Coulomb breakup of ^{8}B within a Dynamical Eikonal Approximation

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What makes ^{8}B so interesting?

- One-p halo candidate ($S_p = 137$ keV);
  seen as $^8\mathrm{B} \equiv {}^7\mathrm{Be} + \mathrm{p}$
  Breakup used to study halo structure
- Coulomb breakup of astrophysical interest:
  Inverse reaction of $^7\mathrm{Be}(\mathrm{p},\gamma)^8\mathrm{B}$,
  important for solar-neutrino studies.
  Idea: extract $\sigma_{\mathrm{capture}}$ from σ_{bu}, but
  - Influence of nuclear interaction in breakup ?
  - Only E1 in capture, while also E2 in breakup
  - Role of higher-orders in breakup ?

We study ^{8}B breakup addressing these issues
Several experiments are analysed within one model

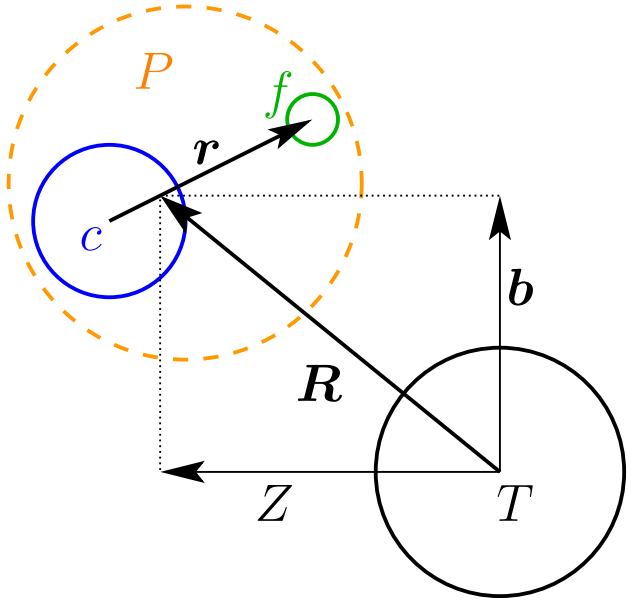
Framework

Projectile (P) modelled as a two-body system:
core (c)+loosely bound nucleon (f) described by

