

Hungarian Academy of Sciences Institute for Nuclear Research, Debrecen



ATOMKUTATÁSOK
KUTATÁSI KÖZPONTJA





dr. Krasznahorkay Attila

D.Sc., titular professor

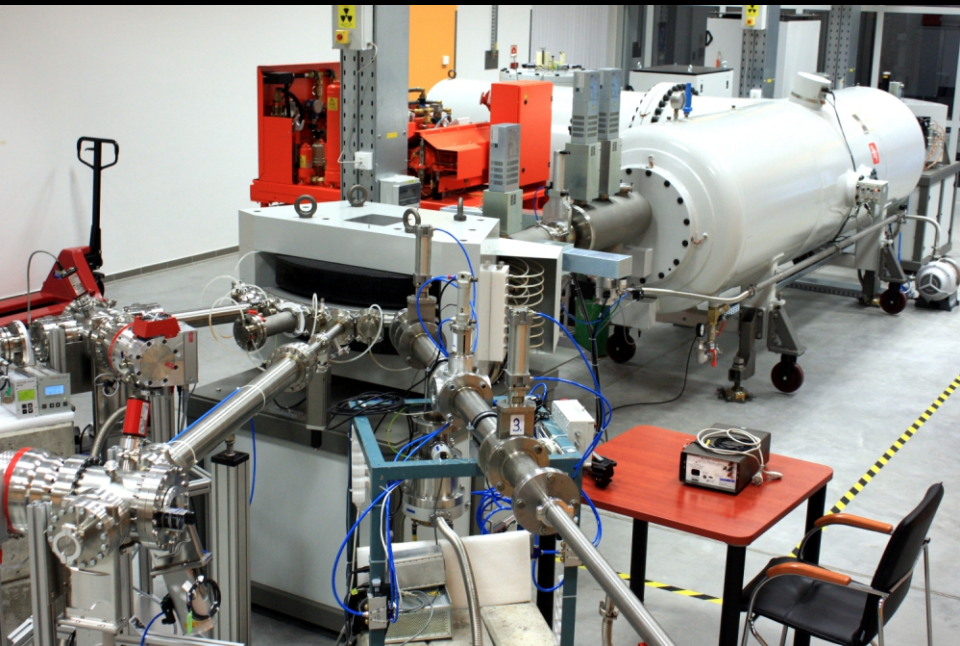
Institute for Nuclear Research, Debrecen
University of Szeged, University of Debrecen

The unknown part of the Universe, the dark matter

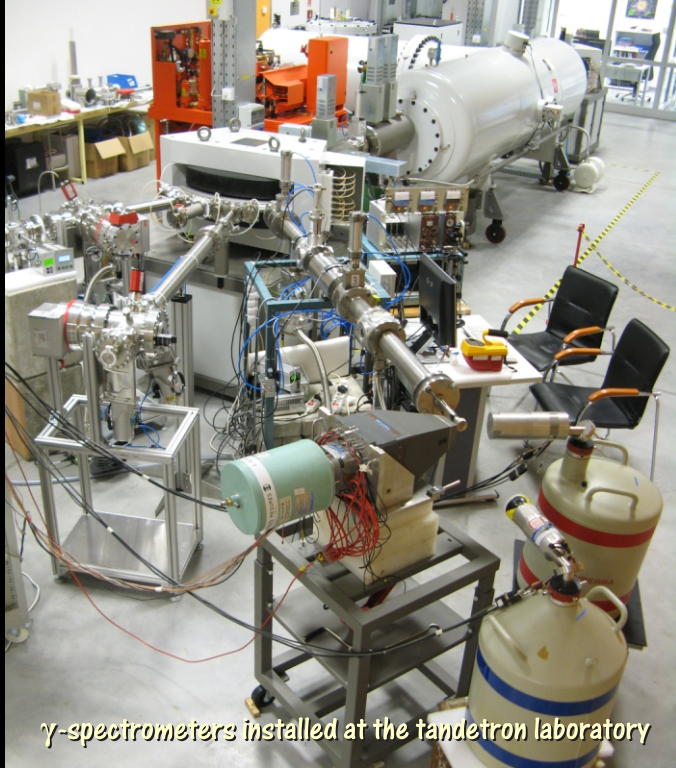
In recent years, new research directions have emerged investigating the dark matter. One of them is the so-called dark photon research. The expected lifetime of the dark photon is very short, and it mainly decays into electron-positron pairs. Studying the high energy e^+e^- pairs in a magnetic dipole transition of ^8Be by using a unique spectrometer built at MTA Atomki, we were able to observe correlated e^+e^- pairs, which may be created in the decay of a new particle. US theoretical physicists concluded that our data could be evidence for a fifth fundamental force and not for the dark photon. Our publications have generated significant media coverage. If this particle can be detected in other laboratories as well, then this will completely change our current vision of the Universe.

