Elastic scattering of weakly-bound nuclei ^{8}B and ^{9,10,11}C on ^{nat}Pb target

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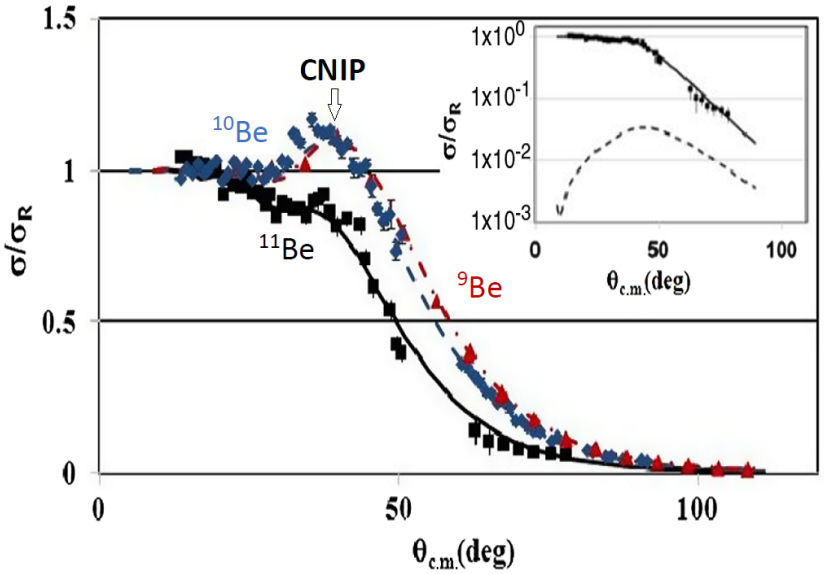
- Motivation
- Experimental setup
- Results and discussion
- Summary

Motivation

Elastic scattering is an ideal tool to study exotic nuclei

Many elastic scattering measurements using the neutron-rich nuclei ^{6}He, ^{11}Be and ^{11}Li around the Coulomb barriers have been performed.



- Coulomb Nuclear Interference Peaks (CNIP) for ^{11}Be is suppressed.
- The effect of the breakup on elastic scattering is strong.

A. Di Pietro et al., Phys. Rev. Lett. 105, 022701 (2010)

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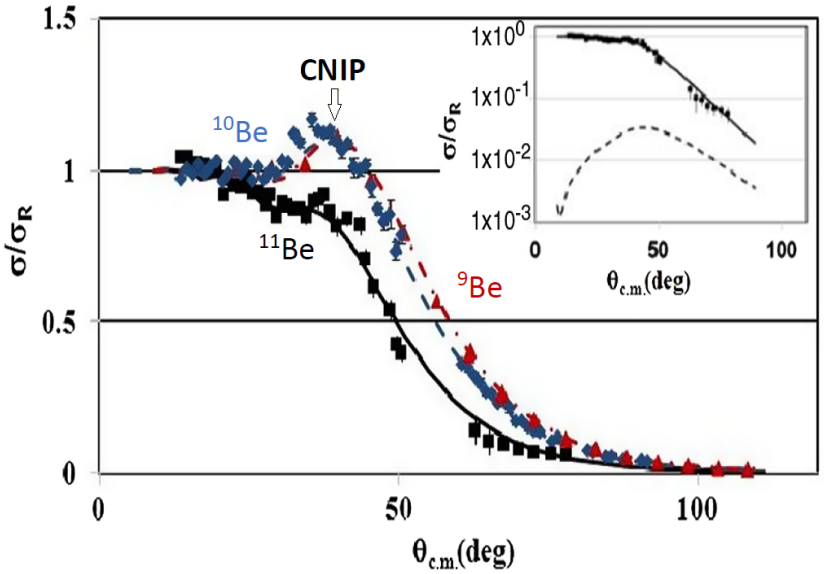

