

The PREX-II measurement of the ^{208}Pb Neutron Skin Thickness

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The JLab experiment PREX-II, extension of the experiment PREX, measured for the first time, in a model independent way, the neutron skin of the nucleus ^{208}Pb . The existence in heavy nuclei of a neutron skin, that is of a positive difference between the radii of the neutron and proton distributions, was supposed to exist since many years, but up to PREX and PREX-II measurements, its incontrovertible and quantitative measurement was not possible due to extreme experimental difficulties and the use of techniques, which produced results whose analysis could not be performed in a model independent way. To overcome these difficulties, PREX and PREX-II measured, in the electron scattering off the nucleus ^{208}Pb , the Parity Violating Asymmetry (APV), which is the fractional difference between the elastic cross sections of right-handed and left-handed electrons scattered off a nucleus. This measurement provided, in a model independent way, a value of the lead neutron skin equal to 0.283 ± 0.071 fm. Because the value of the ^{208}Pb neutron skin is related to the density dependence of the symmetry energy, this measurement is strongly correlated to neutron star features. In particular, it implies, for neutron stars of mass equal to 1.4 solar masses, a radius between 13.25 and 14.26 Km and a tidal deformability between 642 and 955. These results agree with NICER telescope observations but are slightly in tension with the values inferred from the GW170817 gravitational wave (GW) signal observation by LIGO and VIRGO interferometers. New and more precise measurements of the ^{208}Pb neutron skin as well as more multi-messenger observations of neutron star mergers are hence necessary to confirm whether this tension is real.

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