An update on the hypothetical X17 particle

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Observation of Anomalous Internal Pair Creation in ^{8}Be: A Possible Indication of a Light, Neutral Boson

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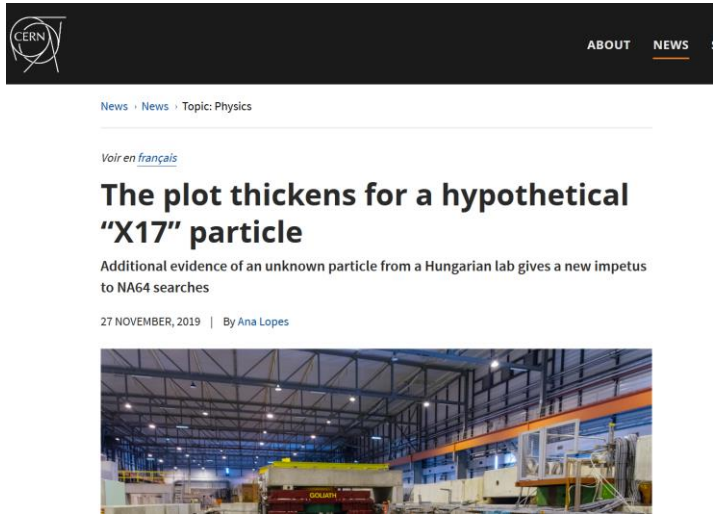
Electron-positron angular correlations were measured for the isovector magnetic dipole 17.6 MeV ($J^\pi = 1^+$, $T = 1$) state → ground state ($J^\pi = 0^+$, $T = 0$) and the isoscalar magnetic dipole 18.15 MeV ($J^\pi = 1^+$, $T = 0$) state → ground state transitions in ^{8}Be. Significant enhancement relative to the internal pair creation was observed at large angles in the angular correlation for the isoscalar transition with a confidence level of $> 5\sigma$. This observation could possibly be due to nuclear reaction interference effects or might indicate that, in an intermediate step, a neutral isoscalar particle with a mass of $16.70 \pm 0.35(\text{stat}) \pm 0.5(\text{syst})$ MeV/c^2 and $J^\pi = 1^+$ was created.



The ATOMKI anomaly → signals for a new 17 MeV boson → gauge boson of a new fundamental force of nature

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Feature Articles

A New Particle is Being Born in ATOMKI that Could Make a Connection to Dark Matter

Attila J. Krasznahorkay, Attila Krasznahorkay, Margit Csatlós, Lóránt Csige & János Tímár

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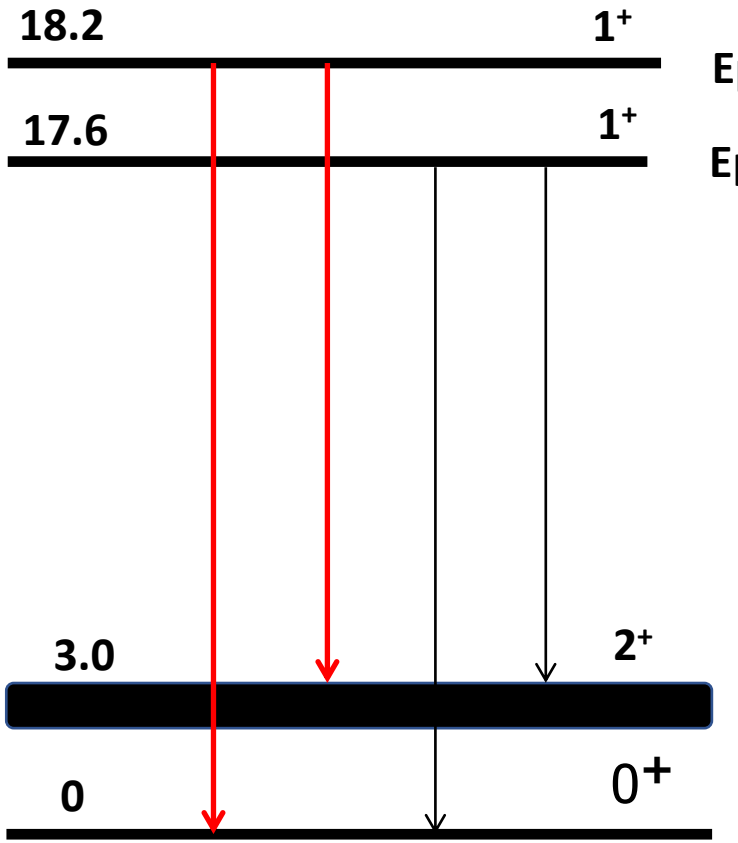
feature article

A New Particle is Being Born in ATOMKI that Could Make a Connection to Dark Matter

