

A new detection set-up for searching the X17 boson

Monday, 27 May 2024 15:56 (1 minute)

Recently, a nuclear physicists team from ATOMKI (Debrecen, Hungary) observed three significant anomalies in the emission of electron-positron pairs in the ${}^7\text{Li}(p, e^+ e^-){}^8\text{Be}$, ${}^3\text{H}(p, e^+ e^-){}^4\text{He}$ and ${}^{11}\text{B}(p, e^+ e^-){}^{12}\text{C}$ nuclear reactions [1-3]. These anomalies have been interpreted as the signature of the existence of a boson (referred as X17) of mass $M_{X17} = 16.8 \text{ MeV}/c^2$, that could be a mediator of a fifth force characterised by a strong coupling suppression of protons compared to neutrons (protophobic force). To clarify the present scenario the n_TOF Collaboration at CERN is engaged to realise an experimental program to probe the X17 existence and to study its properties through the first study of the ${}^3\text{He}(n, e^+ e^-){}^4\text{He}$ reaction and performing a renewed measurement of the ${}^7\text{Li}(p, e^+ e^-){}^8\text{Be}$ process. In case of a positive result, the n_TOF program also foresees the study of the conjugate ${}^2\text{H}(n, e^+ e^-){}^3\text{He}$ and ${}^2\text{H}(p, e^+ e^-){}^3\text{H}$ reactions, that offers a unique opportunity to study the supposed protophobic nature of the fifth force.

The experimental set-up described here is based on the use of four large μRwell chambers properly arranged to surround the target, providing the 3D reconstruction of electron and positron tracks. The μRwell chambers are inside to an array of scintillating bar, which provides the trigger. Finally, all the detectors are immersed in a magnetic field of 500 Gauss, to measure charge and momentum of $e^+ e^-$ ejectiles through their curvature. In this talk is described the experimental setup and the experimental program. The results of tests using proton and neutron beams are also discussed.

[1] A. J. Krasznahorkay et al., Phys. Rev. Lett. 116, (2016) 042501.

[2] A. J. Krasznahorkay et al., Phys. Rev. C 104, (2021) 044003.

[3] A. J. Krasznahorkay et al., Phys. Rev. C 106, (2022) 061601.

Collaboration

n_TOF

Role of Submitter

The presenter will be selected later by the Collaboration

Primary author: GUSTAVINO, Carlo (INFN - Roma 1)

Presenter: GUSTAVINO, Carlo (INFN - Roma 1)

Session Classification: Integration and Detector Systems - Poster session

Track Classification: T8 - Integration and Detector Systems