Investigating halo properties through reactions with ^{11}Li

Patrick Fortier

Department of Physics and Astronomy

Saint Mary's University

Outline

- Introduction to halo nuclei
- Importance of ^{10}Li
- Experimental design
- Preliminary data
- Conclusions

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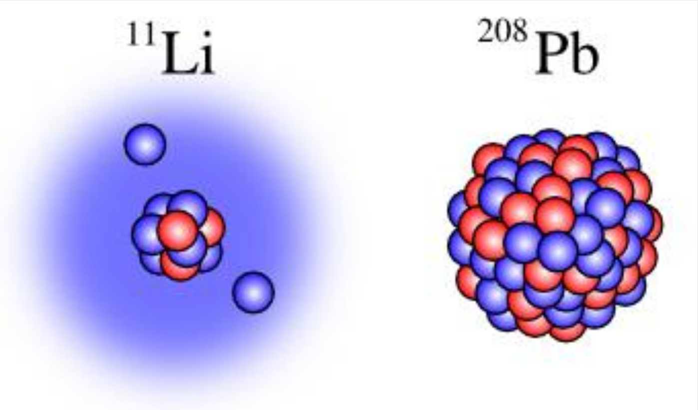
Introduction to Halo Nuclei

- Halo nuclei are a type of exotic nuclei with a large σ_R due to a large trailing density distribution



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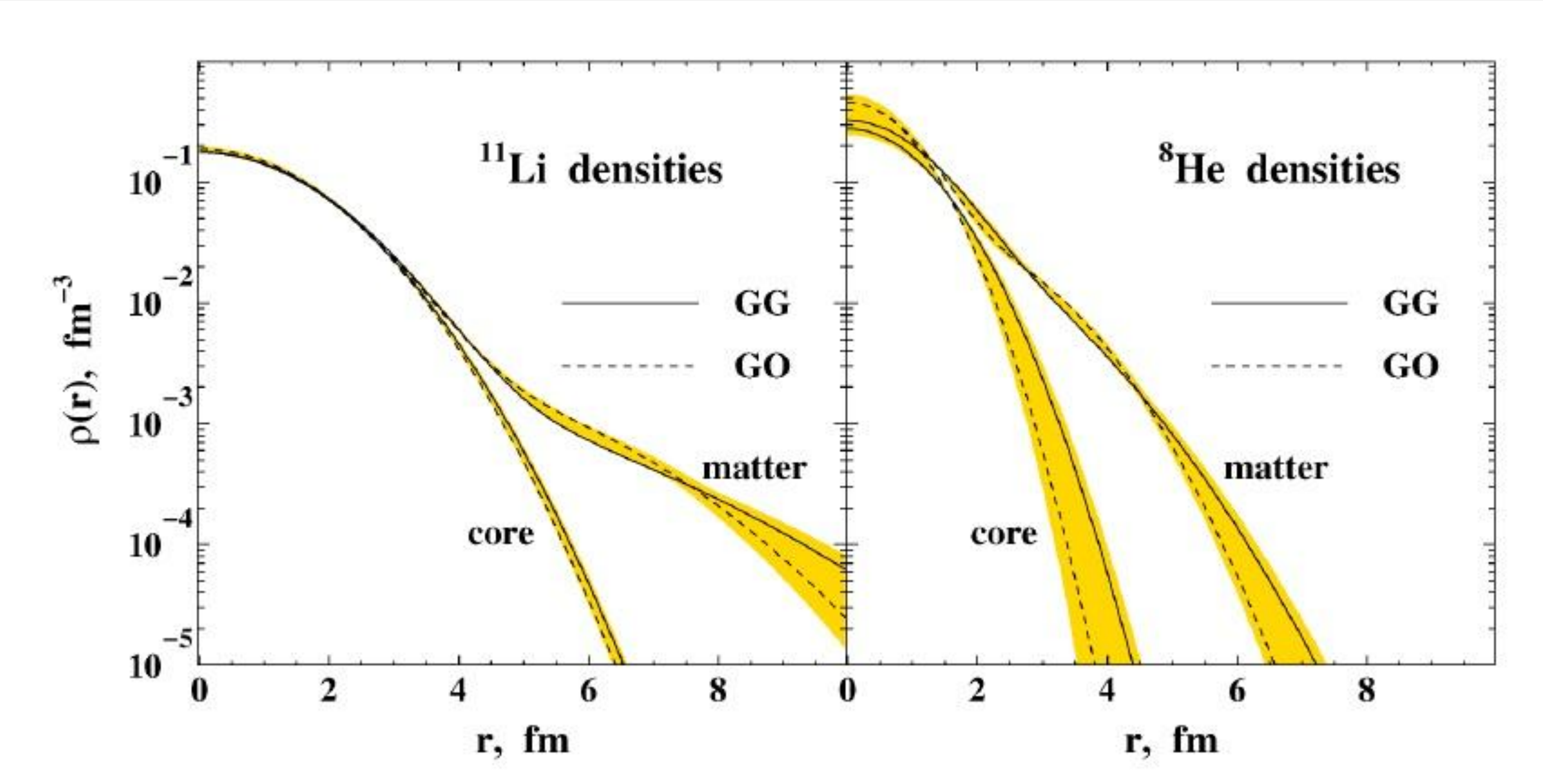
Densities in Halo Nuclei



