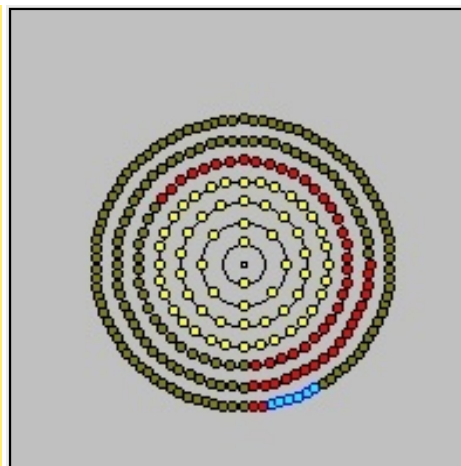


2,8,18,32, 32,18,2



Ground State Electron Configuration with compressed Orbitals (n= 162)

0,0,0,0,18,54,90



Singularity

280 = 60 + 52 + 6 + 162

	s	p	d	f	g	h	i	j
1	2							
2	2	6						
3	2	6	10					
4	2	6	10	14				
5	2	6	10	14	18			
6	2	6	10	14	18	22		
7	2	6	10	14	18	22	26	
8								

Term Symbol

$1S_0$



First prepared in 9.02.1996 by Sigurd Hofmann, Victor Ninov, Fritz Peter Heßberger, Peter Armbruster, H. Folger, Gottfried Münzenberg, H.J. Schött (Gesellschaft für Schwerionenforschung, Darmstadt, Germany)

S. Hofman et al., "The New Element 112." Zeitschrift für Physik A 354 (1996), 229-230. P.J. Karol, H. Nakahara, B.W. Petley, & E. Vogt,

CAS Reg-ID:

54084-26-3

Name Derived From

IUPAC

Ununbium is pronounced as oon-oon-BI-em

"The results of this study are of characteristically high quality but there is insufficient internal redundancy to warrant conviction at this stage. Confirmation by further results is needed to assign priority of discovery to this collaboration."

S. Hofmann, V. Ninov, F. P. Hessberger, P. Armbruster, H. Folger, G. Munzenberg, H. J. Schott, A. G. Popeko, A. V. Yeremin, S. Saro, R. Janik, M. Leino. "The new element 112", *Z. Phys. A* 354, 229230 (1996).

Using the electromagnetic velocity filter SHIP, fusion-like residues of the reaction of ^{70}Zn with enriched ^{208}Pb targets were measured. Two chains of localized alpha-emitters were identified as originating with $^{277}\text{112}$. The quality of the data is very high. However, regarding the complete criteria, there is only one incidence of redundancy, that assigned to the previously uncharacterized isotope ^{269}Hs that appears in both events; there is no redundancy involving known daughters. The observed alpha leads to the known isotope ^{265}Sg , but then reports a ^{261}Rf alpha energy that is in significant disagreement with known energies, posing uncertainty with the assignment. The last alpha in the chain agrees extremely well with that of descendant ^{257}No , but is the only concordant daughter comparison event of the entire 112 set.

Y. A. Lazarev, Y. V. Lobanov, Y. T. Oganessian, V. K. Utyonkov, F. S. Abdullin, A. N. Polyakov, J. Rigol, I. V. Shirokovsky, Y. S. Tsyganov, S. Iliev, V. G. Subbotin, A. M. Sukhov, G. V. Buklanov, B. N. Gikal, V. B. Kutner, A. N. Mezentsev, K. Subotic, J. F. Wild, R. W. Loughheed, K. J. Moody. "a- Decay of $^{273}\text{110}$: Shell closure at $N=162$ ", *Phys. Rev. C* 54, 620624 (1996).

Reference reports its ^{273}Ds alpha particle with energy 11.35 MeV in agreement with this Hofmann et al. groups 11.45 MeV when resolution is taken into account. There are other chains in this reference noted with less confidence, but that nevertheless do not provide further redundancy to these results by Hofmann et al.