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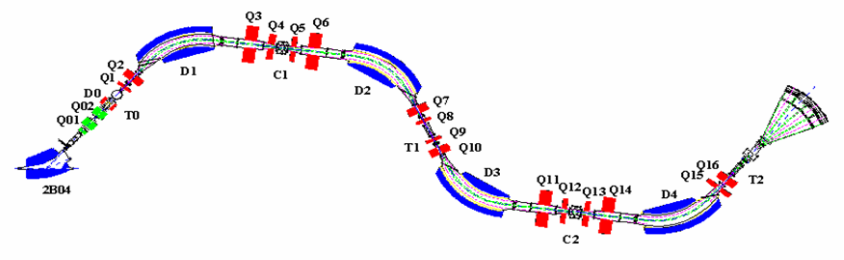
How about proton-halo nuclei ?

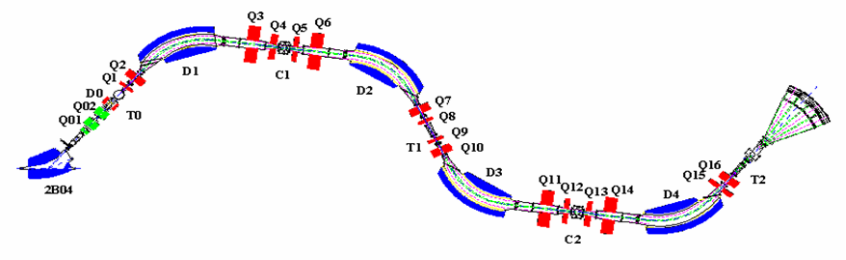
At above-barrier energies ?

Experimental setup



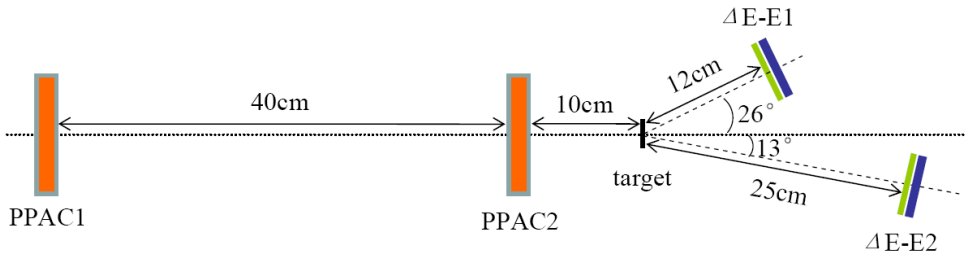
RIBLL (Radioactive Ion Beam Line in Lanzhou) is a typical Projectile Fragmentation(PF)type facility. RIBLL has three focal points (T0,T1 and T2)and two focal planes(C1 and C2).

Experimental setup

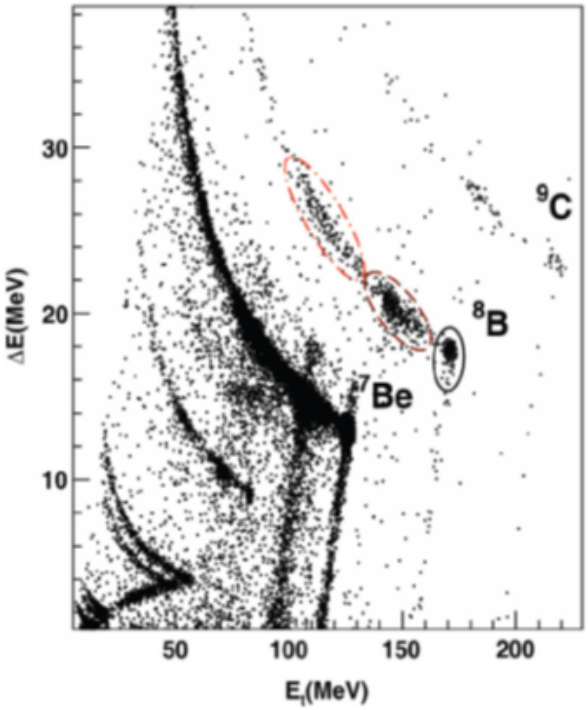


RIBLL (Radioactive Ion Beam Line in Lanzhou) is a typical Projectile Fragmentation(PF)type facility. RIBLL has three focal points (T0,T1 and T2)and two focal planes(C1 and C2).

