



Discovering new elements

I cannot imagine many things more exciting than discovering a new element. Perhaps that is because I am a chemist, but the idea that you are seeing an element that no-one has ever seen before is thrilling.

At the very end of 2015, the International Union of Pure and Applied Chemistry (IUPAC), which oversees chemistry around the world, announced that four new elements had been discovered. One of these was by a team from Japan and is the first element to be discovered in Asia. The other three were by a joint team of Russian and American scientists.

These elements have numbers 113, 115, 117 and 118. As they complete the 7th row of the periodic table, if any further elements are discovered then a new period or row will be required.

The elements have yet to be named, but the groups which have been credited with their discovery have the right to suggest the name and symbol. There are rules to naming elements – they have to be inspired by people, places, nature or mythology – but the final decision rests with the International Union of Pure and Applied Chemistry.

Heavier and heavier

The last time new elements were announced was in 2011 – elements 114 and 116. These were subsequently named Flerovium (symbol Fl) for 114 and Livermorium (symbol Lv) for 116.

These super-heavy elements are not naturally occurring so the discovery involves not just finding them but also making them by smashing together atoms of other elements. The Japanese team made element 113 by firing a beam of zinc-70 atoms

(zinc atoms with 30 protons and 40 neutrons) at a target made of bismuth-209 (bismuth atoms with 83 protons and 126 neutrons) – both of which are naturally occurring. After thousands of hours of this bombardment they had made enough atoms of element 113 to make a claim about the identity of this new element.



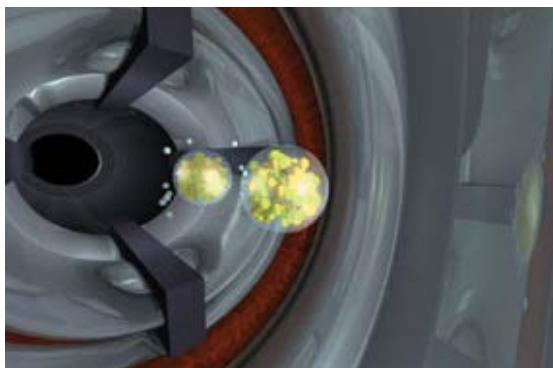
The RIKEN Nishina Centre in Japan is home to this high-energy accelerator which was used to fuse two lighter elements together to create the new element 113.

Elements 114 and 116 are named after two Nuclear Physics laboratories, the Flerov lab in Russia and the Lawrence Livermore lab in the USA.

Like most super heavy elements, element 113 is very unstable and decays to a different element after only the fraction of a second. This means that to prove it has been made requires more than collecting some and putting it into a jar. These new elements are usually identified by looking at the radiation they emit as they decay – the energy and type of that radiation and the nuclides (new nuclei) that are produced.

The Japanese team first claimed to have made this element in 2004 but they had to provide further evidence to prove its existence. Part of the difficulty for the team was that element 113 produced element 111 as it decayed – and element 111 was only verified at the end of 2004. Only known nuclei are permitted as part of the evidence for the existence of a new element. The team went back to the lab and over the past 10 years have gathered sufficient evidence to convince IUPAC that they have indeed made element 113.

The teams credited with the discovery of the other elements have similar stories – the discovery of new elements is not an easy task.



A computer simulation of a collision between an ion of calcium-43 and an americium-243 target; the particles fused to form an atom of element 115.

An eighth row?

Researchers are now likely to begin to look for elements beyond the 7th row of the periodic table. To make these elements will be even more challenging as the targets for the bombardment experiments would probably have to be made of super-heavy, short-lived elements themselves. No one has yet claimed to have made an element heavier than 118 and it is not even known if it can be done.

The periodic table may, therefore, be complete – but there is always the possibility that a heavier element may one day be discovered.

TEMPORARY NAMES

The new elements are given names and symbols based on their atomic numbers.

113 ununtrium Uut

115 ununpentium Uup

117 ununseptium Uus

118 ununoctium Uuo

Look here!