$$H_0 = T_r + V_{cf}(\boldsymbol{r})$$

V_{cf} adjusted to reproduce
bound state

Target T seen as
structureless particle

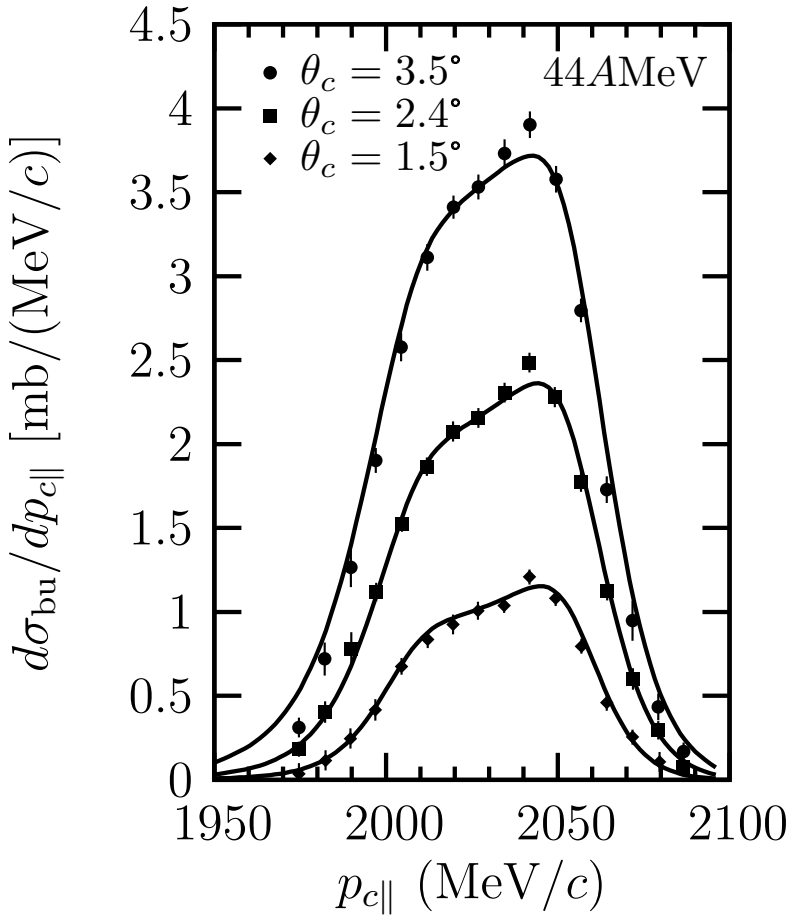


P-T interaction simulated by optical potentials
$\Rightarrow$ breakup reduces to three-body scattering problem:
$[T_R + H_0 + V_{cT} + V_{fT}]\,\Psi(\boldsymbol{R}, \boldsymbol{r}) = E_T \Psi(\boldsymbol{R}, \boldsymbol{r})$
solved using Dynamical Eikonal Approximation

Baye, PC, Goldstein PRL 95, 082502 (05); PRC 73, 024602 (06)

Parallel-momentum distributions

^{8}B + Pb @ 44AMeV (MSU) [Davids PRL 81, 2209 (01)]