- primary beam: 54.2 AMeV ^{12}C
- primary target: 2615 μm Be
- secondary beam: 500 pps for ^{8}B, 5000 pps for ^{7}Be

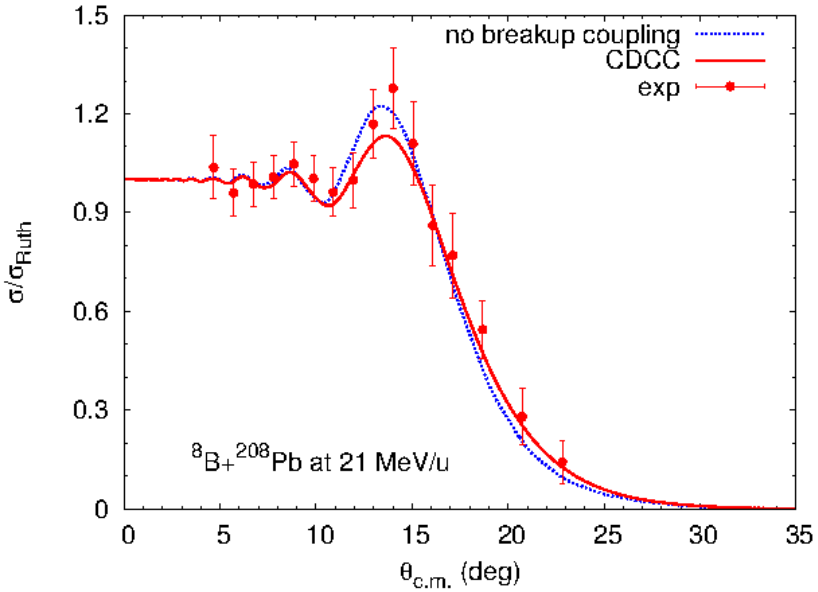


The incoming beam were reconstructed by two position-sensitive Parallel-Plate Avalanche Counters (PPACs). The scattered particles were detected with two silicon detector ΔE-E telescopes.



Y.Y.Yang, J.S.Wang et al., NIMA 701, 1

^{8}B elastic scattering



- The Coulomb Nuclear Interference Peak (CNIP) is not suppressed.
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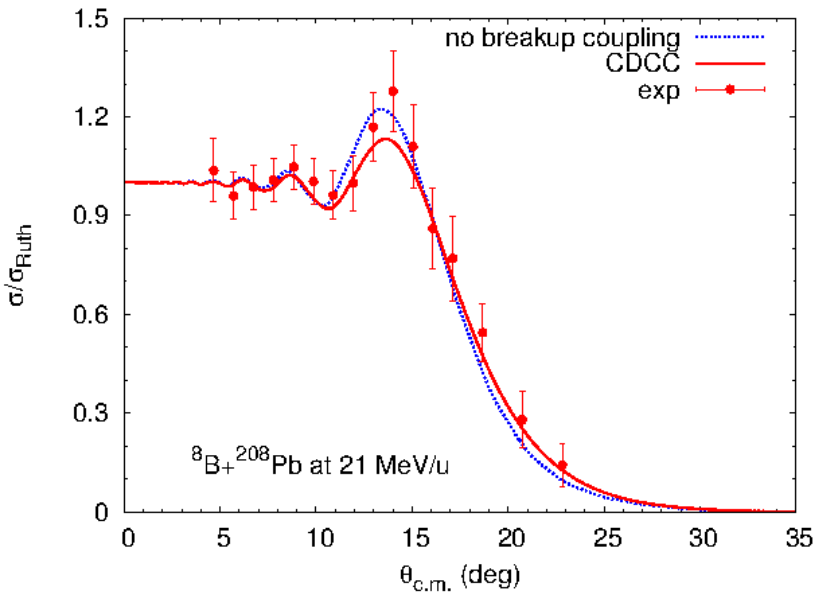
^{8}B elastic scattering