A few important publications:

1. Krasznahorkay A. et al.: Observation of Anomalous Internal Pair Creation in ^8Be : A Possible Indication of a Light, Neutral Boson, *PHYS. REV. LETT.* 116: 042501, 2016
 2. Krasznahorkay A. et al.: N=14 and 16 shell gaps in neutron-rich oxygen isotopes, *PHYS. REV. C* 69: 034312, 2004
 3. Krasznahorkay A. et al.: Excitation of isovector spin-dipole resonances and neutron skin of nuclei, *PHYS. REV. LETT.* 82: 3216, 1999
 4. Krasznahorkay A. et al.: On the excitation energy of the ground state in the third minimum of ^{234}U , *PHYS. LETT. B* 461: 15, 1999
 5. Krasznahorkay A. et al.: Excitation of the isovector GDR by inelastic alpha-scattering as a measure of the neutron skin of nuclei, *NUCL. PHYS. A* 567: (3) 521-540, 1994
- [Our original paper on the new boson published in Phys. Rev. Lett](#)
 - [Article in Scientific American about our results](#)
 - [News in the Hungarian TV \(in Hungarian\)](#)
 - [A talk presented by Prof. Jonathan Feng in USA, about our results](#)



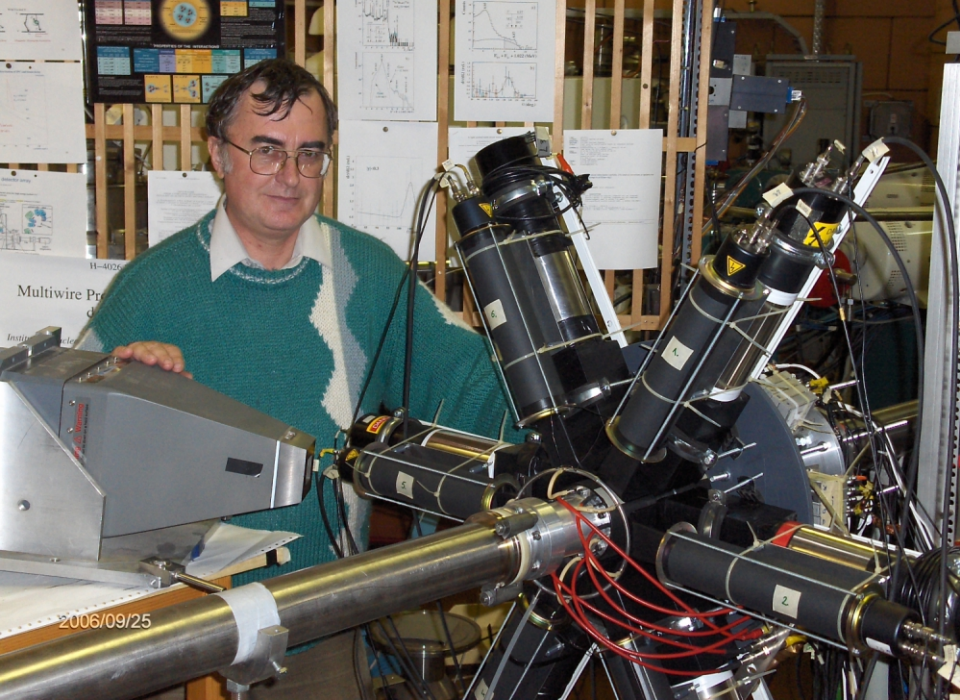
The new tandemron accelerator laboratory in Atomki Debrecen