For a song including all the elements of the periodic table: <http://tinyurl.com/ogqq9jh>

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Periodic Table of the Elements																	
Legend: Alkali Metals (Yellow), Alkali Earth Metals (Orange), Transition Metals (Green), Other Metals (Purple), Lanthanides (Light Blue), Actinides (Light Green), Metalloids (Light Purple), Other Non Metals (Light Green), Halogens (Light Blue), Noble Gases (Light Blue), Unconfirmed (Grey)																	
Atomic Number: 26 55.845 Atomic Weight Fe Iron Chemical Symbol: Fe Name: Iron																	
1 1.008 H Hydrogen																	2 4.003 He Helium
3 6.94 Li Lithium	4 9.012 Be Beryllium															10 20.180 Ne Neon	
11 22.990 Na Sodium	12 24.305 Mg Magnesium															18 39.948 Ar Argon	
19 39.098 K Potassium	20 40.078 Ca Calcium	21 44.956 Sc Scandium	22 47.867 Ti Titanium	23 50.942 V Vanadium	24 51.998 Cr Chromium	25 54.938 Mn Manganese	26 4.000 Fe Iron	27 58.933 Co Cobalt	28 58.693 Ni Nickel	29 63.546 Cu Copper	30 65.38 Zn Zinc	31 69.723 Ga Gallium	32 72.63 Ge Germanium	33 74.922 As Arsenic	34 78.96 Se Selenium	35 79.904 Br Bromine	36 83.798 Kr Krypton
37 85.468 Rb Rubidium	38 87.62 Sr Strontium	39 88.906 Y Yttrium	40 91.224 Zr Zirconium	41 92.906 Nb Niobium	42 95.96 Mo Molybdenum	43 (99) Tc Technetium	44 101.07 Ru Ruthenium	45 102.91 Rh Rhodium	46 106.42 Pd Palladium	47 107.87 Ag Silver	48 112.41 Cd Cadmium	49 114.82 In Indium	50 118.71 Sn Tin	51 121.76 Sb Antimony	52 127.60 Te Tellurium	53 126.90 I Iodine	54 131.29 Xe Xenon
55 132.91 Cs Caesium	56 137.33 Ba Barium	57-71 Lanthanides	72 178.49 Hf Hafnium	73 180.95 Ta Tantalum	74 183.84 W Tungsten	75 186.21 Re Rhenium	76 190.23 Os Osmium	77 192.22 Ir Iridium	78 195.08 Pt Platinum	79 196.97 Au Gold	80 200.59 Hg Mercury	81 204.38 Tl Thallium	82 207.2 Pb Lead	83 208.98 Bi Bismuth	84 (209) Po Polonium	85 (210) At Astatine	86 (222) Rn Radon
87 (223) Fr Francium	88 (226) Ra Radium	89-103 Actinides	104 (267) Rf Rutherfordium	105 (268) Db Dubnium	106 (269) Sg Seaborgium	107 (270) Bh Bohrium	108 (269) Hs Hassium	109 (278) Mt Meitnerium	110 (281) Ds Darmstadtium	111 (281) Rg Roentgenium	112 (285) Cn Copernicium	113 (286) Uut Ununtrium	114 (289) Fl Flerovium	115 (288) Uup Ununpentium	116 (293) Lv Livermorium	117 (294) Uus Ununseptium	118 (294) Uuo Ununoctium
57 138.91 La Lanthanum	58 140.12 Ce Cerium	59 140.91 Pr Praseodymium	60 144.24 Nd Neodymium	61 (145) Pm Promethium	62 150.36 Sm Samarium	63 151.96 Eu Europium	64 157.25 Gd Gadolinium	65 158.93 Tb Terbium	66 162.50 Dy Dysprosium	67 164.93 Ho Holmium	68 167.26 Er Erbium	69 168.93 Tm Thulium	70 173.05 Yb Ytterbium	71 174.97 Lu Lutetium			
89 (227) Ac Actinium	90 232.04 Th Thorium	91 231.04 Pa Protactinium	92 238.03 U Uranium	93 (237) Np Neptunium	94 (244) Pu Plutonium	95 (243) Am Americium	96 (247) Cm Curium	97 (247) Bk Berkelium	98 (251) Cf Californium	99 (252) Es Einsteinium	100 (257) Fm Fermium	101 (258) Md Mendelevium	102 (259) No Nobelium	103 (262) Lr Lawrencium			

The periodic table showing the most recently discovered elements in grey. The latest elements have temporary names until the new ones are confirmed.