A.V. Dobrovolsky *et al.* Nuclear Physics A **766** (2006) 1–24

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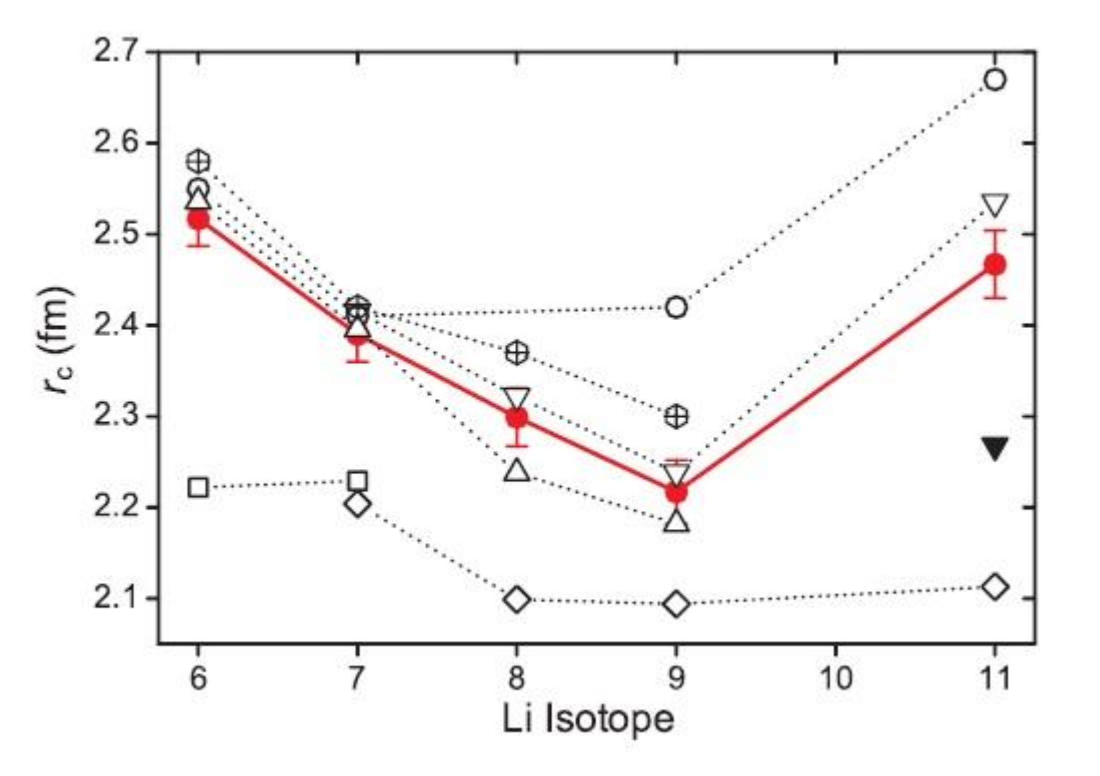
Why Study ^{11}Li

- Nucleon distributions within the core (and r_c)
- Magic numbers
- Matter radii
- Understanding isotopic chains



R. Sanchez *et al.* Physical Review Letters **96** (2006) 033002

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Importance of Unbound Nuclei

