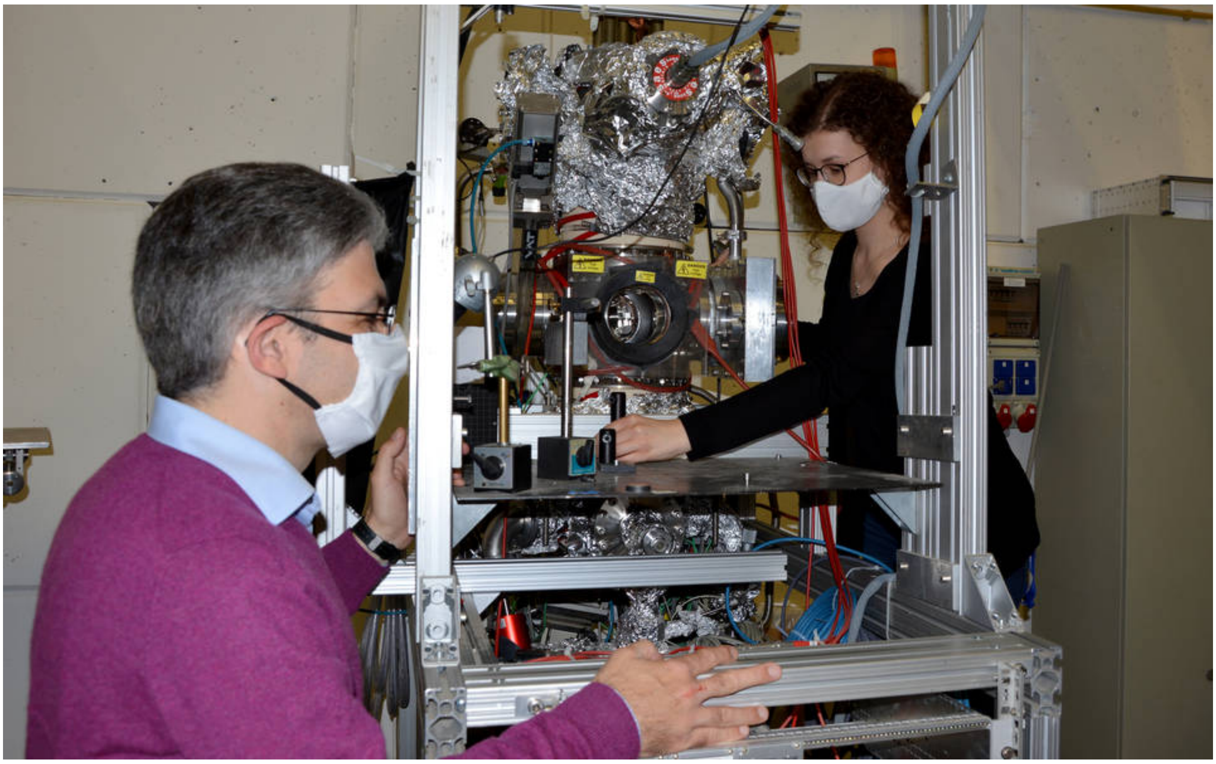
October 28, 2020

Mainz University and GSI to play an important role in the EU-funded network of doctoral students for research on radioactive elements

Nuclear and atomic physicists and nuclear chemists of Mainz University and GSI are closely involved in the EU Innovative Training Network on Laser Ionization and Spectroscopy of Actinide Elements
Joint press release by GSI, HIM and JGU