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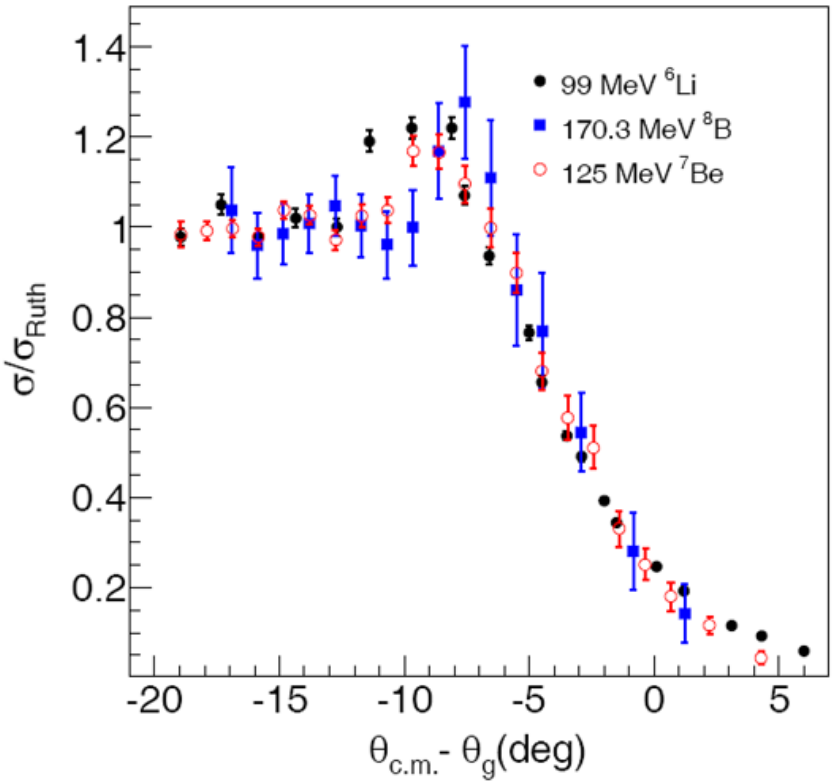
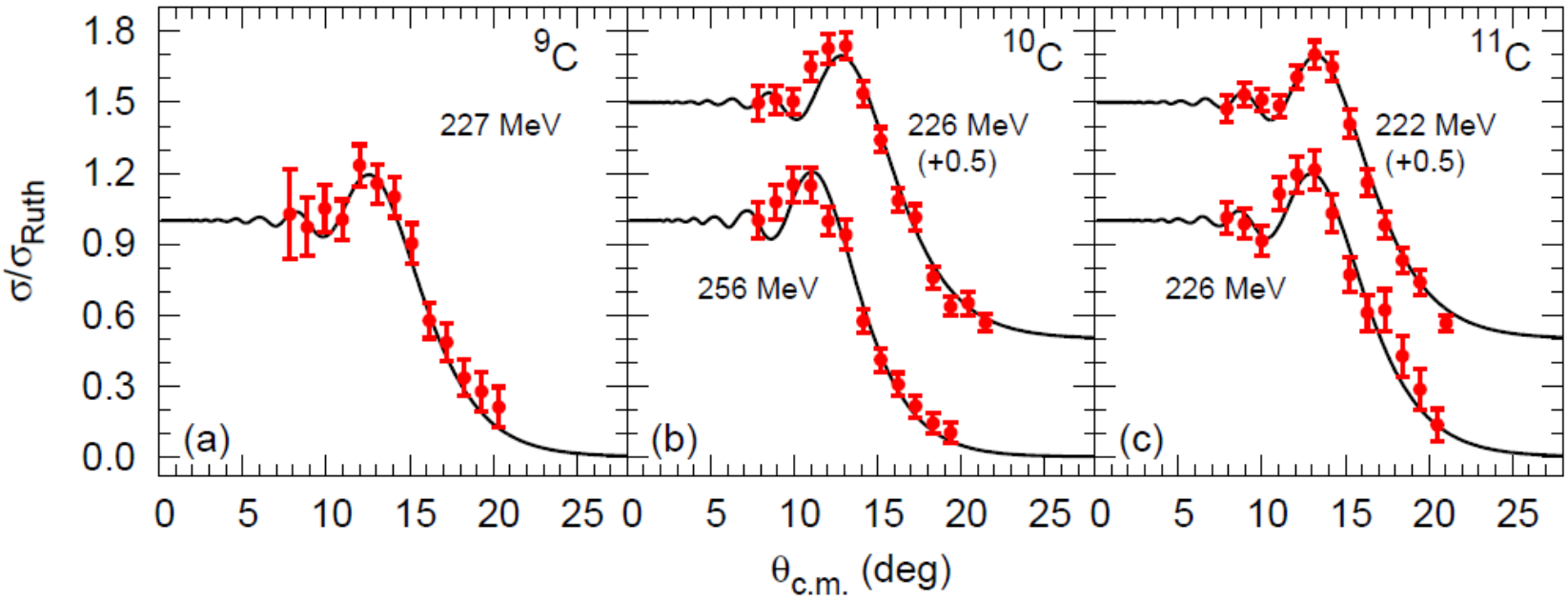
Y.Y.Yang, J.S.Wang et al., PRC 87, 044613 (2013)



