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Investigating the dark sector with the PADME experiment

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The anomaly observed in the opening angle and invariant mass distributions of e^+e^- pairs produced in the decays of excited ^{8}Be, ^{4}He and ^{12}C nuclei [1-3] can be interpreted with the creation and subsequent decay of a particle of mass approximately 17 MeV which has been named X17.

Along the years, several light particles have been postulated by theoretical extensions of the Standard Model with a wide range of properties, in the attempt of justifying some unexplained phenomena like the (g-2)μ anomaly or the nature of the dark matter. Up to now, none of these new feebly interacting particles has ever been observed. The existence of the X17, if confirmed, will then represent a real breakthrough in the search of physics phenomena beyond the Standard Model.

The Positron Annihilation into Dark Matter Experiment (PADME) is a fixed-target experiment, at the Laboratori Nazionali di Frascati of INFN, searching for a dark photon and other dark sector candidates among the annihilations of a beam of positrons, with energy <500 MeV, on the electrons of the target [4]. PAMDE has already collected a first set of physics-grade data over the last few years that allowed to measure the total cross-section of electron-positron annihilation into photons below 1 GeV.
In 2022 PADME collected a new data set, centered at $\sqrt{s}$ ~17 MeV, to produce on-shell the X17 [5]. These data are under analysis to provide a confirmation of the particle nature of the excesses observed in the spectroscopic measurements of Beryllium, Helium and Carbon.
An overview of the PADME results and of the future scientific program will be given.

References
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Primary author: GIANOTTI, Paola (LNF)

Presenter: GIANOTTI, Paola (LNF)

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