materials as a response to common challenges faced by human beings, and in order to solve environmental, energy and resource problems and to establish a safe and secure social platform (refer to 1 in Part 2 Chapter 2 Section 2).

Within MIC, the Institute of Information and Communications Technology (NICT) promotes the R&D of platform technologies, such as advanced quantum-control technology and photon-level, signal-control technology, unused-frequency band technology, and atom/molecular-level structure-control technology; NICT does so by using new materials including atoms, molecules and superconductors in order to overcome technical and performance limits and to realize dramatic progress in the areas of future information and communication technology.

METI conducts 1) the development of nanoelectronics technology whose operating principle is based on near-field light that is used to realize optical elements such as lower loss and multifunctional polarization control components and 2) the development of molecular imaging equipment that contributes to an exceptionally early detection of cancer by detecting functional changes in cells. METI also conducts the development of processing-platform technology related to welding techniques and forging technology that control elements in nano-order for further improving reliability, strength and lightness that are leveraged with the characteristics of high-quality steel materials whose structure are controlled in nano-order. Furthermore, METI makes efforts for the establishment of safety evaluation techniques in order to smoothly promote the development and application of nanomaterials that are the foundation of nanotechnology.

In addition, MEXT and METI have supported the formation of the "Tsukuba Innovation Arena" (TIA), a center that integrates industry, academia and government in a cooperative environment that has four key organizations at its core and where a leading-edge nanotechnology research facility and talented personnel are combined.

(R&D of light/quantum S&T)

Many quantum beams, including light, neutron beams and ion beams are practically used for precision observation, precision machining and substance creation, all of which are leveraged with their excellent properties. For example, a laser is used for precisely machining semiconductors, and synchrotron radiation is used for structure analysis at the atom level.

Due to dramatic progress in S&T, nowadays, it is required to process at the atom/molecule level and to examine the structure and capability of substances in detail, something that was previously impossible. Therefore, the S&T of light and quantum science support a wide spectrum of S&T, from academic research to industrial applications, as being extremely important, key technologies.

MEXT promotes the R&D of light/quantum S&T through cooperation with and interaction among various researchers in industry, academia and government by linking the potential of Japan's light/quantum S&T with needs in other areas. MEXT also has been conducting the "Development of platform technology for the formation of a light/quantum science center" since FY 2008, with the aim of promoting the development of human resources who will continue to make contributions in this area in the future.

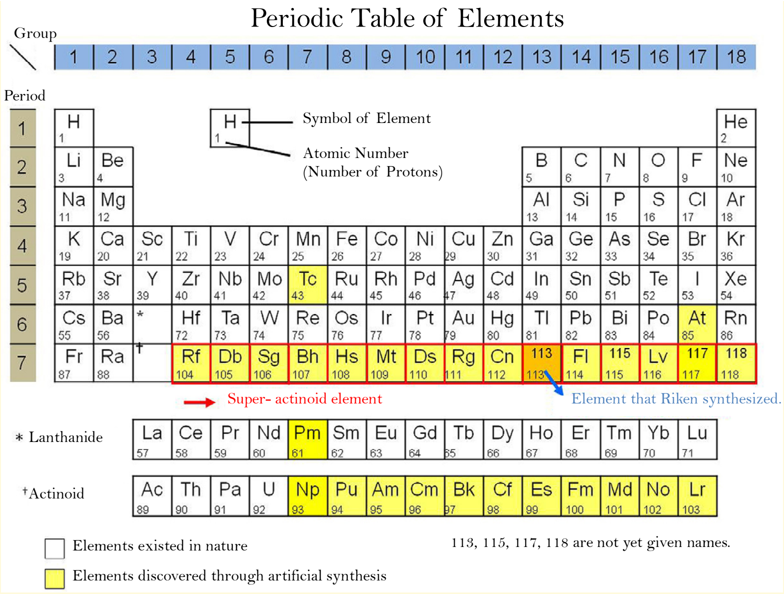
Column 2-6 Element 113 – Japan's Expectations for Naming an Element for the First Time in Japanese History

In August 2012, Japan has come one step closer to every scientists' dream, being able to name a new element in the periodic table. Kosuke Morita, Laboratory Head, et.al. of the research group at the Riken Institute has succeeded in developing the third –round synthesis of the Element 113 isotope of "^{278}113 (mass numbers 278). The research group had confirmed the synthesis of Element 113 twice in 2004 and 2005; furthermore, the group has not only succeeded in synthesizing the element but also in synthesizing its decay in a distinct manner from the previous two times. This provides significant meaning for making a definitive conclusion in discovering the element 113.