The very low breakup threshold (0.1375 MeV for ^{8}B $\longrightarrow$ ^{7}Be + p) has a small influence on the elastic scattering.

^{9,10,11}C elastic scattering

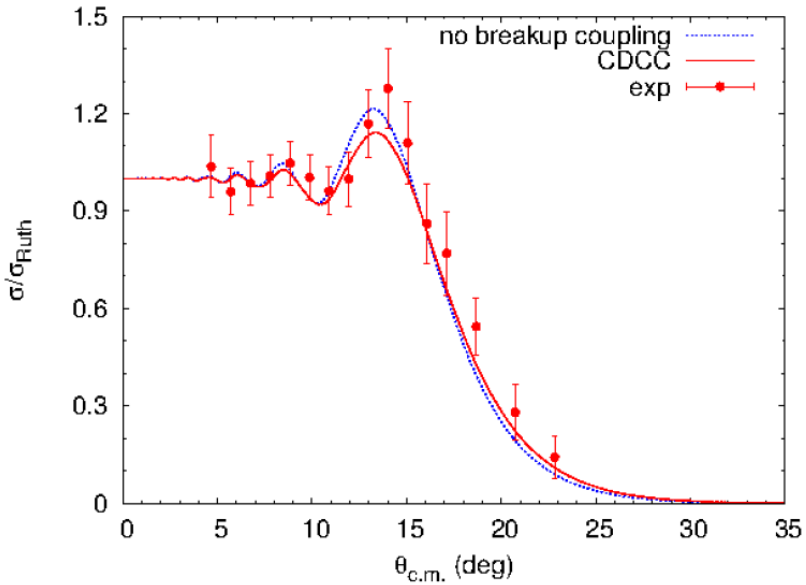


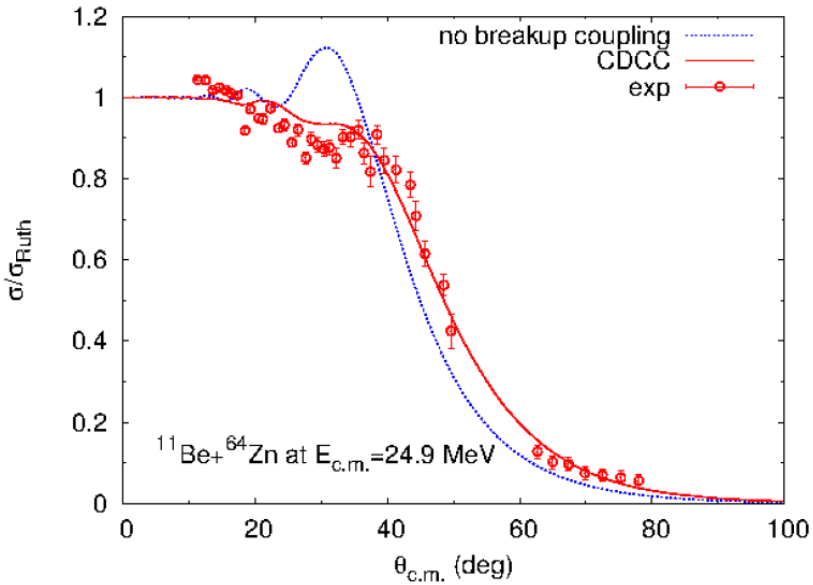
Similar with ^{8}B ! !

