

Probing many aspects of the halo structure in Be nuclei

by beating the crap out of it

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Setup

Shared infrastructure

- TIGRESS gamma-ray detectors
 - High efficiency for S1297
 - Full suppression for S1202
- SHARC vacuum chamber, with modifications
- Madrid dE-E telescope configurations
 - Silicon detectors, often DSSDS
 - Plug into a motherboard
 - Readout with TIGRESS electronics
 - 2 dE1-dE2-Eforward and one E for S1202 to discriminate d,p
 - 4 dE-E for Madrid to discriminate ¹¹Be (elastic or inelastic), ¹⁰Be (breakup), anything else
- Run as a campaign
 - Also did this last year







Setup











S1297 Reaction & Motivation

S1297: Structure of ¹⁰Be

- •¹¹Be(p,d) on CD2 target at ¹⁰Be
- energy of ~ 10 MeV/u

•Direct reactions

Populate excited states in ¹⁰Be
Evaluate (confirm, really) spin with angular distribution of outdoing deuteron

•Measure (or guesstimate, if you're Byron) wave function composition by spectroscopic factor (absolute cross section)

•2- state an excited halo?
•Use TIGRESS to tag ~6 MeV states that can't be resolved by particle spectroscopy by measuring their gamma decay



S1297

Started with ¹³C(p,d) @ 7 MeV/u to shake down electronics as best as possible

Then went to 11Be(p,d) @9.93 MeV/u

Typically 1.5 to 2 x 10⁵ particles per second

Trigger flaw messed up particle-gamma coincidences for first half of run

Some S1297 results



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Some S1297 results



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Some S1297 results



S1202 Reaction & Motivation



S1202: Reaction dynamics of halo nuclei, part of an ongoing program

- ¹¹Be+¹⁹⁷Au at 3.2, 2.9 MeV/u near Coulomb barrier
- Dipole polarizability
- Resonances (unbound states)
- Breakup
- Role of 0.320 MeV excited state
- Measure elastic, inelastic, and breakup channel cross sections, to quantify influence
 - Goal: quantify role of these effects
 - Tag inelastic scattering (excitation) with TIGRESS
 - Suppression of elastic cross section relative to simple Rutherford observed in ¹¹Li



Scaling



S1202

Started with ¹²C at 5 MeV/u for shakedown & efficiency

Took some 22 Ne 3.2 MeV/u for further shakedown

Then went to 11Be(p,d) @3.2, then 2.9 MeV/u

Again, typically 1 to 1.8 x10⁵ particles per second

Typically 1.5 to 2 x 10⁵ particles per second

No electronics problem

Exploring Halo effects in the Scattering of ¹¹Be on Heavy Targets



Exploring Halo effects in the Scattering of ¹¹Be on Heavy Targets



2.9 and 3.6 MeV/u of ¹¹Be will test Scaling effect



• Both experiments got useful data

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- Both experiments were successful from on-line data (S1297, after trigger fixed)
- Both sets of experimenters went home happy



Canada's national laboratory for particle and nuclear physics Laboratoire national canadien pour la recherche en physique nucléaire et en physique des particules

Thank you! Merci

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