RESEARCH

PREX-II DEMONSTRATES THE EXISTENCE OF THE NEUTRON SKIN IN LEAD NUCLEI

The existence of a neutron "skin" in heavy nuclei in which the number of neutrons exceeds the number of protons has recently been confirmed by a research published on Physical Review Letters on 28th April 2021 by the PREX-II collaboration, an experiment held at Jefferson Lab, the US research centre dedicated to particle physics, based in Virginia, whose members include INFN. The "skin" would appear to be like a uniform shell made up by the excess neutrons surrounding an agglomeration of protons and neutrons. The study also showed that the thickness of the outer layer of neutrons in the nuclei of lead 208, the most widespread and stable isotope of this element, is thicker than previously thought.

The data collected by PREX-II allowed to measure with unprecedented precision the thickness of the neutron skin, defined quantitatively as the difference between the radius of the neutron distribution and the radius of the proton distribution. This peculiar configuration of neutrons in the heaviest elements of the periodic table is the result of the forces acting inside the atomic nuclei, which tend to contrastingly minimise the surface area of the nuclei (surface tension) and to push out the excess neutrons to balance the energy needed to keep the nuclei together (symmetry energy).

The result of the PREX-II collaboration is also of great importance for astrophysics because it provides valuable insights into the characteristics of neutron stars, whose radius is determined by the symmetry pressure, which is in turn responsible for the neutron skin in lead nuclei. The measurement of this physical quantity will also allow to describe more accurately the deformations which a neutron star undergoes because of the gravitational field induced by another star, in the fusion phenomena of these celestial bodies. ■