- Resonances in ^{10}Li tell us about the halo formation and reaction mechanisms
- We do not fully understand why ^{10}Li is unbound compared with ^{11}Li
- Broader view of the strong force and structural models

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Previous Studies on ^{10}Li

- Mass of ^{10}Li still inconclusive
- Previous studies have looked at transfer reaction $^{9}Li + p \rightarrow {}^{10}Li$
- Many theoretical models but resonances in ^{10}Li are still unknown

Experiment

- Run at ISAC II at TRIUMF
- Secondary ^{11}Li beam at ≈4A MeV
- Using two-body kinematics and investigating one neutron transfer:
  - $^{11}Li + p \rightarrow {}^{10}Li^* + d \rightarrow {}^{9}Li + n + d$
- Looking for ^{10}Li resonant structures in ^{11}Li

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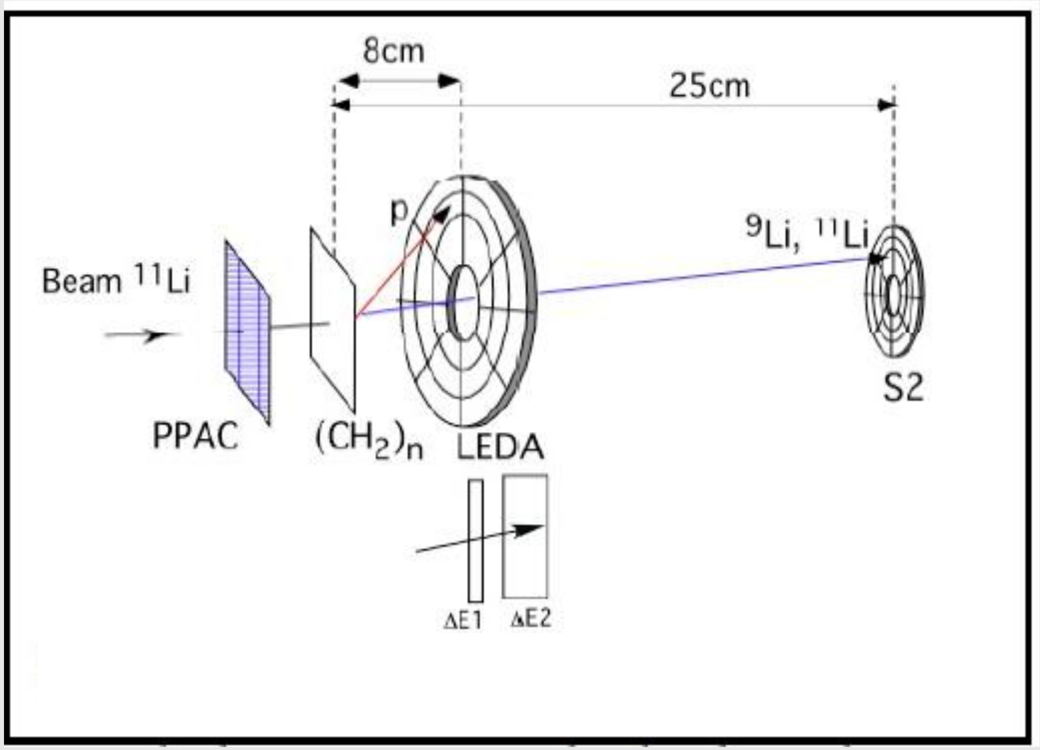
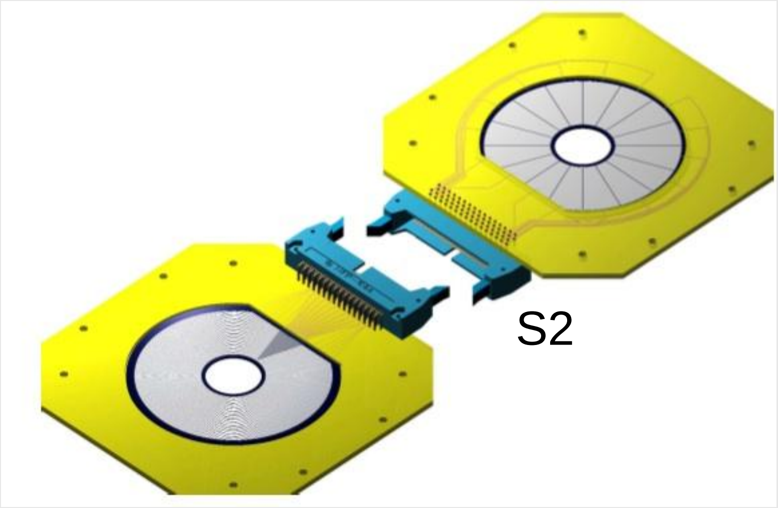
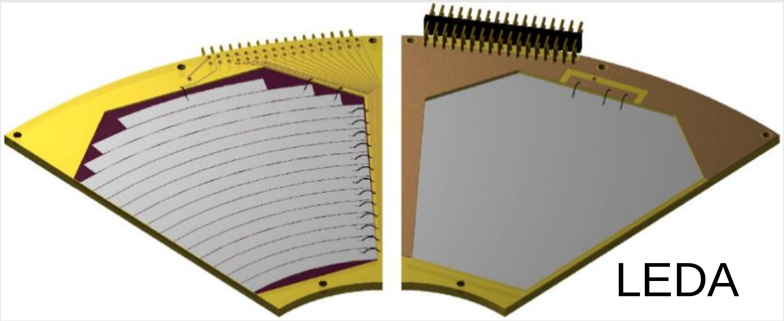
Experimental Setup