Study of the ^{8}Be M1 transitions

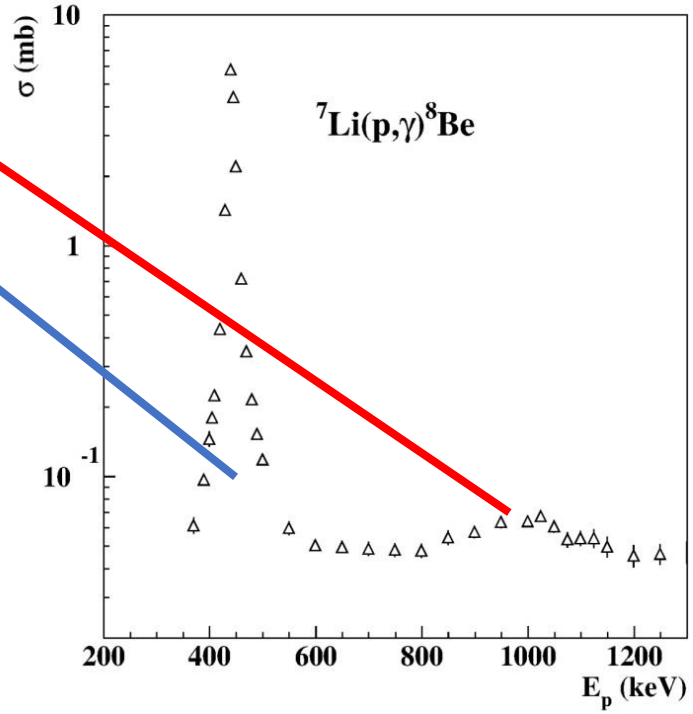
^{8}Be

Excitation with the
^{7}Li(p,γ)^{8}Be reaction



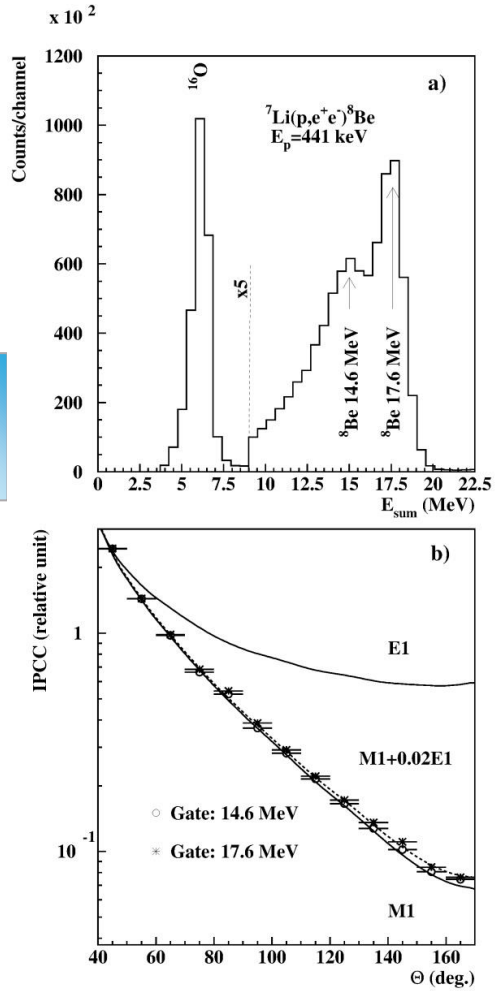
Ep= 1030 keV

Ep= 441 keV

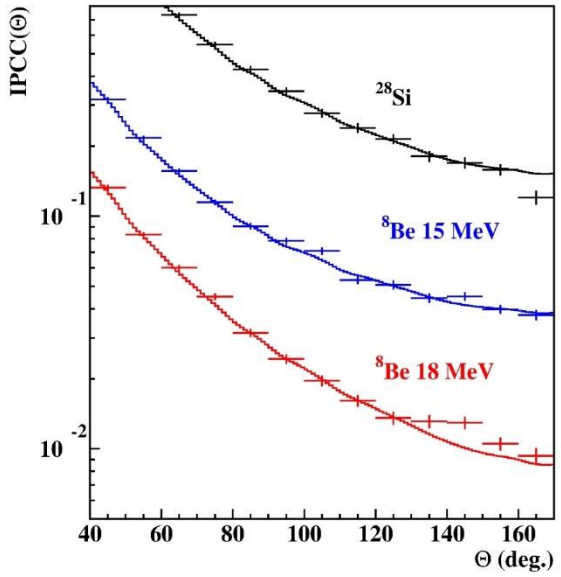


e^+-e^- energy-sum spectra and angular correlations

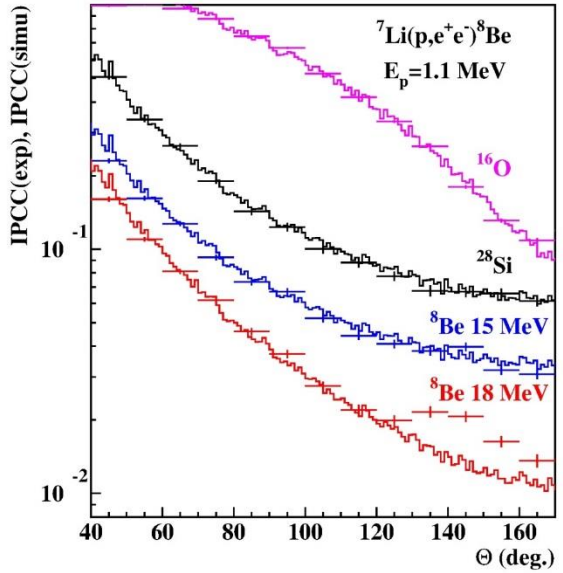
^{8}Be



E$_p$=1.04 MeV

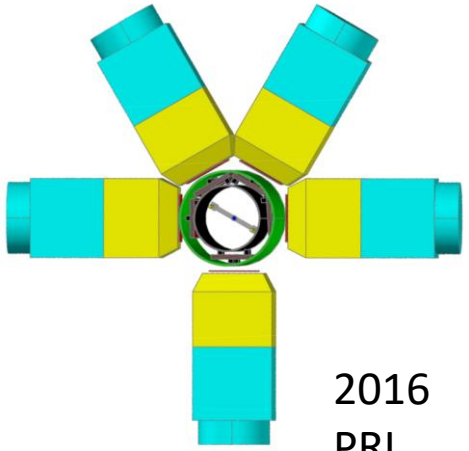


E$_p$=1.10 MeV

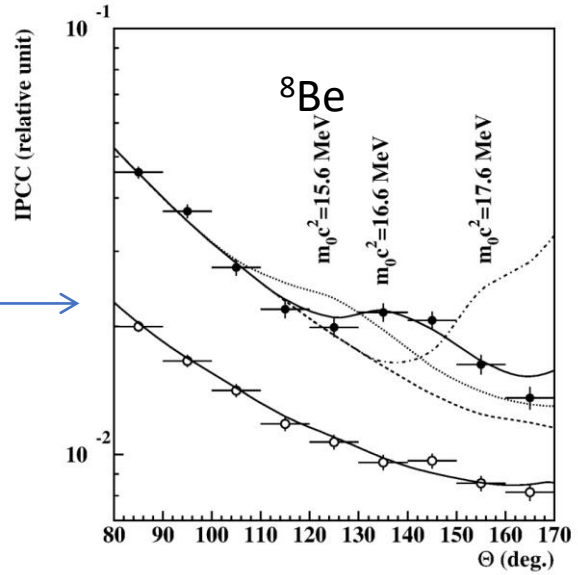


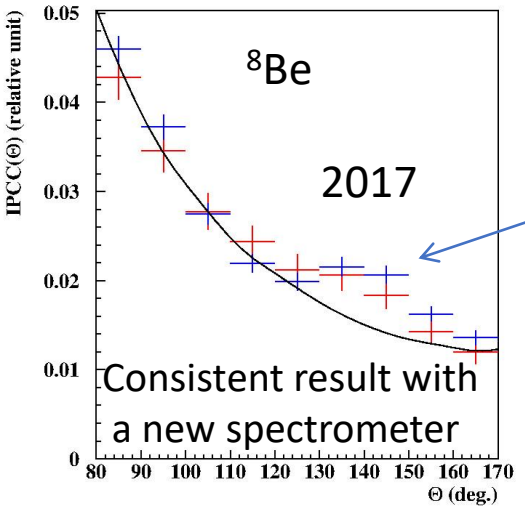
Angular correlations measured from the decay of the Ex=18.2 MeV resonance