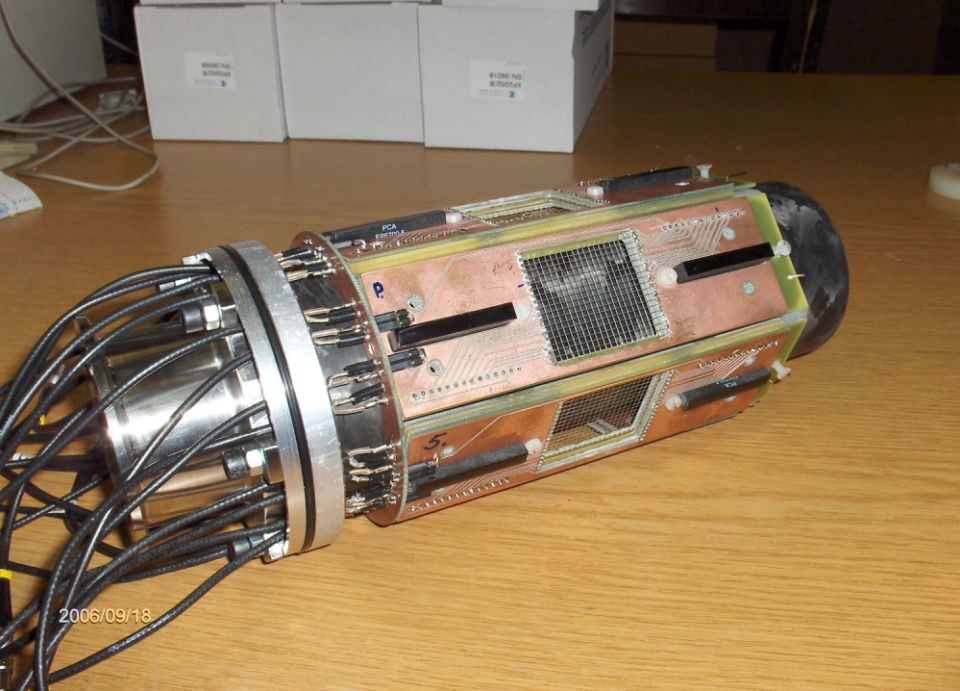
γ -spectrometers installed at the tandetron laboratory



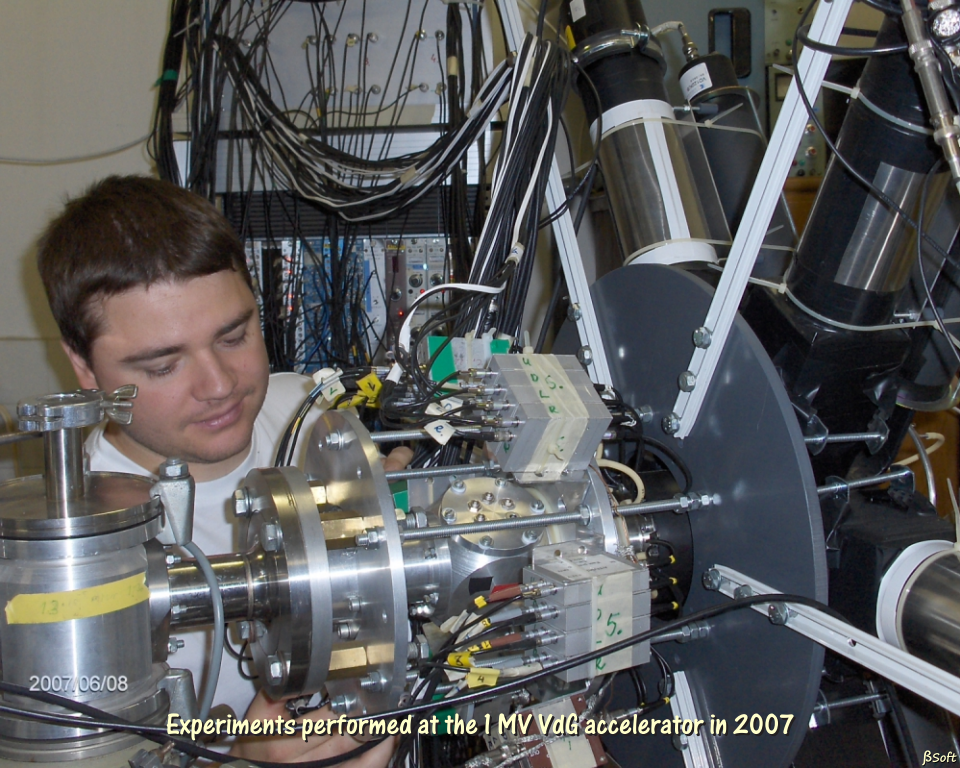
Our pair spectrometer installed recently in the tandetron laboratory