^{10,11}C: Y.Y.Yang, J.S.Wang et al., PRC 90, 014606 (2014)

^{9}C: preliminary data

^{8}B and ^{11}Be elastic scattering





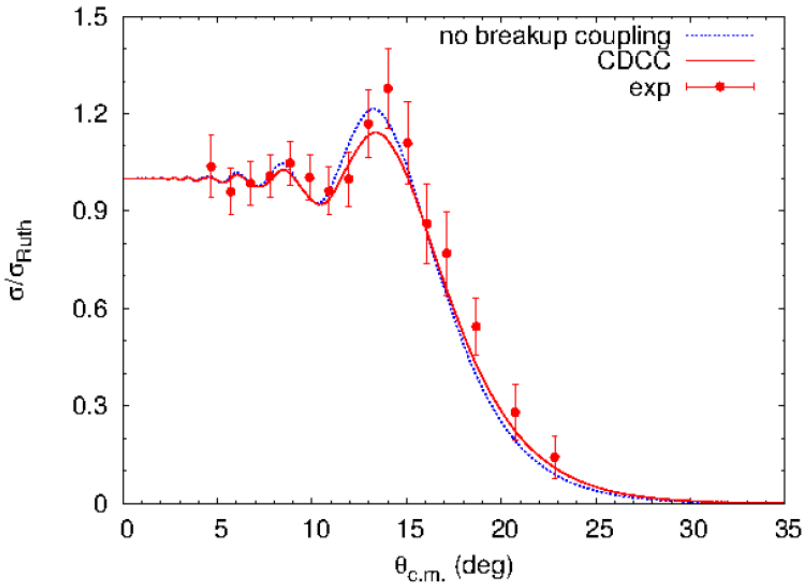
- valence proton
- $\sim$ 3.3 the Coulomb barrier
- heavy target - ^{nat}Pb