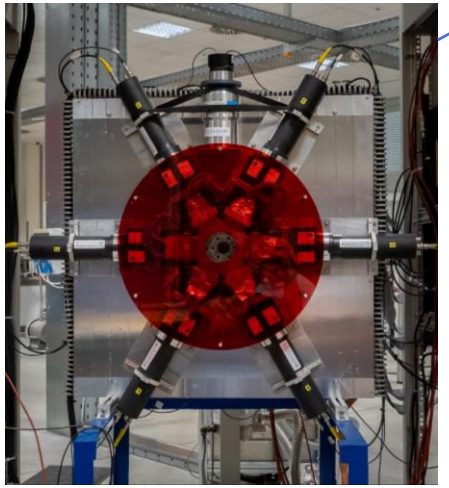
Previous experimental results

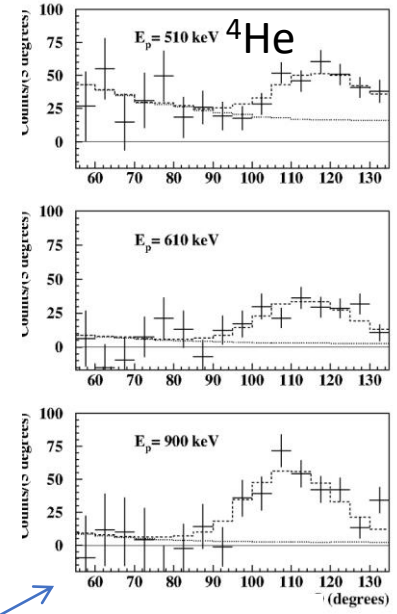


2016
PRL

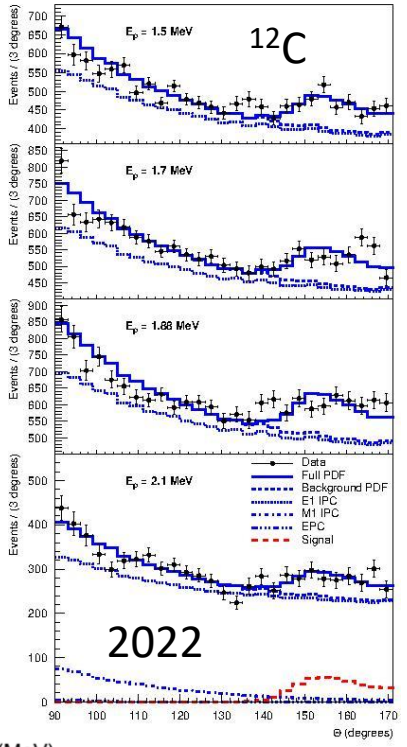




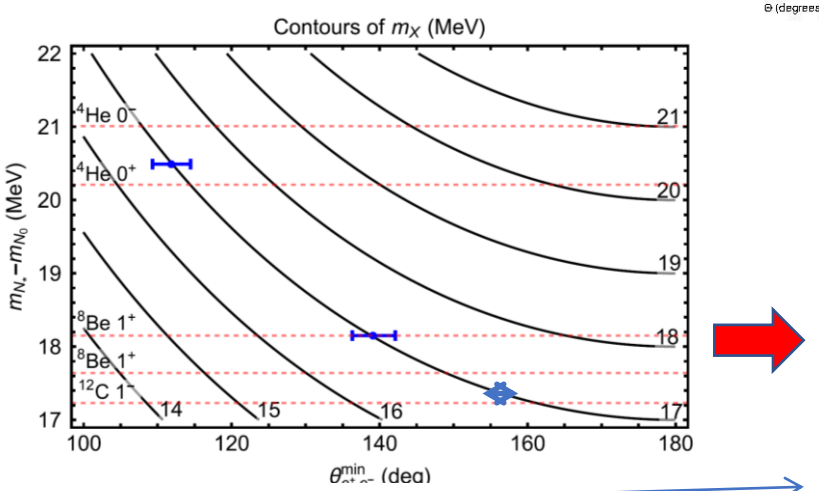


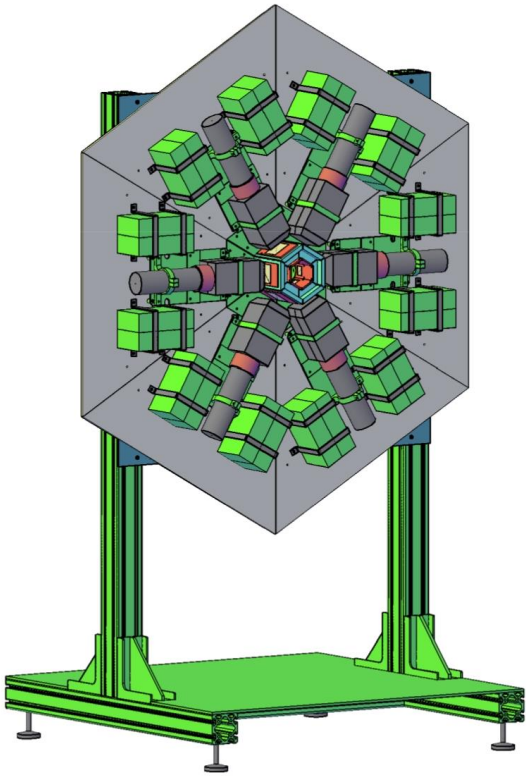


2021



2022





The newest version of the spectrometer

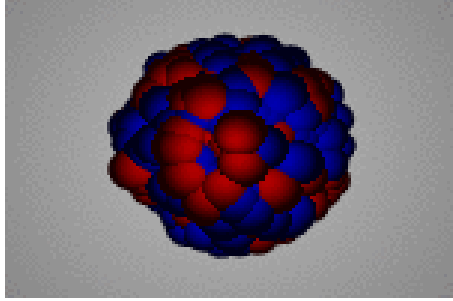
- **Kinematical evidence for the X17 particle**
- **Vector character of X17 is supported**
- **Ejected with L=1 in ^{8}Be**

On the acceptance of the spectrometers

The following facts give us confidence about the reliability of the experimental results:

- Good agreement between the experimental and simulated acceptances,