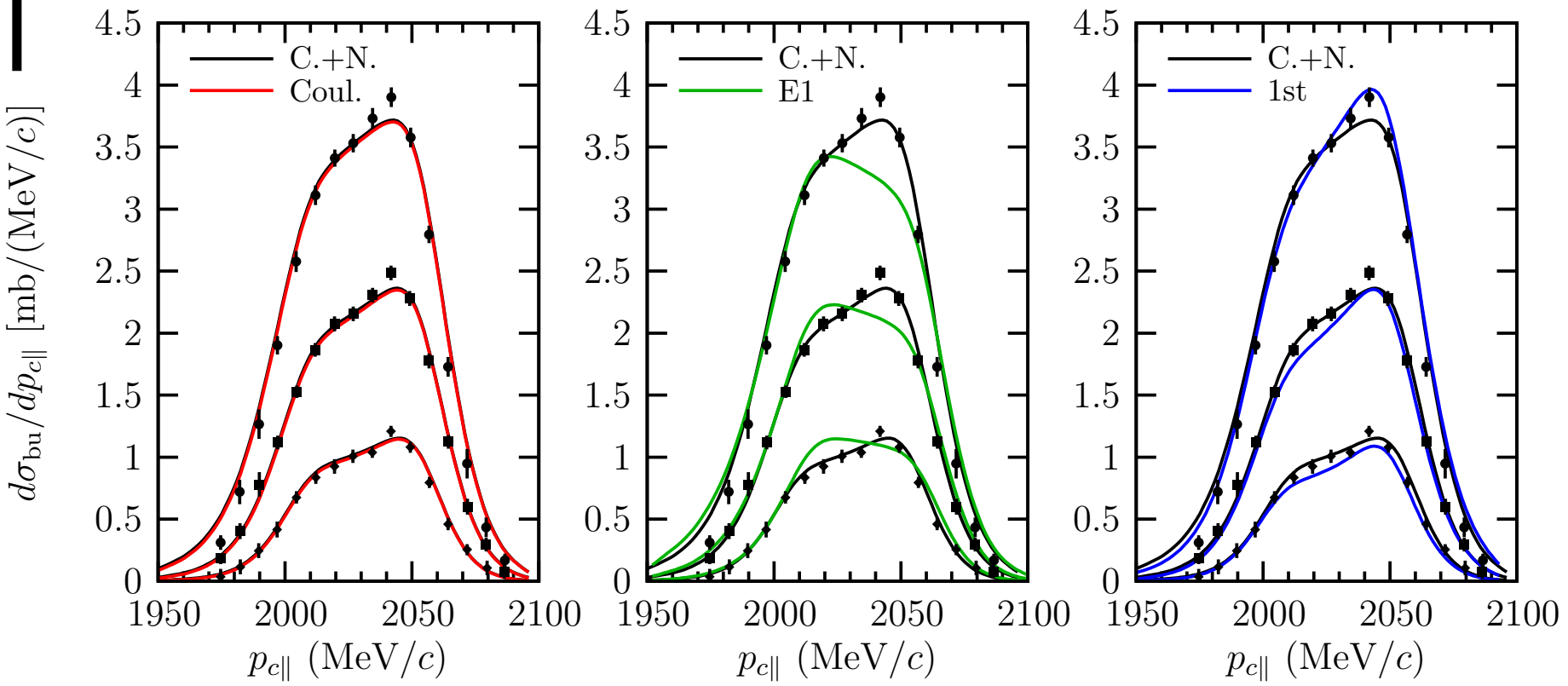


Good agreement with exp. (no fitting parameter)

although simple ^{8}B description

Analysis

^{8}B + Pb @ 44 AMeV (MSU) [Davids PRL 81, 2209 (01)]



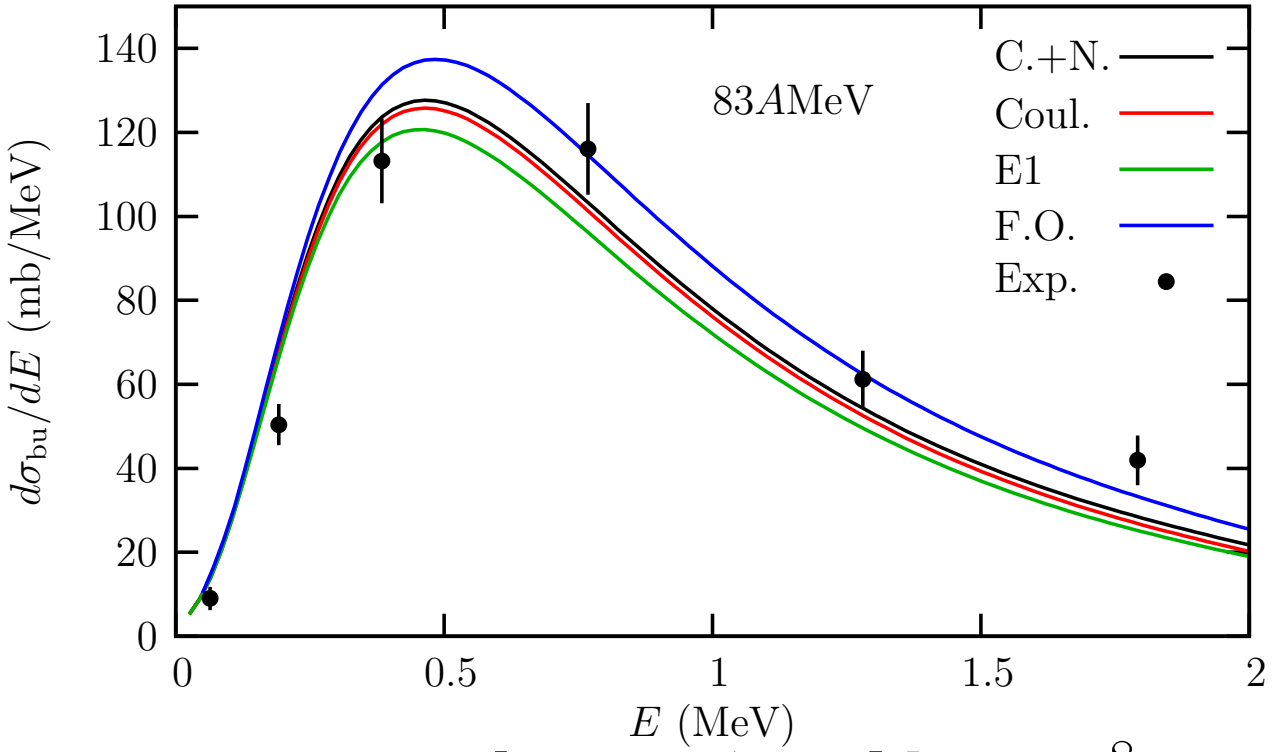
Nuclear interaction negligible at forward angles

Significant E1-E2 interference (asymmetry)

