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Searching for the X17 with the PADME experiment

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Certain classes of dark matter theory predict the existence of a new, hidden "Dark Sector"of particles which interact with Standard Model particles only through the exchange of a new, massive mediator particle. This is the scenario that the Positron Annihilation into Dark Matter Experiment (PADME) was originally designed to test, using the positron beam at the Beam Test Facility (BTF) at the INFN Laboratori Nazionali di Frascati (LNF) [1,2].
The 2021 confirmation of the X17 anomaly, observed in internal pair creation nuclear decays at the ATOMKI institute in Debrecen, Hungary, kindled significant interest in this anomaly within the particle physics community [3]. Assuming that the anomaly comes from the decay of a new particle to an e^+ e^- pair, time-reversal symmetry means that the new particle must be producible in e^+ e^-annihilation. Since the beam used at PADME is the only positron beam in the world with the correct energy to create this new particle on resonance, the PADME collaboration pivoted to study the X17 anomaly in the reaction e^+ e^-⟶X17⟶e^+ e^-, aiming to confirm/disprove the particle hypothesis [4].
In 2022, PADME Run 3 was dedicated specifically to this search. Approximately 1010 positrons on target were collected for each of the 47 beam energy values in the range 262 - 298 MeV.
This talk will give an overview of the scientific program of the experiment and of the data analyses ongoing.

References

[1] P. Agrawal et al., Eur. Phys. J. C 81 (2021) 11, 1015.
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[3] A. J. Krasznahorkay et al., Phys. Rev. C 104, 044003 (2021)
[4] L. Darmé et al., Phys. Rev. D 106 (2022) 11, 115036.

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