- Good agreement between experimental and simulated IPCC values for ^{16}O, ^{28}Si, ^{8}Be 17.6 MeV and 15.1 MeV transitions for large angular ranges,
- Consistent experimental results with 6, 5, and 2 telescopes,
- Good agreement between experimental and simulated IPCC values for asymmetric energy distributions of the $e^{+}e^{-}$ pairs,

Observation of the X17 anomaly in the decay of the Giant Dipole Resonance



GDR

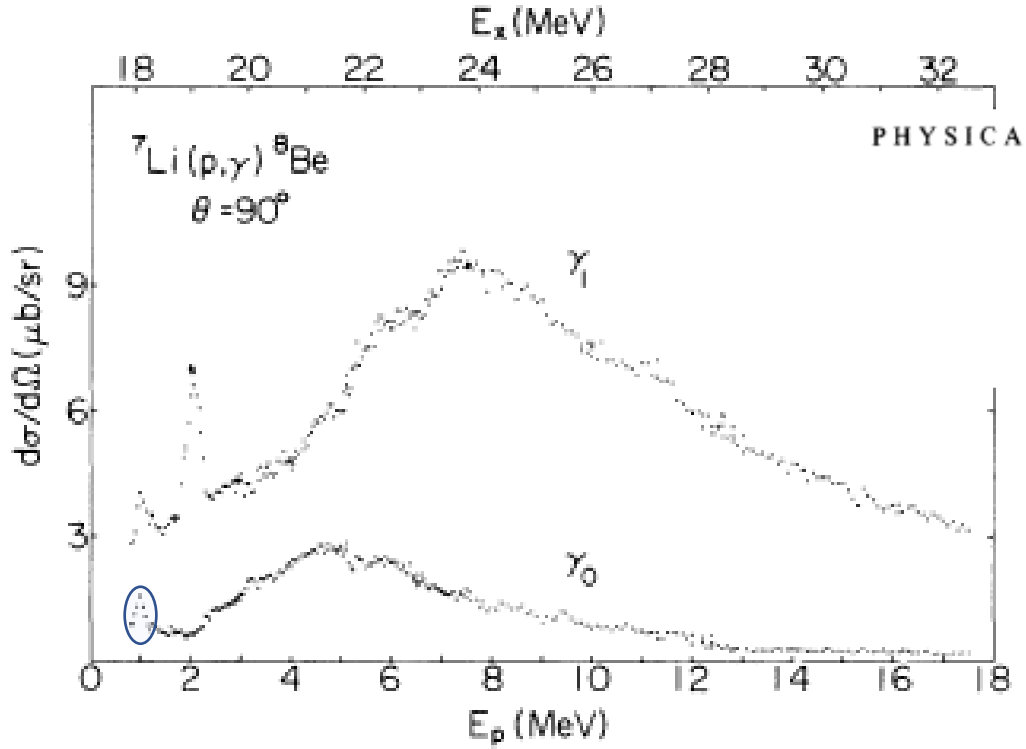


FIG. 3. The yield functions for the γ_0 and γ_1 transitions obtained at 90°, which show the broad giant resonances built on the ground state and the first excited state of ^{8}Be.