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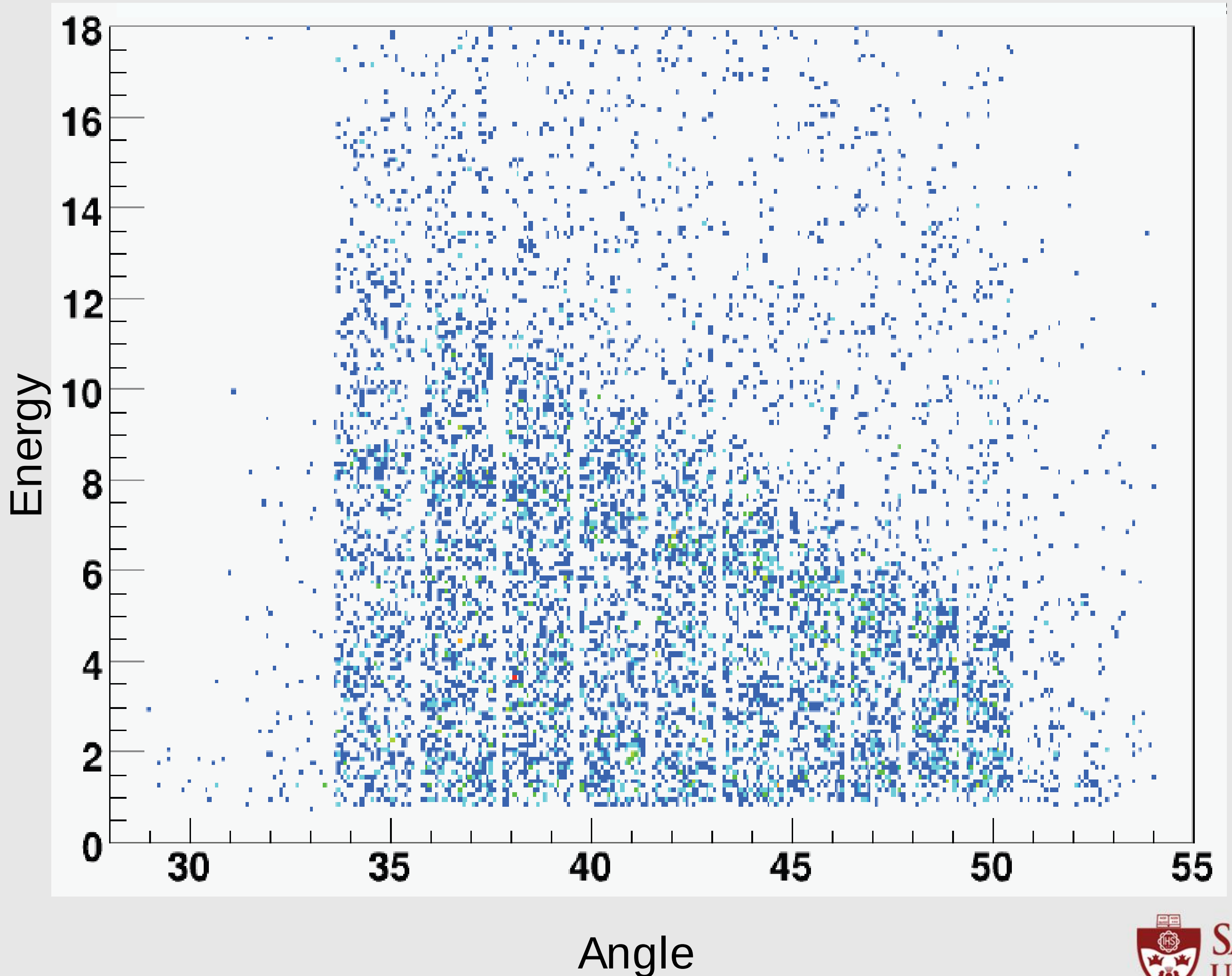
Raw Data



