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Searching for the Anomalous Internal Pair Creation in ^8Be

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In 2016, the announcement of an anomaly in the Internal Pair Creation (IPC) in the isoscalar magnetic dipole transition in ^8Be [1] triggered an effort worldwide to investigate this phenomenon. According to the model of Rose for the IPC process [2,3], the e^+e^- angular correlation distribution drops quickly with the e^+e^- relative angle. In contrast, a peak-like behavior was observed at around 140° . This result was interpreted as the creation and subsequent decay of a previously unknown neutral boson, named X(17), with a mass of $m_{\text{X}}c^2 = 16.7 \pm 0.35(\text{stat})\text{-MeV}$.

At the Laboratori Nazionale di Legnaro (LNL-INFN), a new e^+e^- pair spectrometer was built and commissioned. The EJ2000 (polyvinyl toluene) scintillator material was used in its construction. The project aims to measure the angular correlation distribution of the e^+e^- pairs from the IPC process in light nuclei. In 2023 and 2024, the first experimental campaign occurred at the AN2000 accelerator facility at LNL-INFN. LiF targets were irradiated to study the proton-induced nuclear reactions $^7\text{Li}(p, e^+e^-)^8\text{Be}$ and $^{19}\text{F}(p, \alpha e^+e^-)^{16}\text{O}$. The $1_1^+ \rightarrow 0_1^+$ and $1_2^+ \rightarrow 0_1^+$ electromagnetic transitions in ^8Be were been studied. The interest in those transitions lies in that anomalies have been reported [1,4]. In addition, the $0_2^+ \rightarrow 0_1^+$ electromagnetic transition has been taken as a reference due to the high e^+e^- emission. This work reports the first results of this experimental campaign, providing a panorama of the new opportunities for studying the IPC process using this new e^+e^- pair spectrometer.

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- [2] E. Rose, Phys. Rev. 76 (1949) 678.
- [3] E. Rose, Phys. Rev. 78 (1950) 184.
- [4] J. Krasznahorkay et al., Phys. Rev. Let. 116 (2016) 7.

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