

Low-mass dark sector searches with deuteron photodisintegration

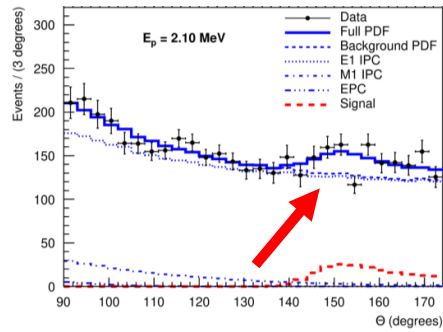
**Cornelis J.G. Mommers, Group Marc Vanderhaeghen,
University of Mainz**

Phys.Rev.D 109 (2024) 9, 095010

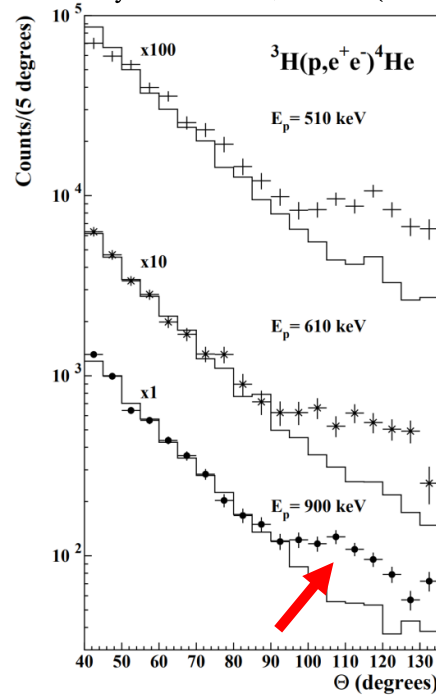
Phys.Lett.B 858 (2024) 139031

Unexplained bumps in data?

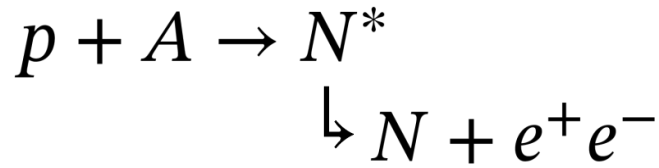
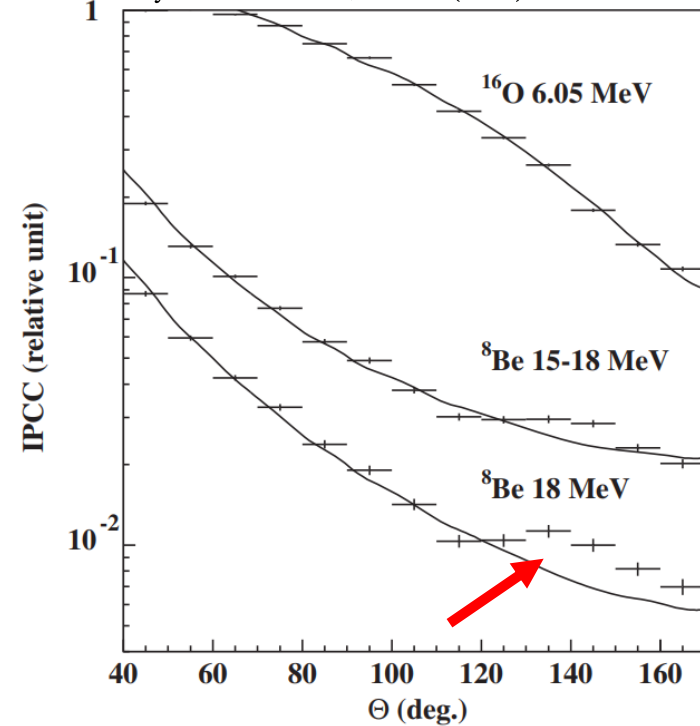
Phys. Rev. C 106, L061601 (2022)



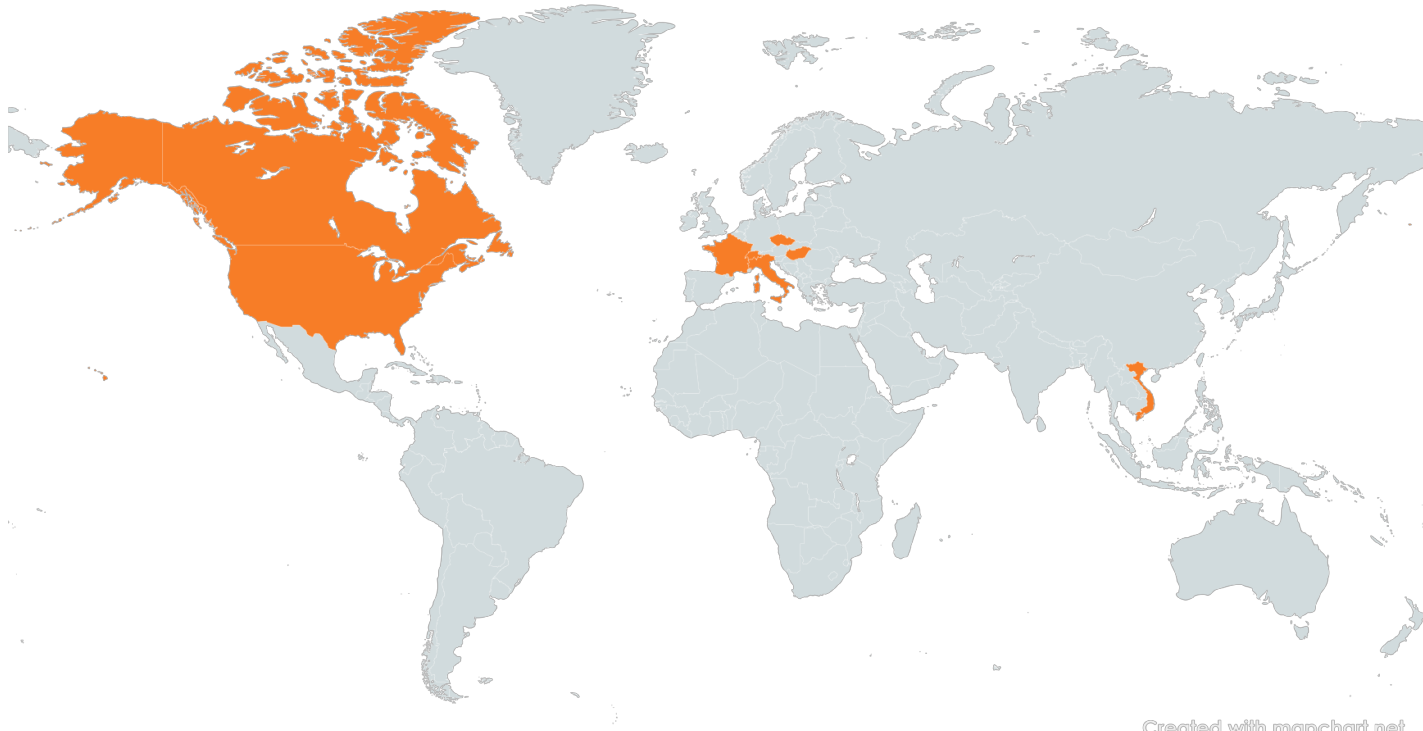
Phys. Rev. C 104, 044003 (2021)



