# Medieninformation

TECHNISCHE UNIVERSITÄT DARMSTADT

## Discovering neutron halos and neutron skins

**Darmstadt, February 8, 2018. The European Research Council awards an ERC Consolidator Grant to Alexandre Obertelli, researcher at the Department of Physics, and supports him for a period of five years with a total of 2.55 Million Euros. This will extend to antimatter the activities of TU Darmstadt in the domain of experimental Nuclear Physics.**

The prestigious ERC Consolidator Grant for Alexandre Obertelli is linked to the project "PUMA – antiProton Unstable Matter Annihilation". Its goal is to investigate neutron skins and halos, which are characterised by the development of low-density pure neutron matter at the surface of neutron-rich radioactive nuclei. PUMA will develop an innovative technique aiming at probing the tail of the nuclear density with antimatter.

One of the most fascinating quantum phenomena in Nature is the occurrence of neutron halos and neutron skins in atomic nuclei. Thick neutron skins and halos have not yet been seen in medium mass nuclei, i.e. with more than 20 nucleons, and would be unique low-density neutron matter accessible in the laboratory. Their study should greatly enhance our knowledge on nuclear structure and the nuclear equation of state, intimately linked to the structure of neutron stars. The above fundamental phenomena related to the unbalance of neutron and protons in unstable nuclei are essential to understand the complex nature of nuclei, nuclear matter and related astrophysical processes.

With PUMA, Alexandre Obertelli and his team will estimate the neutron over proton densities in the tail of the matter density distribution of short-lived radioactive nuclei, to evidence and study neutron skins and halos. To address these two questions of nuclear structure, PUMA explores a new way to study radioactive nuclei produced at very low kinetic energy: the interaction of antiprotons with unstable nuclei. The idea behind is to count the number of antiproton-induced annihilations of neutrons and protons. This approach has never been developed anywhere thus far.

PUMA is based on a new apparatus: a transportable trap to store antiprotons and maximize their interaction with slow rare isotopes in order to trigger annihilations and measure the resulting radiation. The PUMA methodology involves two steps: First of all the storage of antiprotons will be performed at the new low-energy antiproton facility ELENA at CERN. In a second step the antiprotons will be transported to the ISOLDE facility of CERN, few hundred meters away from ELENA, where slow radioactive nuclei are produced.

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Alexandre Obertelli defended his PhD thesis in 2005 at the Paris-Sud university, France. He was hired as a staff physicist at the Commissariat à l'Energie Atomique (CEA) in France in 2006 where he developed his research on the spectroscopy of radioactive nuclei.

In 2010, he obtained his first ERC grant for in-beam gamma spectroscopy at the RIBF, RIKEN, Japan. The project was based on a new device to allow the spectroscopy of short-lived nuclei produced at minute quantities. After being granted his second ERC for PUMA, Alexandre Obertelli moved to TU Darmstadt to continue his research.

Alexandre Obertelli is author of more than 100 scientific articles. He is member of the physics advisory committees of the radioactive heavy-ion beam facilities GANIL in France, RIBF and RCNP in Japan and of the scientific council of IPN Orsay, France. Furthermore he became part of the SPSC (SPS and PS Experiments Committee) of CERN on January 1, 2018. In parallel to CERN, he intends to contribute to the development of the physics program at GSI/FAIR in the near future.

(http://www.ikp.tu-darmstadt.de/obertelli):

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