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Searching for the two γ -decay of the X(17)

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Serious efforts have been made to find particles related to dark matter. According to theoretical predictions, a (10 MeV-1 GeV) light particle is expected (hereinafter called X-boson), which mediates the interaction between dark particles.
Krasznahorkay et. al. have succesfully investigated the X⟶e−e+ mode [1]. They excited the EX = 17.6 MeV and EX = 18.15 MeV states of 8Be and measured the angular correlation between the e− and e+ particles emitted during the de-excitation of these states.
Signifcant peak-like enhancement of the internal pair creation was observed at large angles, which was interpreted as the creation and decay of an intermediate particle with the mass of m0c2 = 16.70±0.35 (stat)±0.5(sys). The observed anomaly could not be described within conventional nuclear physics [2]. Feng et. al. suggested an explanation assuming a vector gauge boson with a mass of m 0c2 = 16.7 MeV, Jπ = 1+ mediateing a fifth force [3]. According to this interpretation, the X-boson decays with e −e +-pair emission. More recently, Ellwanger and Moretti gave another interpretation of these data [4]: a Jπ=0− pseudo scalar particle was observed.
According to the Landau-Yang theorem, the X ⟶γγ decay is allowed only if the X - particle is pseudo scalar. In the case of a vector boson, it is strictly forbidden. In order to be able to choose between the two different scenarios, it was decided to study the X⟶γγ
mode using the 3 He(n, γ)4 He reaction.
The γγ -decay of the X-boson might have been observed already by Subbert and Berthollet in the in this reaction [5]. We revisited their experiment and measured the angular correlation
of the γ -rays using 12 3”×3”LaBr3 detectors. If a new particle with a mass of 16.7 MeV is created in the decay of the 0− state, and also decays with two γ photons, their angular
correlation should peak at an angle of Θ=105o with equal energies.
In the talk, the first results of the ongoing X -boson experiments will be presented.

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[2] X. Zhang, G. A. Miller ; Phys. Lett. B773, 159 , (2017).
[3] J. L. Feng et al. ; Phys. Rev. Lett. 117 , 071803, (2016).
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Selected session

1.) Fundamental Symmetries and Interactions
2.) Nuclear Structure and Dynamics

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