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Warsaw, 5 May 2014

Silicon detectors developed at the ITE confirm the existence of element 117

The search for artificially created atoms of the element with atomic number 117, conducted at the accelerator centre in Darmstadt, Germany, has ended in great success. Silicon strip detectors developed at the Institute of Electron Technology in Warsaw have played an important part in the search.

Evidence confirming the existence of the element with atomic number 117 has been obtained at the Centre for Heavy Ion Research (GSI Helmholtzzentrum für Schwerionenforschung GmbH) in Darmstadt. A team of 72 physicists, chemists and engineers from 11 countries, including Poland, have contributed to this achievement, which has been described in the prestigious scientific journal “Physical Review Letters”. Silicon strip detectors developed and fabricated at the Institute of Electron Technology (ITE) in Warsaw made it possible to observe nuclear particles indicating the presence of atoms of the new element.

Element 117 was first created and observed in 2010, during an international experiment conducted at the Joint Institute for Nuclear Research in Dubna, Russia. In line with the established scientific practice, the results needed to be independently confirmed. Such confirmation has only recently been obtained. Due to its short lifetime, element 117 does not occur naturally and must be created artificially. A target made from high-purity isotope of berkelium Bk-249 plays a key part in its production. This radioactive metal decays with a half-life of only 330 days. The material for the target was provided by the renowned Oak Ridge National Laboratory (ORNL) in the US, which produced 13 milligrams of berkelium in a year and a half. The berkelium target was bombarded with heavy ions of calcium at the centre in Darmstadt. Individual atoms of element 117 were subsequently extracted from huge cascades of emerging nuclear particles, and their decay products were observed. Parameters of particle detectors used were essential for the success of the experiment.

Silicon charged-particle detectors, developed and fabricated at the Institute of Electron Technology in cooperation with the Institut für Radiochemie at the Technische Universität München and the GSI Helmholtzzentrum für Schwerionenforschung GmbH, were designed specifically for the Focal Plane Detector Box (FPDB) for the TASCA (TransActinide Separator and Chemistry Apparatus) separator at GSI. The FPDP consists of three different detector setups manufactured at ITE. The main one is called the stop detector. There are also auxiliary detectors: the first set registers particles reflected from the stop detector, the next registers light ions which were able to pass through the stop detector.

In the FPDB, atoms of element 117 transformed – in alpha decays – into lighter elements with atomic numbers from 103 to 115. Among such elements, a new isotope Lr-266 of lawrencium, the element with atomic number 103, was detected. Accurate registration of emerging alpha particles made it possible to reconstruct decay chains and identify the source, which turned out to be atoms of element 117.

“Thanks to the excellent cooperation with colleagues from Germany, in particular Alexander Yakushev from GSI, we have developed a set of detectors with optimal parameters for research on transactinide elements for the TASCA separator, which has been recognised as the State-of-the-Art Stop Detector Array”, says Maciej Węgrzecki, chief designer of the detectors, head of the silicon detector team at ITE.

The semiconductor devices designed for the detection of alpha particles, beta particles and protons were developed from the ground up in Warsaw by a team of engineers from ITE, and are protected by patents. The devices earned international acclaim and are used in leading global centres conducting research on transactinide elements. They contributed, among others, to the discovery of heavy atomic nuclei, including isotope 283 of element 112 (copernicium, Cn) in Dubna, and isotopes 270, 271 and 277 of element 108 (hassium, Hs) in Darmstadt. In 2009, they made it possible to observe a record number of thirteen nuclei of isotopes 288 and 289 of element 114 (flerovium, Fl) during a single experiment in Darmstadt. The results of experiments conducted using ITE detectors are the subject of highly cited publications in prestigious scientific journals, including “Nature”. The research described in these publications led the International Union of Pure and Applied Chemistry and the International Union of Pure and Applied Physics to officially recognise and add to the periodic table elements 112 and 114.

The Institute of Electron Technology in Warsaw (ITE) carries out research in the field of electronics and solid-state physics. It develops, implements and popularizes state-of-the-art micro- and nanotechnologies in photonics and micro- and nanoelectronics. The Institute focuses on optoelectronic detectors and radiation sources, state-of-the-art semiconductor lasers, micro- and nanoprobes, nuclear radiation detectors, microsystems and sensors for interdisciplinary applications, as well as application-specific integrated circuits ASIC. In order to allow easier access to the technology, construction and measurement services for industrial and science and research units, the Institute has established the Centre of Nanophotonics, the Centre of Nanosystems and Microelectronic Technologies and the Laboratory for Multilayer and Ceramic Technologies.

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LINKS:

http://www.gsi.de/
GSI Helmholtzzentrum für Schwerionenforschung GmbH in Darmstadt.

http://www.ite.waw.pl/
Institute of Electron Technology in Warsaw.

http://press.ite.waw.pl/
Institute of Electron Technology in Warsaw, press releases.

IMAGES:

ITE140505b_fot01s.jpg **HR:** http://press.ite.waw.pl/images/2014/ITE140505b_fot01.jpg
The latest generation of silicon detectors, dedicated to future nuclear experiments, is presented by Maciej Węgrzecki from the Institute of Electron Technology in Warsaw, Poland. (Source: ITE)