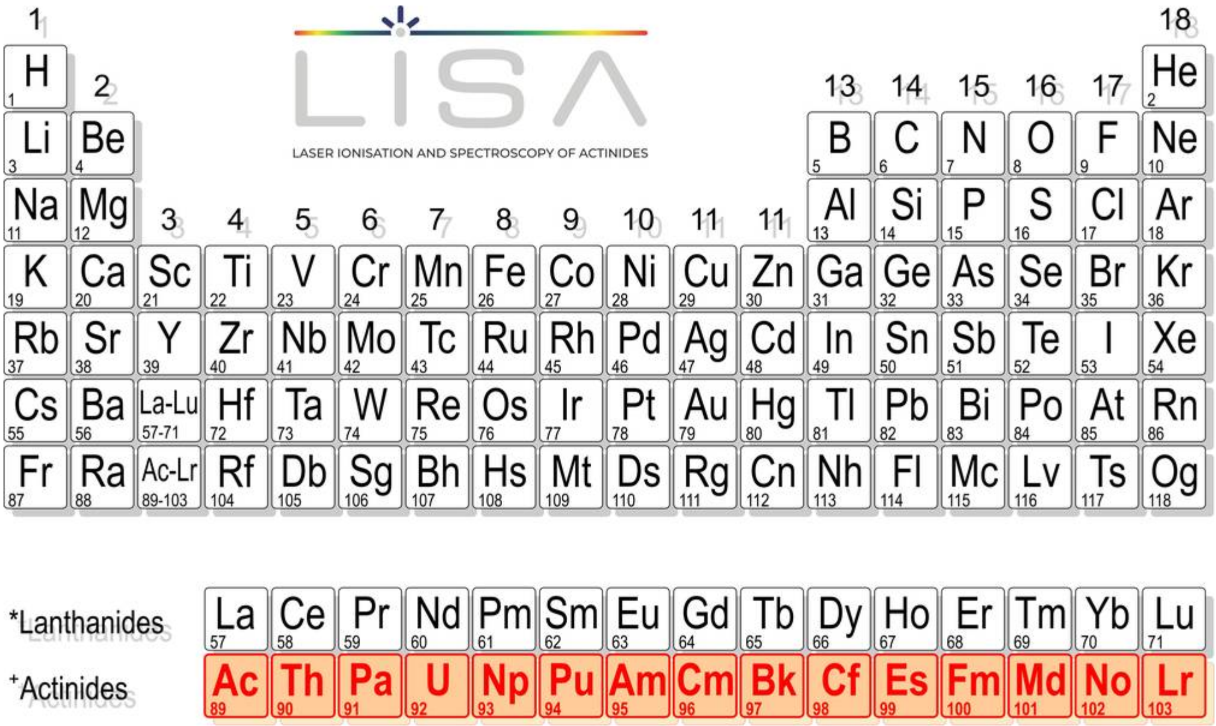


Doctoral student Jessica Warbinek (right) together with her supervisor, Professor Michael Block (left) working on the optimization of a vacuum chamber, which she will subsequently use for her work during the upcoming experimental phase at GSI

In the context of an international network funded by the European Union, scientists at Johannes Gutenberg University Mainz (JGU) and GSI Helmholtzzentrum für Schwer-ionenforschung (GSI) are participating in the education of young postgraduate students in the fields of nuclear and atomic physics and nuclear chemistry. The goal of this Innovative Training Network (ITN) on Laser Ionization and Spectroscopy of Actinide Elements (LISA) is to decipher the structure of actinides, i.e., the heavy, mostly short-lived elements at the bottom of the periodic table, and thus put in place the prerequisite for their future use in biomedical physics, in nuclear applications, and for environmental monitoring. Members of the consortium are some of the world's leading experts in fundamental atomic and nuclear physics and nuclear chemistry. The EU is supporting the LISA project for a period of four years with a total funding worth EUR 4 million.

LISA is coordinated by the CERN research center. As for Mainz University, Professor Christoph Düllmann and Professor Klaus Wendt are involved as is Professor Michael Block at GSI. "Of the 15 early-stage researchers being funded, six are expected to obtain their doctorates at JGU. We thus play a significant role within the new LISA network," said

Professor Klaus Wendt. "Thanks to the highly effective collaboration between our nuclear chemistry and physics disciplines here at JGU with the Helmholtz Institute Mainz in the field of actinide research we are also expecting interesting and important results here." Wendt himself will supervise three doctoral students. This is the second time he has become involved in an EU training network.