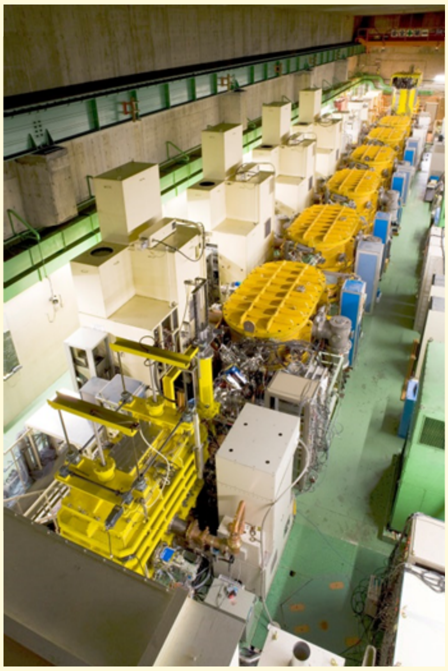
The research group conducted the experiment of partitioning the only nucleus of the super-heavy element including ^{278}113 after a fusion reaction accomplished through irradiation by a zink beam that was accelerated up to 10% of light speed by the "RIKEN Heavy-Ion Linear Accelerator (RILAC)" on a targeted bismuth thin film in order to synthesize the element 113, and observe its nuclear decay. From this experiment, a series of decay occurred, in which the element ^{278}113 became the mendelevium of atomic number 101 (254Md with mass numbers 254); this was observed after six cycles of alpha decay[1] on August 12, 2012. Dubnium, atomic number 105 (^{262}Db with mass numbers 262), is made after four cycles of alpha decay of the element ^{278}113 and is known to follow two decay paths to become ^{254}Md: a spontaneous fission with a probability of 33% and an alpha-decay probability of 67%. ^{262}Db decayed by spontaneous fission in the previous two rounds of synthesis, but it experienced alpha-decay on the third-round in this experiment. This result revealed the two decay paths that the element 113 can follow, and was considered as a credible evidence that three nuclei obtained from the experiment were indeed the ^{278}113 element. Synthesizing the element 113 is extremely difficult. In a total of 553 days of experiments starting in September 2003, the experiments successfully resulted in third-round synthesis after having repeated the collision of the atomic nucleus over 100 trillion times.

The Periodic Table of Elements was proposed by Mendeleyev in 1869. The discovery of naturally existing elements ended with the discovery of uranium, which has an atomic number of 92. Elements 93 and higher have been artificially-synthesized, and the United States, the Soviet Union, and Germany have been recognized as nations who have rights to give names to these synthesized elements. Recently, a collaboration research group between Russia and the United States was granted naming rights to the elements 114 and 116. The priority rights of naming are discussed in a collaborative working group that consists of six members: three from the International Union of Pure and Applied Chemistry and three from the International Union of Pure and Applied Physics. The Japanese research group bases its right to naming the element 113 on its three successful observations, while the collaborative research group between Russia and the United States is insisting their priority rights to name the element. The manner is currently being resolved under discussion in the working group. Naming rights will be granted to Japan if it is recognized as being the first nation in the world to synthesize the element 113; if so, Japan can make its mark on the periodic table of elements, which is an everlasting asset for human beings.

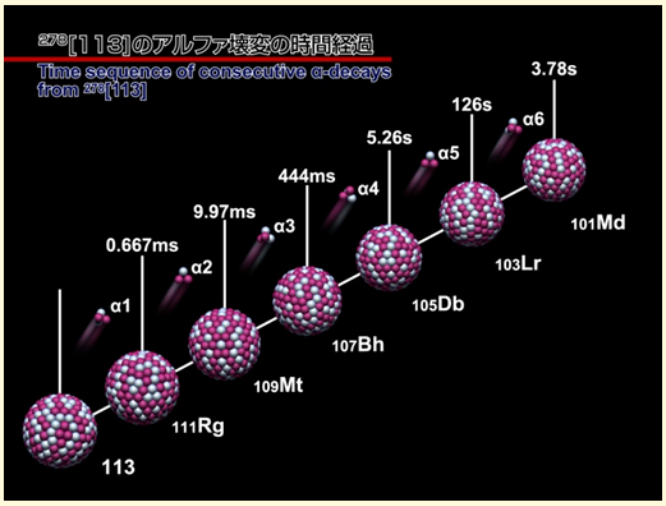
1 An atomic nucleus emits an alpha particle with a mass number of 4 (2 protons and 2 neutrons) in order to transform into an atom with a more stable nucleus. Every time, alpha decay occurs, the mass number for the nucleus of the emitted particle is reduced by 4, and its atomic number is reduced by 2.



Periodic Table of Elements
(This discovery has already been reported as of September 2012)
Courtesy of Riken



RIKEN Heavy-Ion Linear Accelerator (RILAC)
Courtesy of Riken



Decay path and the time course of the newly discovered element 113
Courtesy of Riken

(R&D of advanced information and communication technology)

Information and communication technology is a common platform technology that will play a key role in terms of the contributions made by S&T to overcome various social issues in the future. As a necessary platform for innovation in S&T, it is necessary to effectively and efficiently upgrade systems for information gathering, information aggregation, information consolidation, information management, information analysis, information circulation and information sharing by practically using the information