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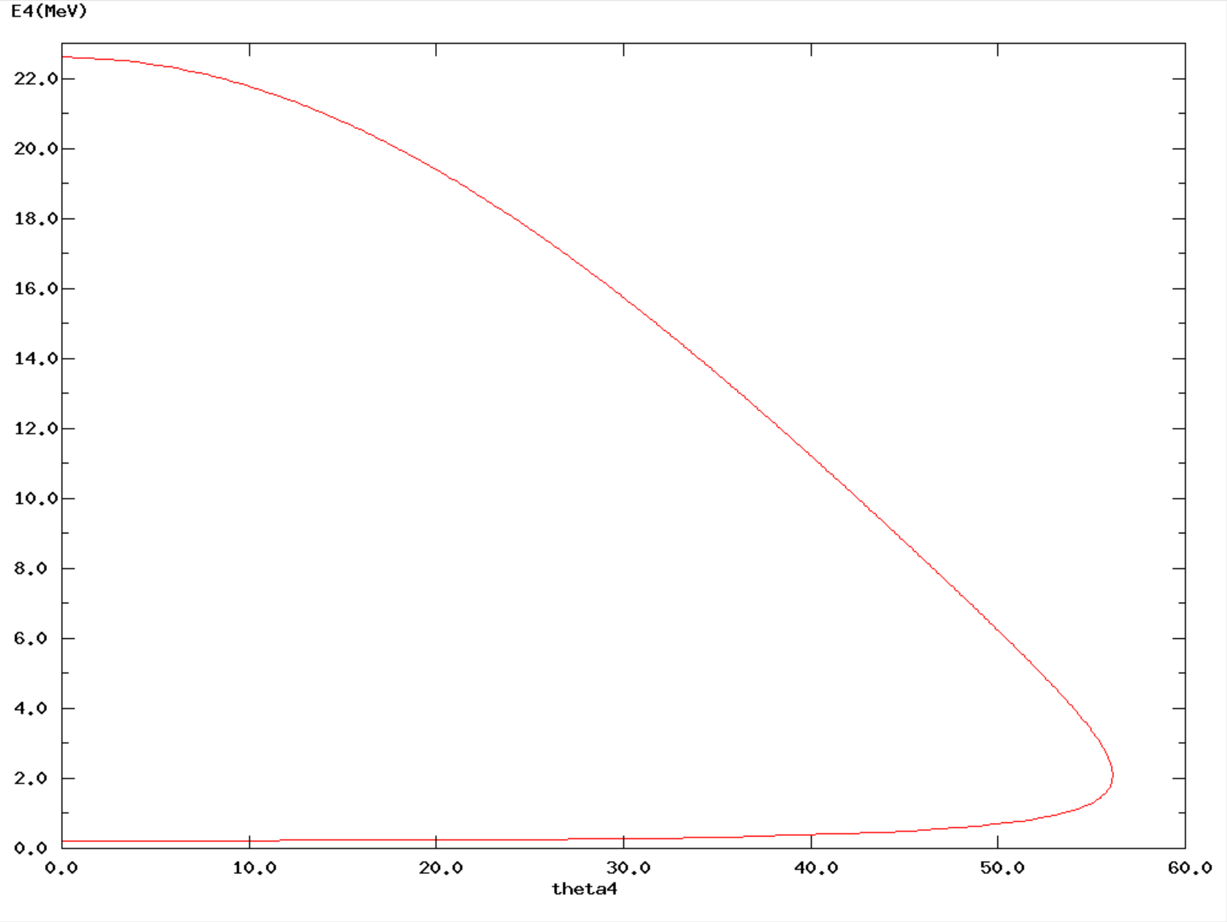