Actinides in the periodic table of the elements.
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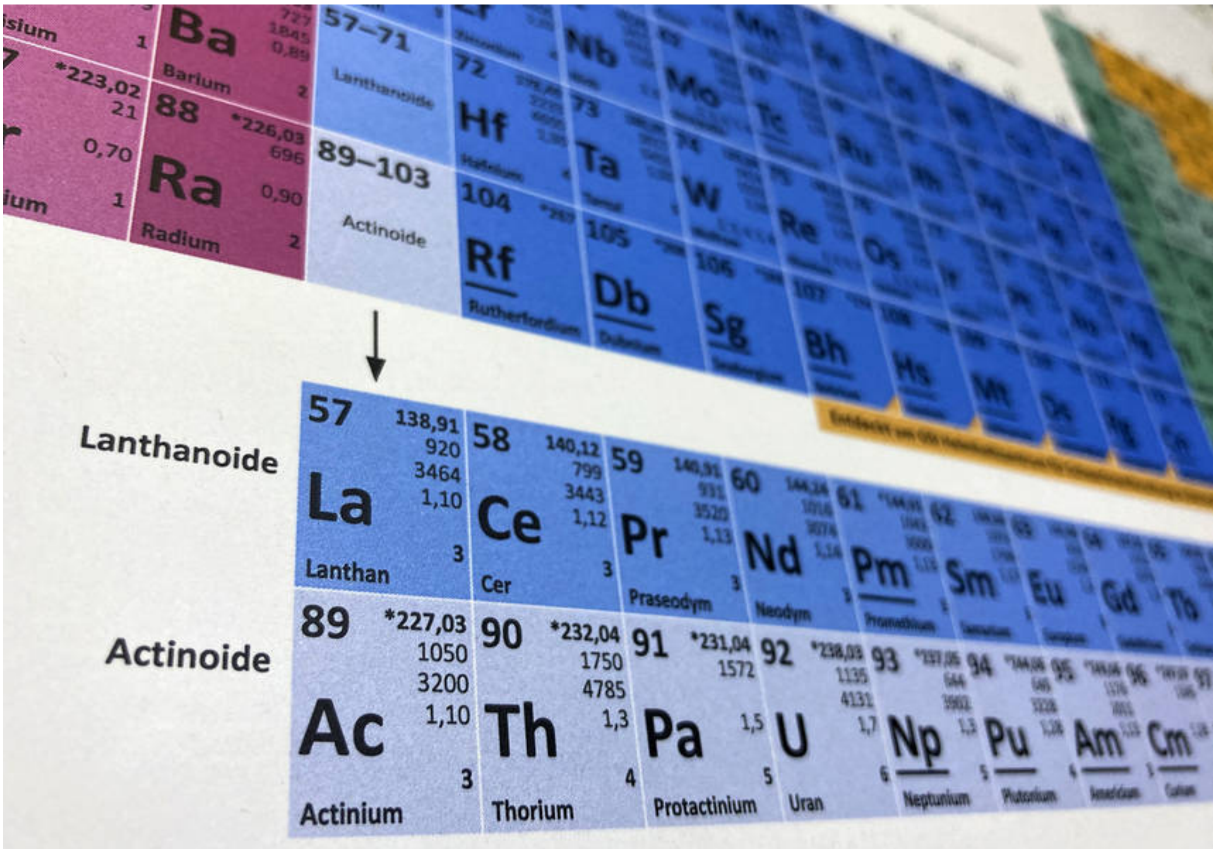
EU Innovative Training Network (ITN) involving many national partners

In addition to the universities in Mainz, Hanover, Jena, Gothenburg in Sweden, and Leuven in Belgium, major research institutions such as CERN, GSI Helmholtzzentrum für Schwerionenforschung (GSI) in Darmstadt, the heavy ion accelerator Grand Accélérateur National d'Ions Lourds (GANIL) in France, and the accelerator facility in Jyväskylä in Finland are also participating in the ITN. There are also two commercial partners based in Kassel and Glasgow. Moreover, there are 12 other partner organizations from Canada all the way to Japan, who can contact the doctoral students for scientific exchange.

In the initial phase, Professor Christoph Düllmann's group at the JGU Department of Chemistry is to chemically purify exotic actinide isotopes that are available in sufficient quantities and are adequately stable. "We will develop techniques to then convert them to a form optimized for the intended experiments within the LISA network in Jyväskylä and at GANIL, also in Mainz and at GSI," explained Düllmann, head of the joint Superheavy Element Chemistry Group of JGU, GSI, and the Helmholtz Institute Mainz (HIM).

At GSI in Darmstadt, Professor Michael Block's group will be employing laser spectroscopy to study the heaviest actinides. These can only be produced artificially and are generally very short-lived. With the help of lasers, the optical excitation of energy levels in the elements' atomic shells will be measured in detail in order to determine their atomic and nuclear properties. "The ITN is an optimal research environment for doctoral candidates to systematically and comprehensively study these exotic actinides," said Block. The first candidate has already started her work at GSI this summer.



Actinides are radioactive metals with atomic numbers 89 to 103 in the periodic table.
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Manufacture and analysis of actinides using novel laser technologies

Uranium and plutonium are probably the best known actinides, but curium, einsteinium, fermium, and mendelevium also belong to this group of radioactive elements. They all are usually extremely unstable and at present can only be produced synthetically in research reactors or particle accelerators. Due to their short-lived nature, they still provide science with major puzzles. Researching them should therefore improve our understanding of their atomic and nuclear properties. Building on this, the LISA network intends to develop new laser technologies to be able to create and investigate actinides for the development of innovative applications. LISA will promote the coherent and symbiotic collaboration between the participants, which is intended to continue after the end of the project.

Due to the on-going coronavirus crisis, the doctoral students from abroad will not yet be able to begin their research in Germany. It is expected that one doctoral student from Poland and another doctoral student from Mexico, as well as candidates from Canada, UK, and the USA, who are all to be supervised in Mainz, will be able to start in late fall 2020. The team is currently planning an academic training session for all 15 doctoral students and other guests in Mainz in the fall of 2021. (JL)

LISA

LASER IONISATION AND SPECTROSCOPY OF ACTINIDES

Logo of the EU Innovative Training Network LISA.