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## Probing the X17 existence and properties using proton and neutron beams

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Three significant anomalies have been observed 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 (hereafter referred to 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).

In this talk is presented a new experimental approach to clarify the present scenario, by searching for the X17 boson in the decay of excited  $A=3,4$  (Tritium, helium-3, helium-4) nuclei through reactions induced by protons or neutrons. The study of the  ${}^3\text{He}(n,e+e-){}^4\text{He}$  and  ${}^3\text{H}(p,e+e-){}^4\text{He}$  reaction, in a wide energy window and using a detector with a large acceptance, would probe the X17 existence and, if the anomaly is confirmed, it allows for the determination of its quantum numbers. In the case of a positive result, the analysis of the  ${}^2\text{H}(n,e+e-){}^3\text{He}$  and  ${}^2\text{H}(p,e+e-){}^3\text{H}$  cross section ratio offers a unique opportunity to shed light on the isospin dependence of the X17- nucleon coupling. The achievable results are discussed on the base of ab-initio calculations, in which the existence of a 17 MeV boson is considered [4,5].

[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.

[4] M. Viviani et al., Phys. Rev. C 105, 014001 (2022), arXiv:2104.07808 [nucl-th].

[5] M. Viviani et al., submitted to Phys. Rev. C. arXiv:2408.16744.

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