

ECT* SEMINAR The X17 anomaly

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Abstract: A rather puzzling anomaly has been recently observed in the emission of electron- positron pairs in the $7\text{Li}(p,e+e-)8\text{Be}$ and $3\text{H}(p,e+e-)4\text{He}$ reactions. This anomaly has been interpreted as the signature of a particle not foreseen in the standard model of particle physics (hereafter X17 boson) with mass $M=16.8$ MeV. The X17 boson could be a mediator of a fifth force, characterized by a strong coupling suppression of protons compared to neutrons. In this talk, we present an ab-initio study of the $3\text{H}(p, e+e-)4\text{He}$ and $3\text{He}(n,e+e-)4\text{He}$ processes. We first analyze the pair production as a purely electromagnetic process in the context of a state-of-the-art approach to nuclear strong-interaction dynamics and nuclear electromagnetic currents, derived from chiral effective field theory (χEFT). Next, we examine how the exchange of a hypothetical low-mass boson would impact the cross section for such a process. We consider several possibilities, that this boson is either a scalar, pseudoscalar, vector, or axial particle. We also provide an overview of an experiment probing pair production in the $3\text{He}(n,e+e-)4\text{He}$ at the n_ToF facility at CERN, currently under construction. We discuss also of other experimental searches of the X17 boson in nuclear reactions, as that one performed by the MEG collaboration at PSI (Switzerland), which are currently repeating the $7\text{Li}(p,e+e-)8\text{Be}$ experiment, or as in the $2\text{H}(p,e+e-)3\text{He}$ and $2\text{H}(n,e+e-)3\text{H}$ reactions, proposed in order to test the "protophobicity" of X17.

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