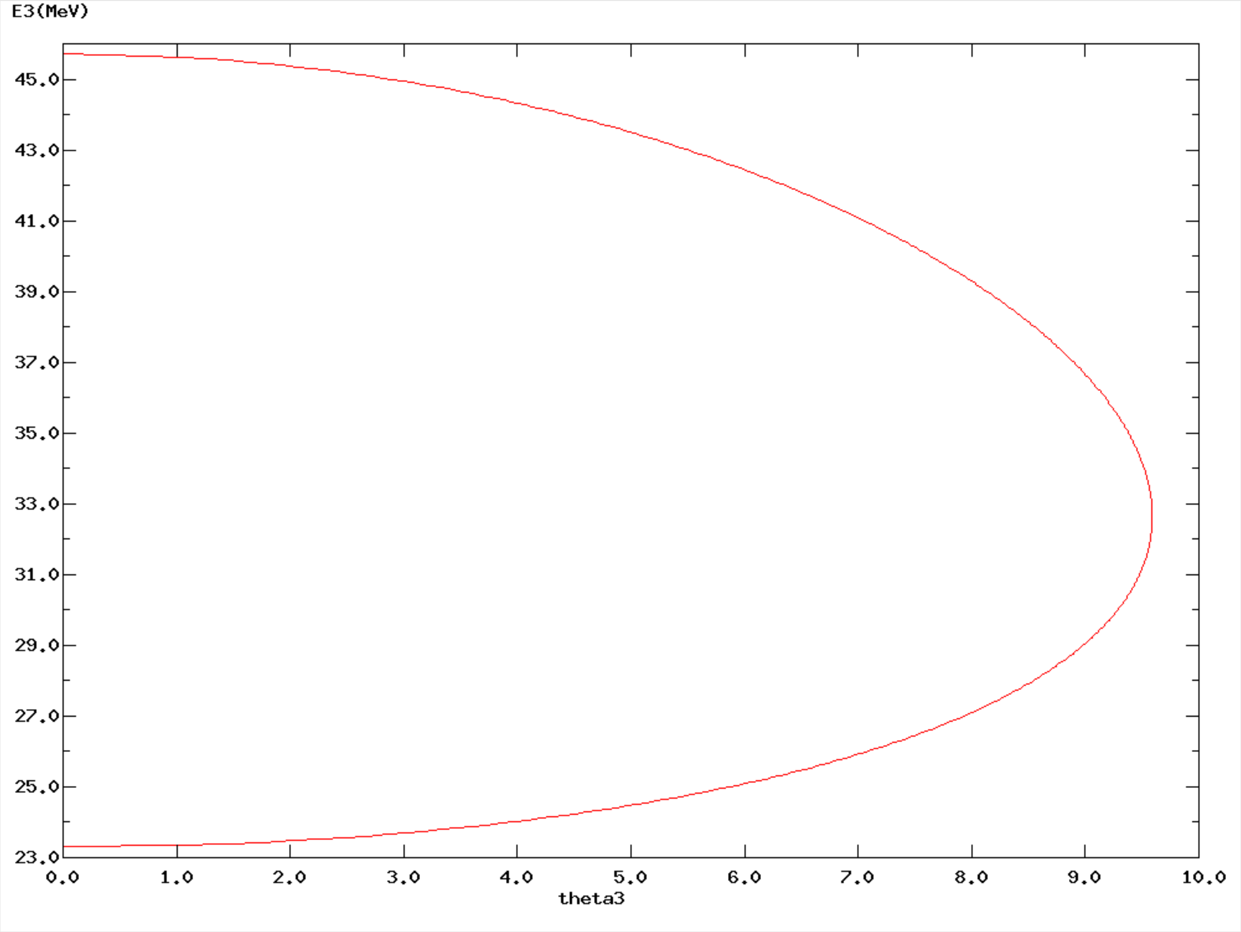
Kinematics – Light Particle