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Giant *E*1 resonances in ^{8}Be from the reaction ^{7}Li(*p*,γ)^{8}Be†

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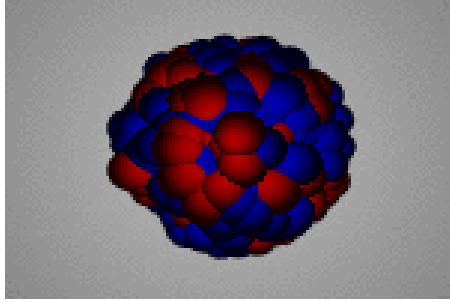
Department of Physics, Stanford University, Stanford, California 94305

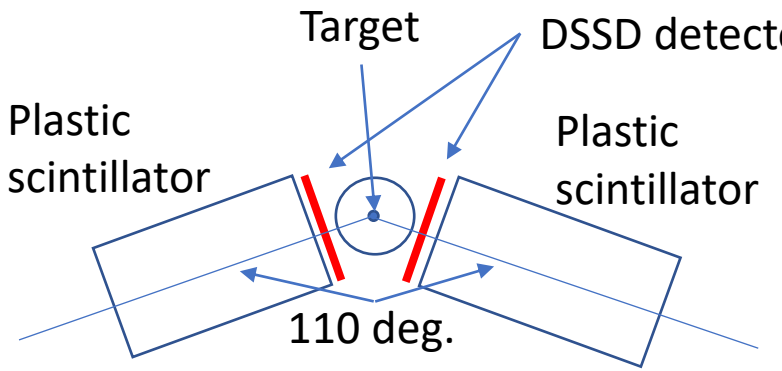
(Received 21 January 1976)

TRK sum rule

$$\int_{1\,8}^{3\,3} \sigma(E)\,dE = 60\,\frac{NZ}{A}\ \text{MeV mb}$$

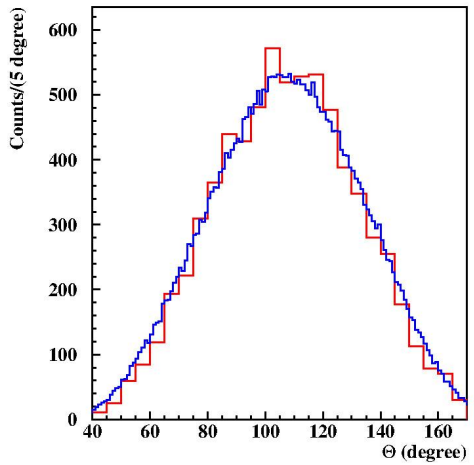
A new e^+e^- spectrometer, their acceptance, γ-ray and energy-sum specta