Phys. Rev. Lett. 116, 042501 (2016)



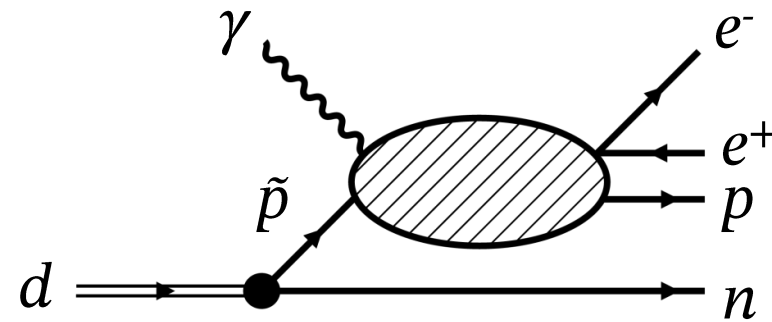
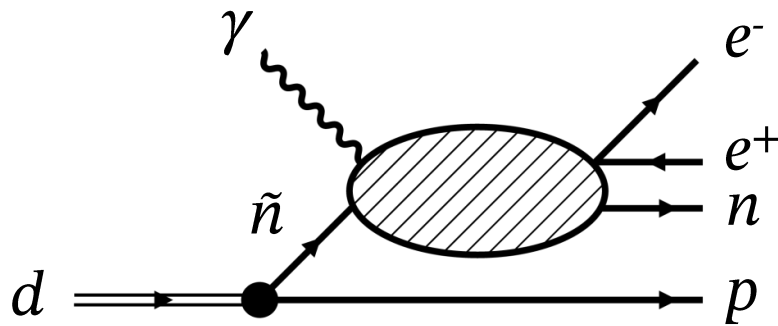
A global search



Created with mapchart.net

$\gamma d \rightarrow e^+ e^- p n$

- Probe proton + neutron separately



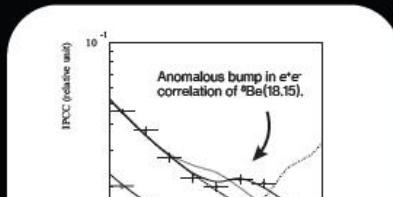
See you at my poster!

X17 discovery potential from $\gamma d \rightarrow e^+e^-pn$ with neutron tagging

Cornelis J.G. Mommers and Marc Vanderhaeghen, JGU Mainz,
Phys. Rev. D (2024) 109, 095010 and Phys. Lett. B 858 (2024) 139031

1. What is X17?

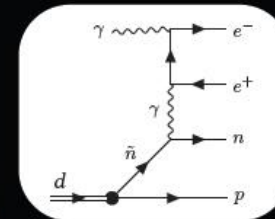
- The ATOMKI group found anomalous signals in the decays of excited ^8Be (figure below), ^4He , and ^{12}C nuclei with statistical significances exceeding 6σ .
- To account for these anomalies, they proposed the existence of X17, a light boson with a mass of $17.02(10)$ MeV.
- Assuming definite parity, X17 is either a pseudoscalar, vector or axial-vector particle.
- This conjecture has sparked a global experimental effort to replicate the anomaly. There are ongoing experiments at CCPAC (Canada), PSI (Switzerland), New JEDI (France), among others.
- Recent measurements from MEG-II (PSI) do not find any significant signal!



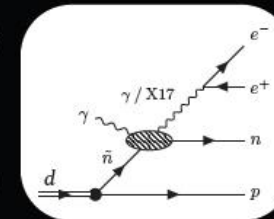
Compared to a fast-moving photon, the slow-moving X17 would give a larger electron-positron opening angle.

3. Neutron tagging

- Neutron target is not available in the lab.
- $\gamma d \rightarrow e^+e^-pn$ with neutron tagging instead.
- Bound neutron is quasi free, proton a spectator.
- Scattering events primarily on quasi-free neutron.



▲ Bethe-Heitler process



▲ Compton process

- X17 has a very narrow width.
- Influence of electron coupling not resolvable inside single bin.
- Cross section only depends on