Experiments performed at the cyclotron laboratory with the new pair spectrometer in 2006

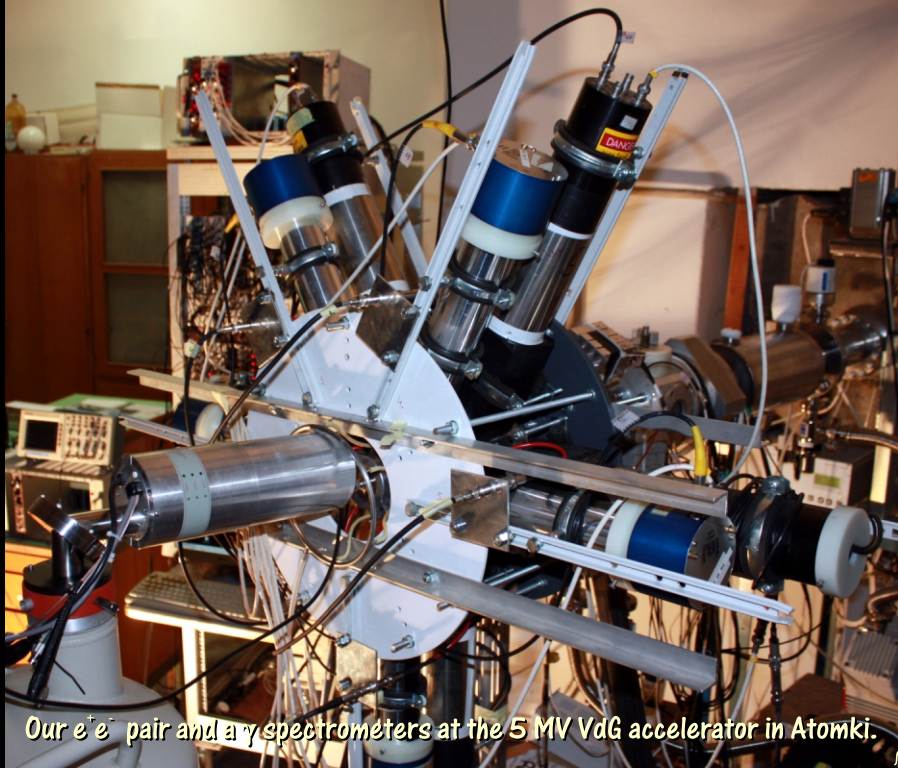


Gas filled multi-wire proportional counters used in the pair spectrometer