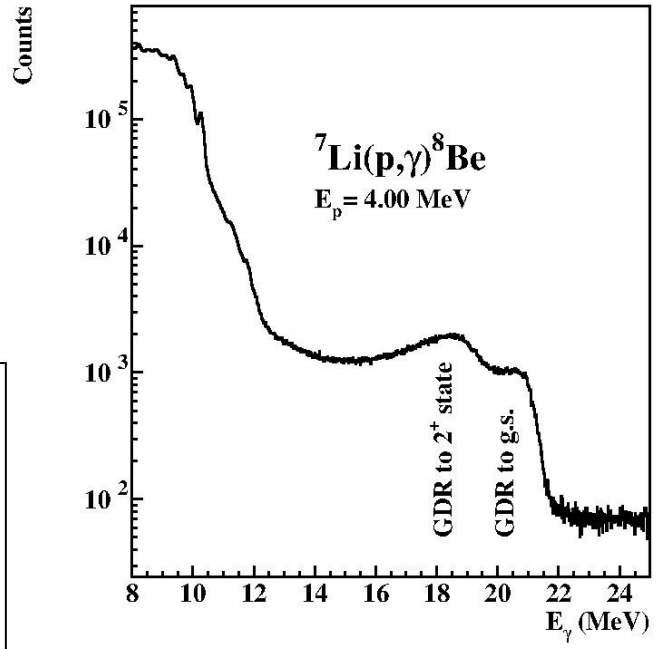


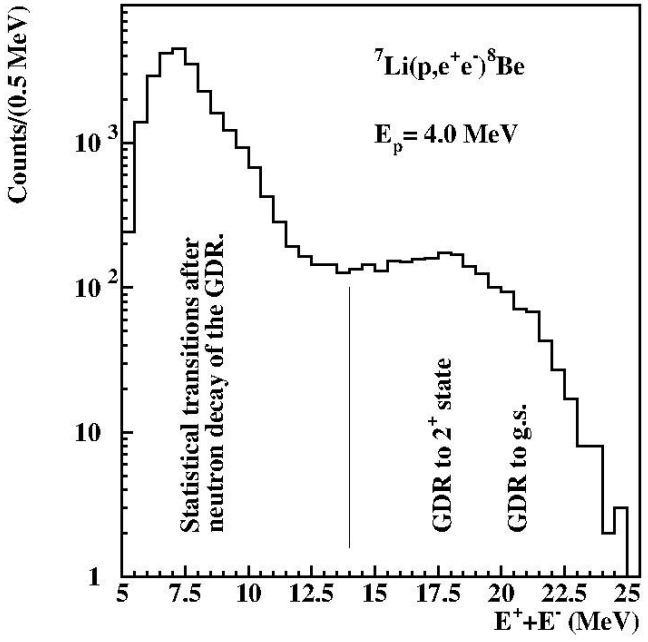


GDR

$LaBr_3$ γ-ray monitor

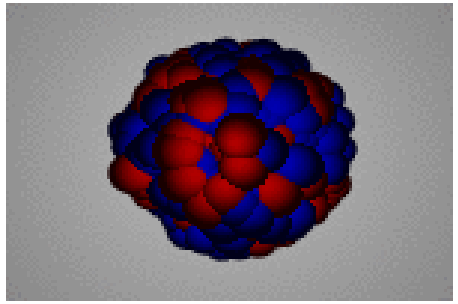




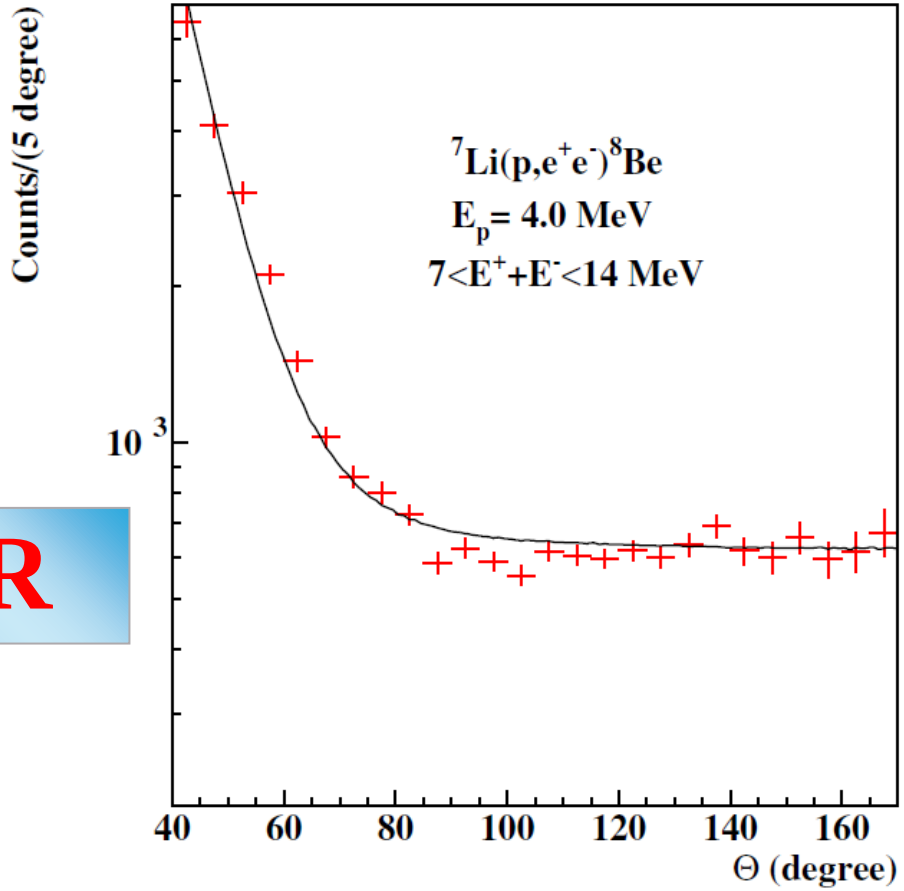


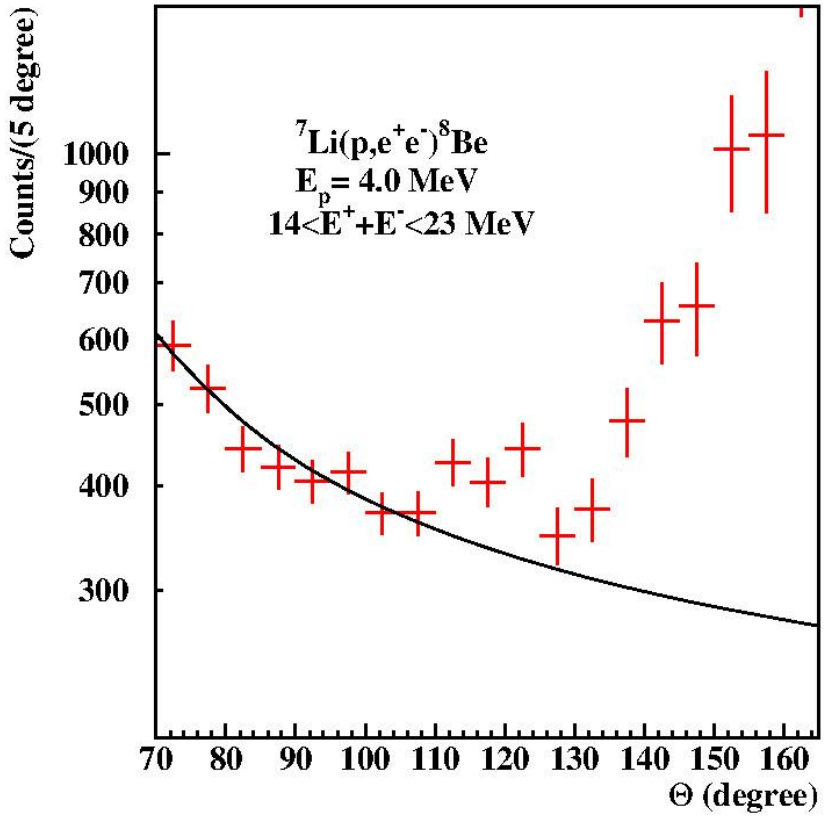
Energy-sum spectrum