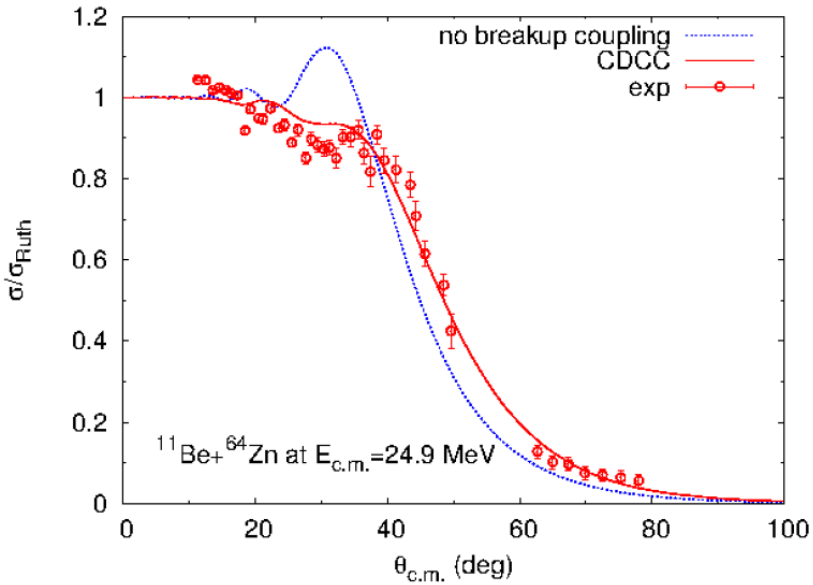
valence neutron

$\sim$ 1.4 the Coulomb barrier

medium target - ^{64}Zn

^{8}B and ^{11}Be elastic scattering





- valence proton
- $\sim$ 3.3 the Coulomb barrier
- heavy target - ^{nat}Pb

valence neutron