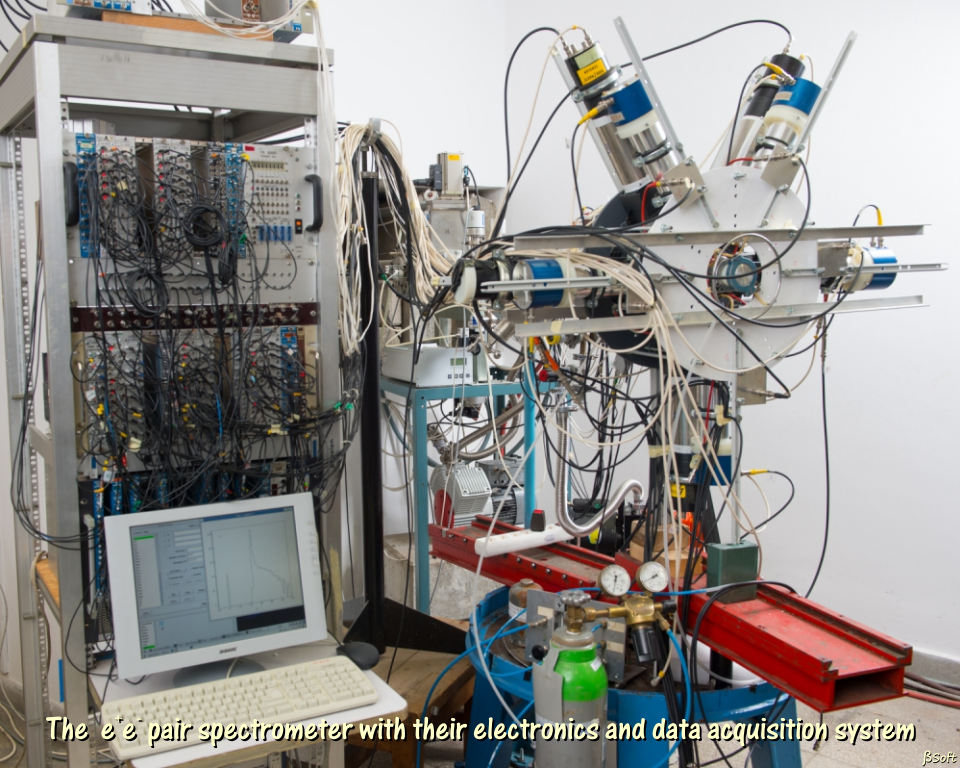


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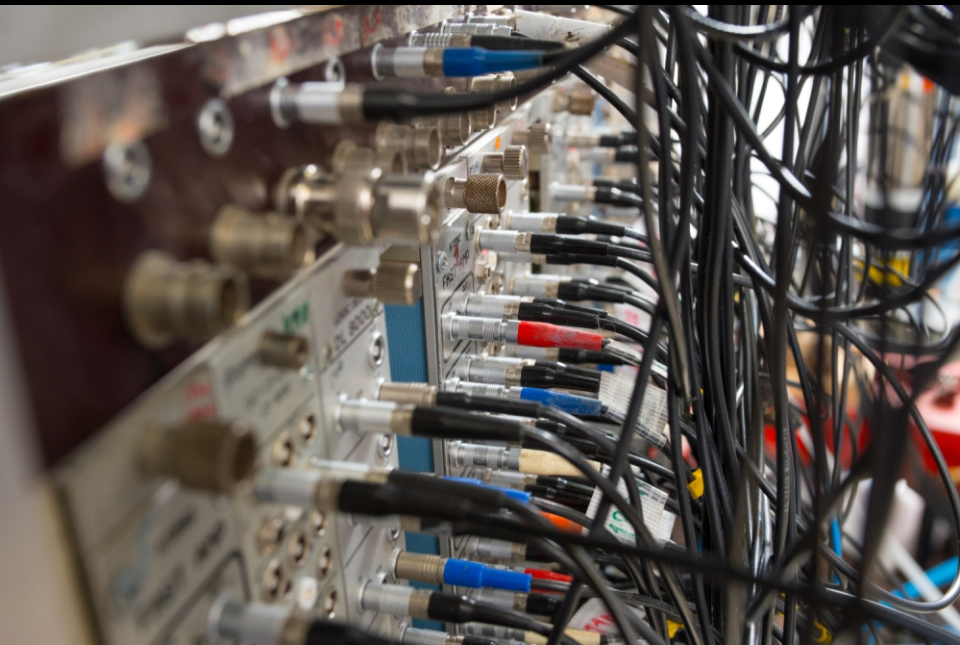
Experiments performed at the 1 MV VdG accelerator in 2007