e^+e^- angular correlations for the low-enegy region, and for the GDR one

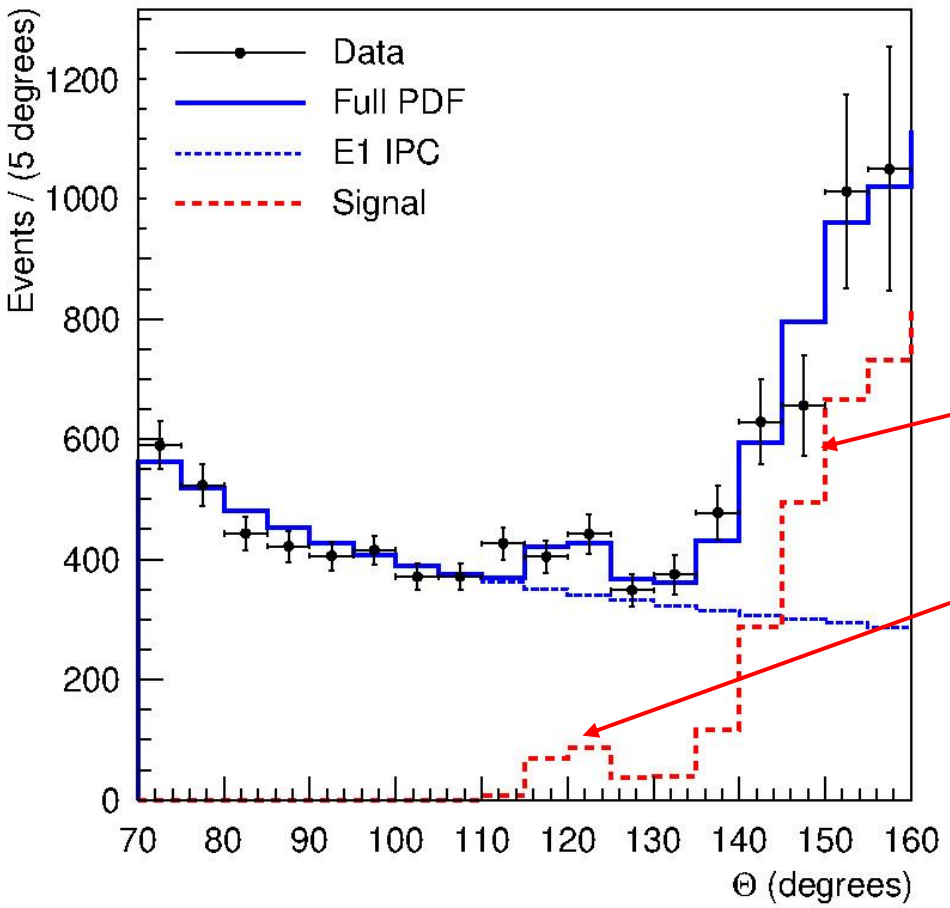


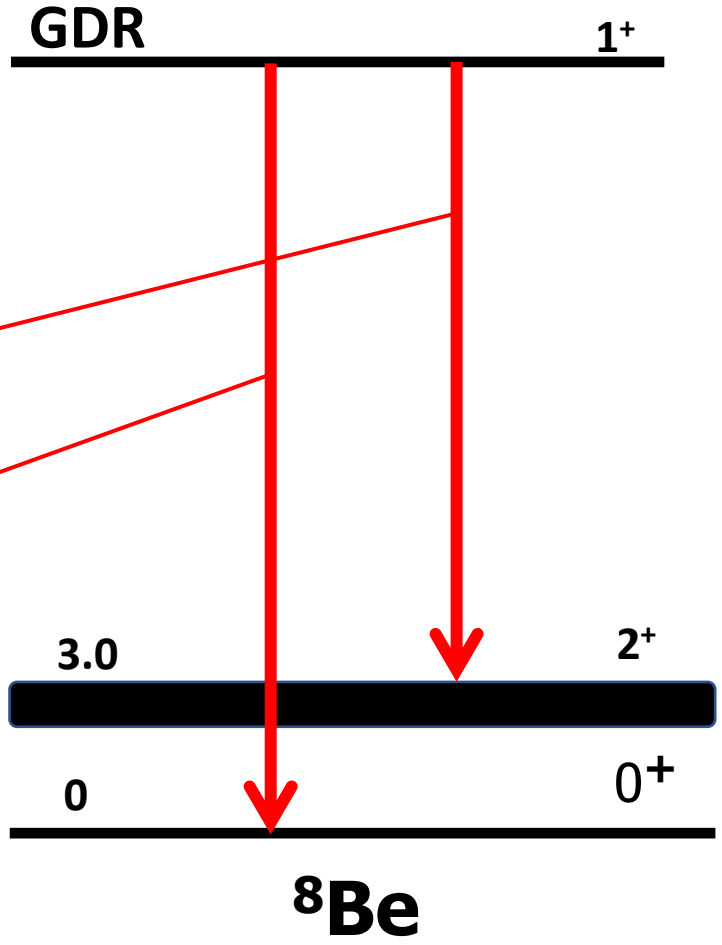
GDR





Fitting the e^+e^- angular correlation for the GDR region



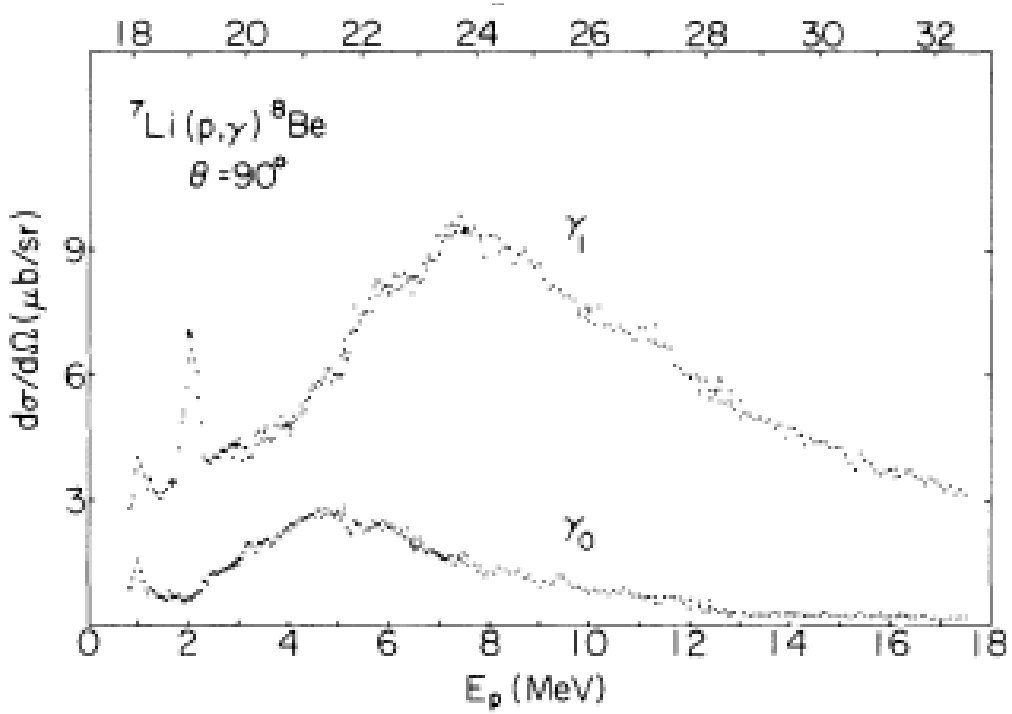


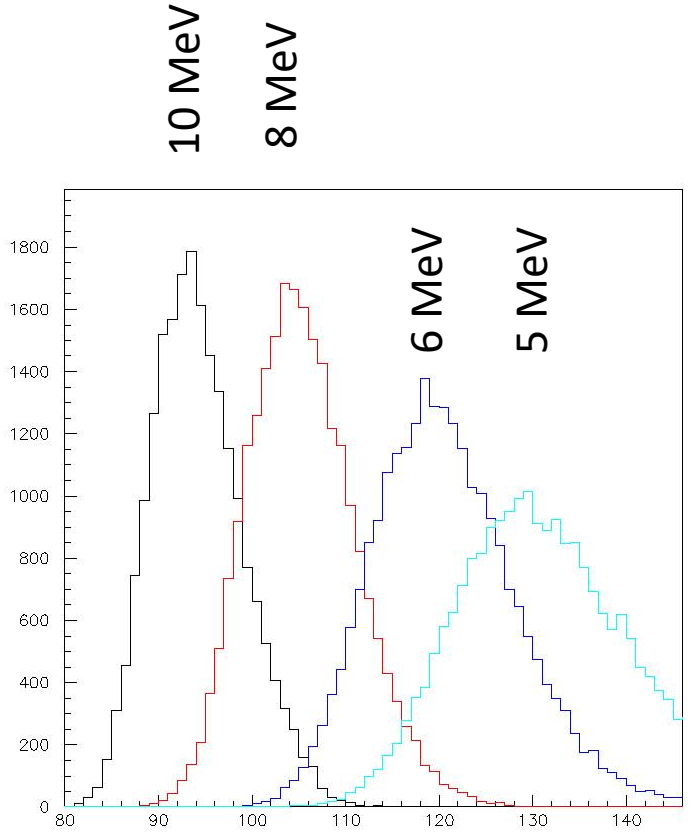
m_0c^2=17 MeV