The Hofmann et al. collaboration reports on one new chain originating from $^{278}\text{112}$ in the $^{70}\text{Zn} + ^{208}\text{Pb}$ reaction. However, re-analysis of the previous report two chains was unable to confirm the original results for the first chain as noted above. Hofmann et al. thus have a total of two alpha and lifetime chains of events originating with the new isotope $^{277}\text{112}$ leading to two alpha and lifetime events of ^{273}Ds , in good agreement with a single observation assigned to ^{273}Ds by Lazarev et al. in their tenuous chain. The chains continue to the previously unknown ^{269}Hs for which alpha energies and lifetimes are similar in both events. The Hofmann et al. chains continue through ^{265}Sg , but with no alpha energies. The lifetimes seen are consistent with 8 s from a previous study of ^{265}Sg but not with 158 s found. Only the first chain of Hofmann et al. resumes, producing ^{261}Rf with an 8.52 MeV alpha and 4.7 s lifetime. The alpha energy is in agreement with the literature value, but the lifetime is not. This situation is also somewhat confounded by the study of ^{261}Rf . Here, 8.30 MeV (but no 8.52 MeV) alpha particles are observed for which the lifetime is acknowledged to be 78 s. As mentioned previously, the first $^{277}\text{112}$ chain ultimately decays through an alpha and lifetime in very good agreement with that for the known isotope ^{257}No . In summary, though, there are only two chains, and neither is completely characterized on its own merit. Supportive, independent results on intermediates remain less than completely compelling at this stage.

The collaborations of Oganessian et al. used the reactions $^{48}\text{Ca} + ^{242}\text{Pu}$ and $^{48}\text{Ca} + ^{244}\text{Pu}$, respectively, each to make one observed chain originating with $^{287}114$ and $^{289}114$, respectively, which pass through unknown intermediates terminating in spontaneous fission.

The Dubna collaboration of Oganessian et al. used the reaction $^{48}\text{Ca} + ^{238}\text{U}$ to make $^{283}112$ in which the two events decay by spontaneous fission with a lifetime of ~ 2 min. An independent repeat of the © 2003 IUPAC, Pure and Applied Chemistry 75, 16011611 On the claims for discovery of elements 110, 111, 112, 114, 116, and 118 1605 same experiment, however, did not lead to any events nor did another independent attempt to follow the eka-Hg chemistry of element 112 produced by the same path lead to any events.

W. Loveland, K. E. Gregorich, J. B. Patin, D. Peterson, C. Rouki, P. M. Zielinski, K. Aleklett. Search for the production of element 112 in the $^{48}\text{Ca} + ^{238}\text{U}$ reaction, Phys. Rev. C 66, 044617-1-5 (2002).

lang="EN-GB">A. B. Yakushev, G. V. Bulkanov, M. L. Chelnokov, V. I. Chepigin, S. N. Dmitriev, V. A. Gorshkov, S. Hübener, V. Ya. Lebedev, O. N. Malyshev, Yu. Ts. Oganessian. First attempt to chemically identify element 112, Radiochim. Acta 89, 743 (2001).

The Oganessian et al. collaborations, in which $^{244}\text{Pu} + ^{48}\text{Ca}$ in the first and $^{248}\text{Cm} + ^{48}\text{Ca}$ in the second case are used to produce decay chains commencing with $^{288}114$ or $^{292}116$, respectively, followed by a pair of well-reproduced \pm -decays assigned to the otherwise unknown $^{284}112$ and terminating in spontaneous fission of previously unknown ^{280}Ds . The decay energies and lifetimes of three events for $^{284}112$ are internally redundant, but no link to recognized nuclei occurs. In the $^{244}\text{Pu} + ^{48}\text{Ca}$ study, another event originating with $^{289}114$ followed by a chain observed through $^{285}112$ and ^{281}Ds terminates with spontaneous fission at $^{277}108$, all previously unknown. The Dubna collaborations have performed careful, high-quality studies whose acknowledgement as discoveries is unfortunately not yet warranted because of unsecured connection to known descendents and unobserved elemental signatures (such as well-resolved X-ray energies).