Kinematics – Heavy Particle



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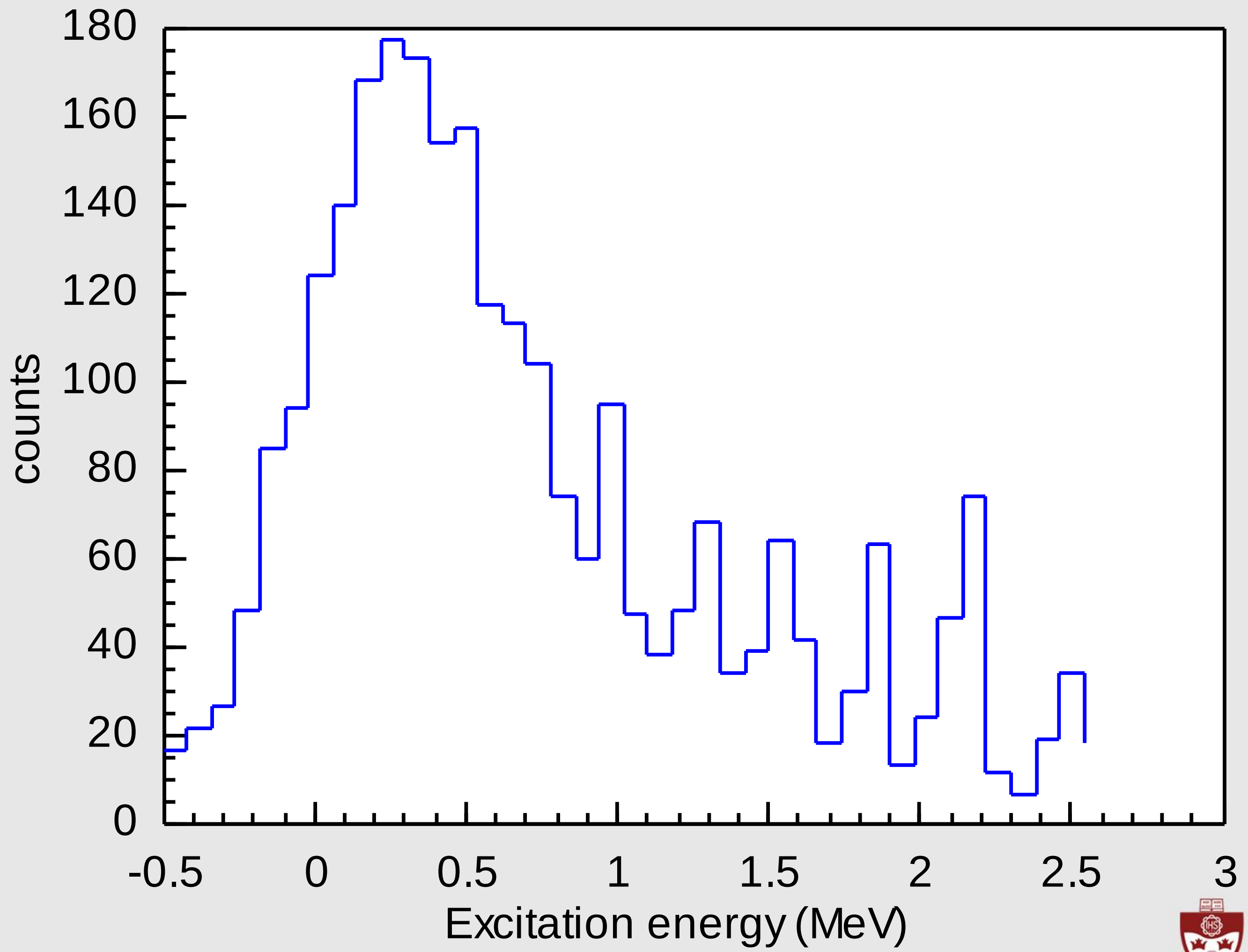
Excitation Energy Spectrum



Conclusions

- A low excitation energy structure is observed in the one neutron transfer reaction $^{11}Li + p \rightarrow {}^{10}Li^{*} + d$ which suggests a low energy resonance. This is the first study of this reaction.
- Further analysis work will involve understanding any possible effect of background channels like
  - $^{11}Li + C \rightarrow d + {}^{21}O$
  - $^{11}Li + C \rightarrow d + {}^{20}O + n$
  - $^{11}Li + p \rightarrow d + {}^{9}Li + n$

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