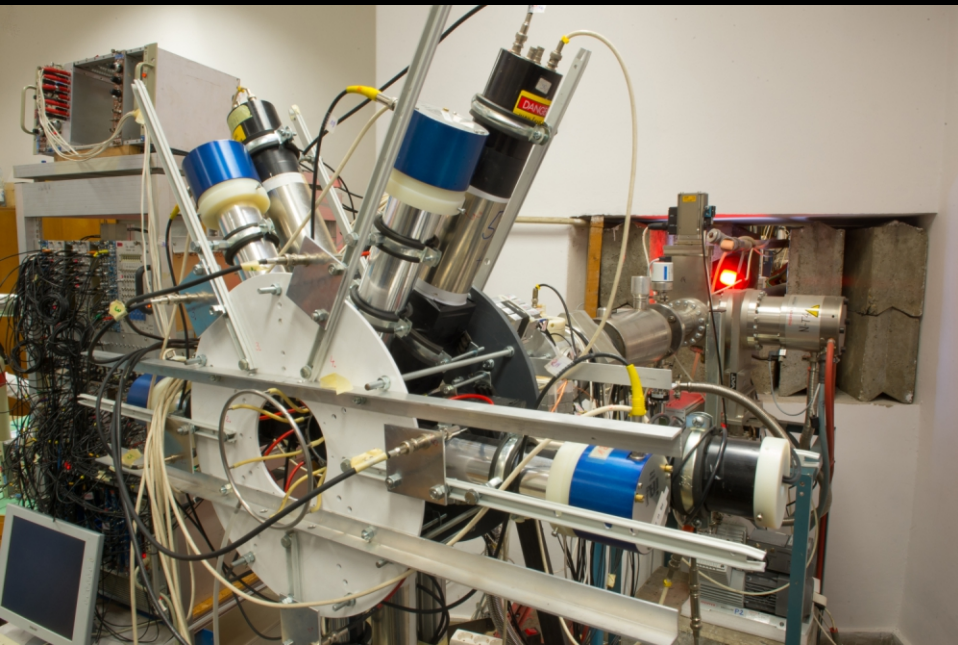
Our e^+e^- pair and γ spectrometers at the 5 MV VdG accelerator in Atomki.



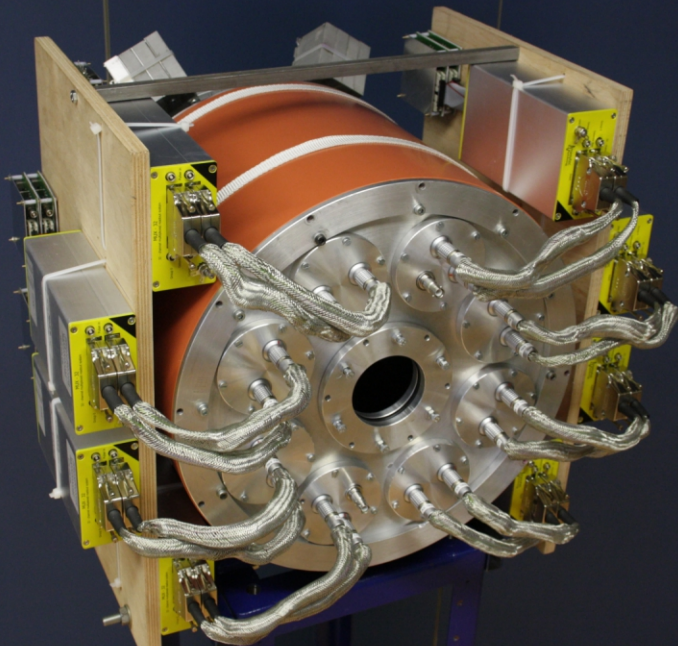
The e^+e^- pair spectrometer with their electronics and data acquisition system



Colourful electronics connected to the pair spectrometer



The Atomki e^+e^- pair spectrometer used for the measurements, published in Phys. Rev. Lett.



A new version of the pair spectrometer working with time projection chambers