Yu. Ts. Oganessian, V. K. Utyonkov, K. J. Moody. "Synthesis of $^{292}116$ in the $^{248}\text{Cm} + ^{48}\text{Ca}$ reaction", Phys. Atom. Nucl. 64, 1349-C1355 (2001).

Yu. Ts. Oganessian, V. K. Utyonkov, Yu. V. Lobanov, F. Sh. Abdullin, A. N. Polyakov, I. V. Shirokovsky, Yu. S. Tsyganov, G. G. Gulbekian, S. L. Bogomolov, B. N. Gikal, A. N. Mezentsev, S. Iliev, V. G. Subbotin, A. M. Sukhov, O. V. Ivanov, G. V. Buklanov, K. Subotic, M. G. Itkis, K. J. Moody, J. F. Wild, N. J. Stoyer, M. A. Stoyer, R. W. Lougheed, C. A. Laue, Ye. A. Karelin, A. N. Tatarinov. "Observation of the decay of $^{262}116$ ", Phys. Rev. C 63, 011301/1-C011301/2 (2001).

This collaboration continues to press arguments favoring their discovery of element 112 through the existence of very long-lived isomeric states of actinides and transactinides, of very high fusion cross-sections for their formation, each several orders of magnitude beyond traditional understanding. As indirect evidence, their discovery of long-lived ^{236}Bk and ^{236}Am more than a decade ago is frequently cited in their papers, yet the several existing compendia of isotopes do not acknowledge the existence of these species. The collaboration results include mention of observing long-lived proton-decay, of deformed spallation products undergoing secondary fusion reactions, and of hyperdeformed shapes, any of which significant topics by themselves should have attracted studies by other groups years ago. Yet this has not occurred. The collaborations arguable use of forceful expressions such as "overwhelming evidence", "clear and proven", and "impossible to refute" is neither convincing nor swaying. Extraordinary intriguing phenomena, not much selective in their measured character, are, in part, necessary for the acceptance of the collaborations interpretations of their data.

A. Marinov, S. Gelberg, D. Kolb. [Abnormal radioactive decays out of long-lived superand hyper-deformed isomeric states](#), Proc. Intl. Symp. on Exotic Nucl. Struct. 1520 May 2000, Debrecen, Hungary, pp. 341344 (2000).

A. Marinov, S. Gelberg, D. Kolb. Discovery of long-lived shape isomeric states which decay by strongly retarded high-energy particle radioactivity, Int. J. Mod. Phys. E 10, 185208 (2001).

A. Marinov, S. Gelberg, D. Kolb. Strongly enhanced low energy alpha-particle decay in heavy actinide nuclei and long-lived superdeformed and hyperdeformed isomeric states, Int. J. Mod. Phys. E 10, 209236 (2001).

A. Marinov. [Isomeric states and uncharacterized \$\alpha\$ -particle groups in nature](#), Proc. 3 rd Int. Conf. on Exotic Nuclei and At. Masses, 27 July, p. 380 (2001).

For completeness, we take note of the Berkeley collaboration study of $^{86}\text{Kr} + ^{208}\text{Pb}$ by Ninov et al.. Three chains terminating in ^{269}Sg enabled observation of intermediate $^{281}112$. Retraction of results appear in:

V. Ninov, K. E. Gregorich, W. Loveland, A. Ghiorso, D. C. Hoffman, D. M. Lee, H. Nitsche, W. J. Swiatecki, U. W. Kirbach, C. A. Laue, J. L. Adams, J. B. Patin, D. A. Shaughnessy, D. A. Strellis, P. A. Wilk. Editorial note: ["Observation of superheavy nuclei produced in the reaction of \$^{86}\text{Kr}\$ with \$^{208}\text{Pb}\$ "](#) [Phys. Rev. Lett. 83, 1104 (1999)], Phys. Rev. Lett. 89, 039901 (2002).