First-order: more asymmetric $\Rightarrow$ higher-order

Energy distribution

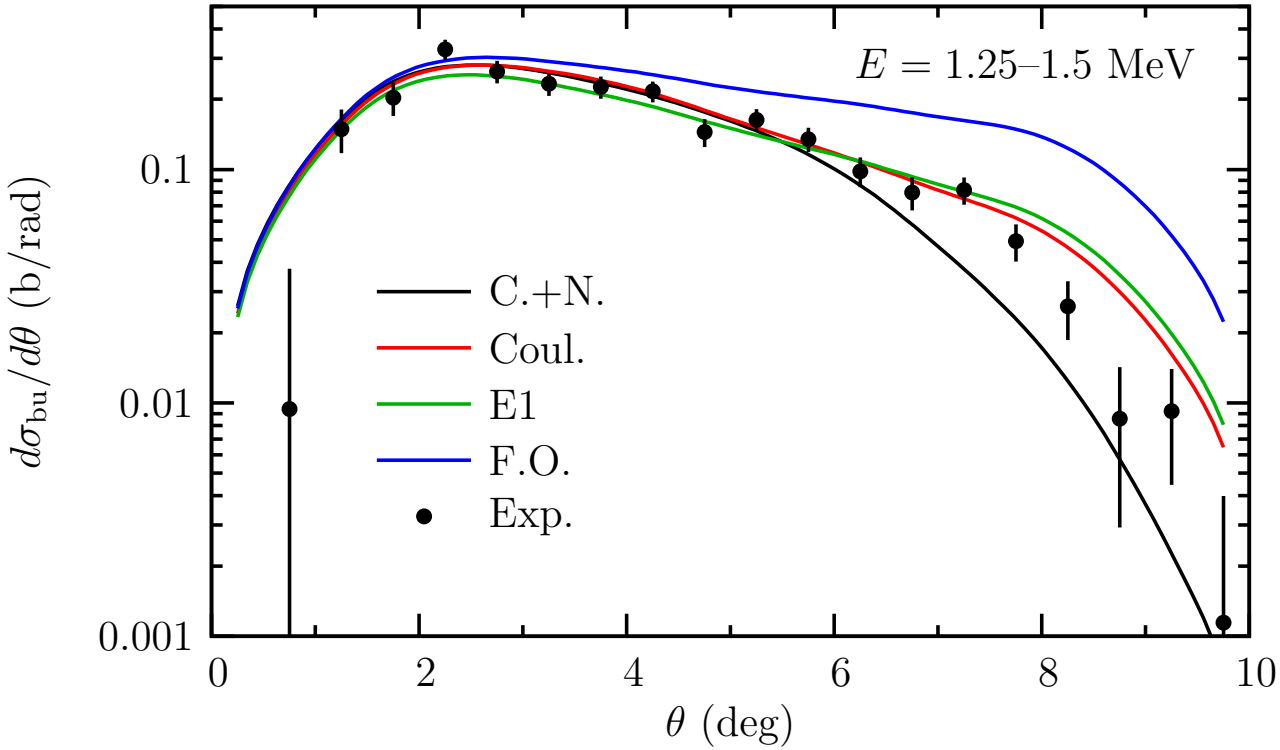
^{8}B + Pb @ 83AMeV (RIKEN) [Davids PRL 83, 2750 (01)]



- Fair agreement with exp. (need better ^{8}B model?)
- No influence of nuclear interaction
- Small influence of E2
- First-order larger $\Rightarrow$ higher-order effects

Angular distribution

^{8}B + Pb @ 52AMeV (RIKEN) [Kikushi PLB 391, 261 (97)]



- Good agreement with experiment
- Nuclear interaction influent only at large angle
- E1 similar to Coul. $\Rightarrow$ no study of E2
- First-order too large $\Rightarrow$ higher-order effects

Conclusion

- Study of several ^{8}B Coulomb breakup experiments
- New reaction model: Dynamical Eikonal Approx.
- Good agreement for various observables with only one reaction model, and one ^{8}B description
- Nuclear interaction negligible at forward angle
- Large E1-E2 interference in breakup
- Significant higher-order effects

$\Rightarrow \sigma_{\rm capture}$ cannot be extracted directly from $\sigma_{\rm bu}$

But might be infered from the ^{8}B description if describes well the breakup data

Future: improve ^{8}B description