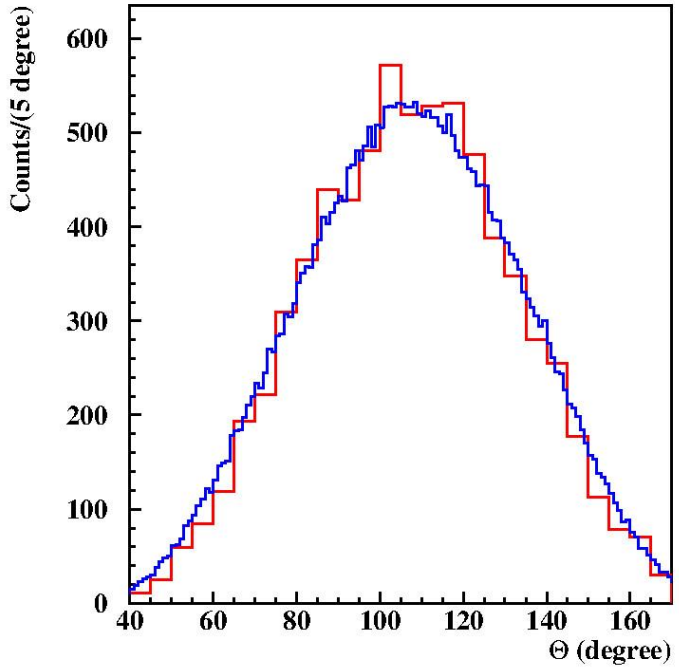
Thank you very much for your kind attention

To ^{8}Be continued…

Simulation for the X17 decay created in the $^{7}Li(p,\gamma)^{8}Be$ reaction at different proton bombarding energies (γ_1 transition)







γ-ray and e^+e^- energy-sum spectra recorded at E_p= 4 MeV