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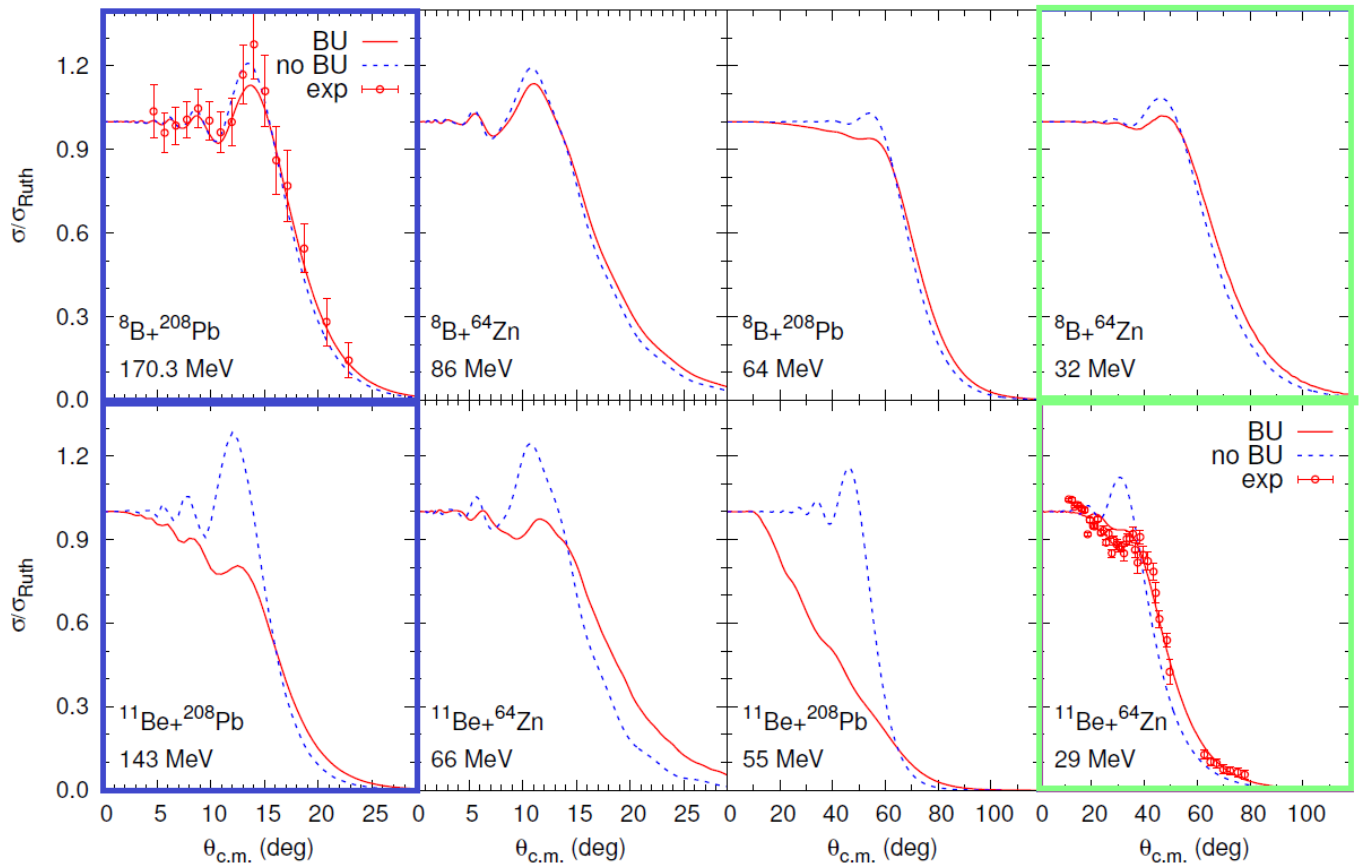
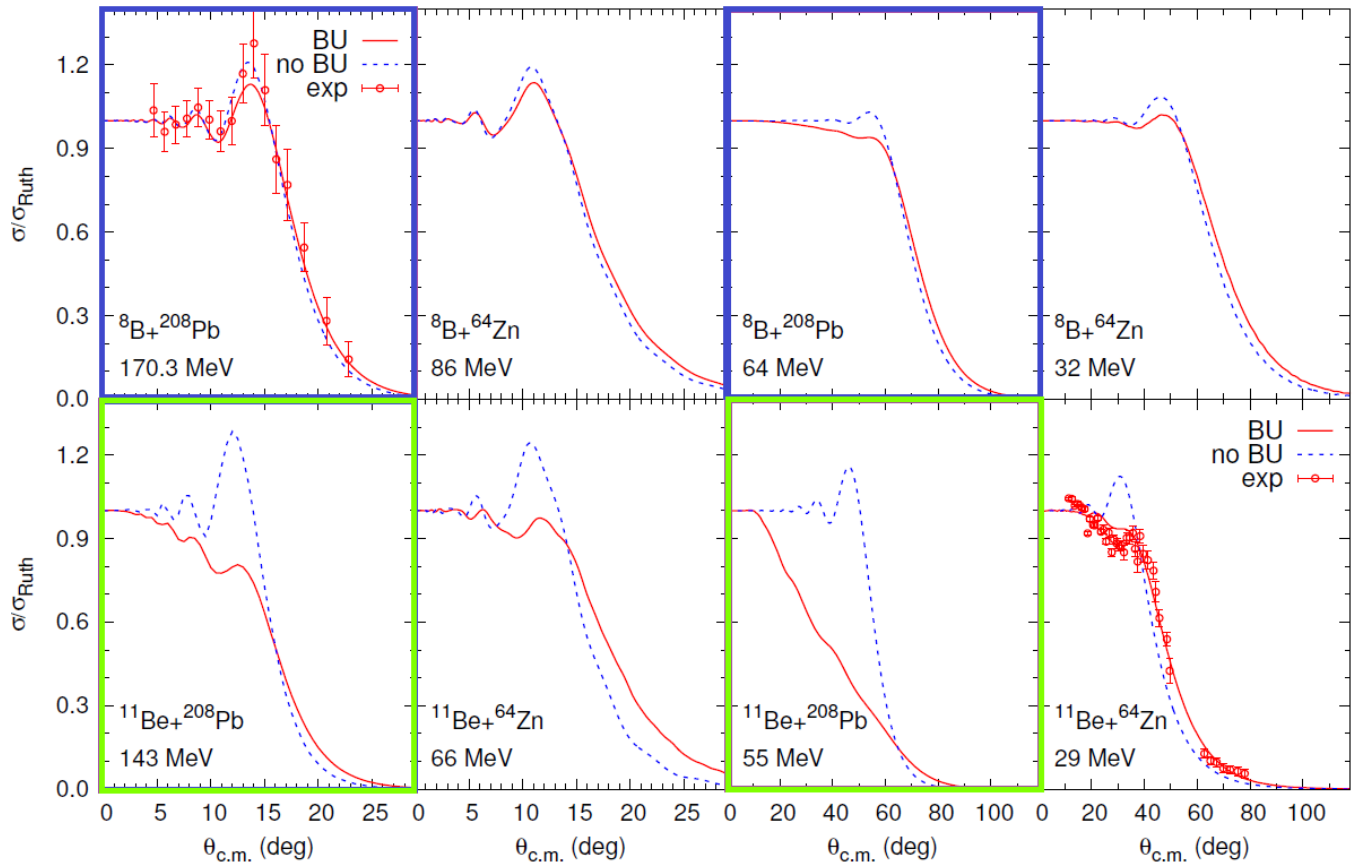
More investigation on the influence of valence particle, energy and target is required.

CDCC calculations for ^{8}B and ^{11}Be - valence particle



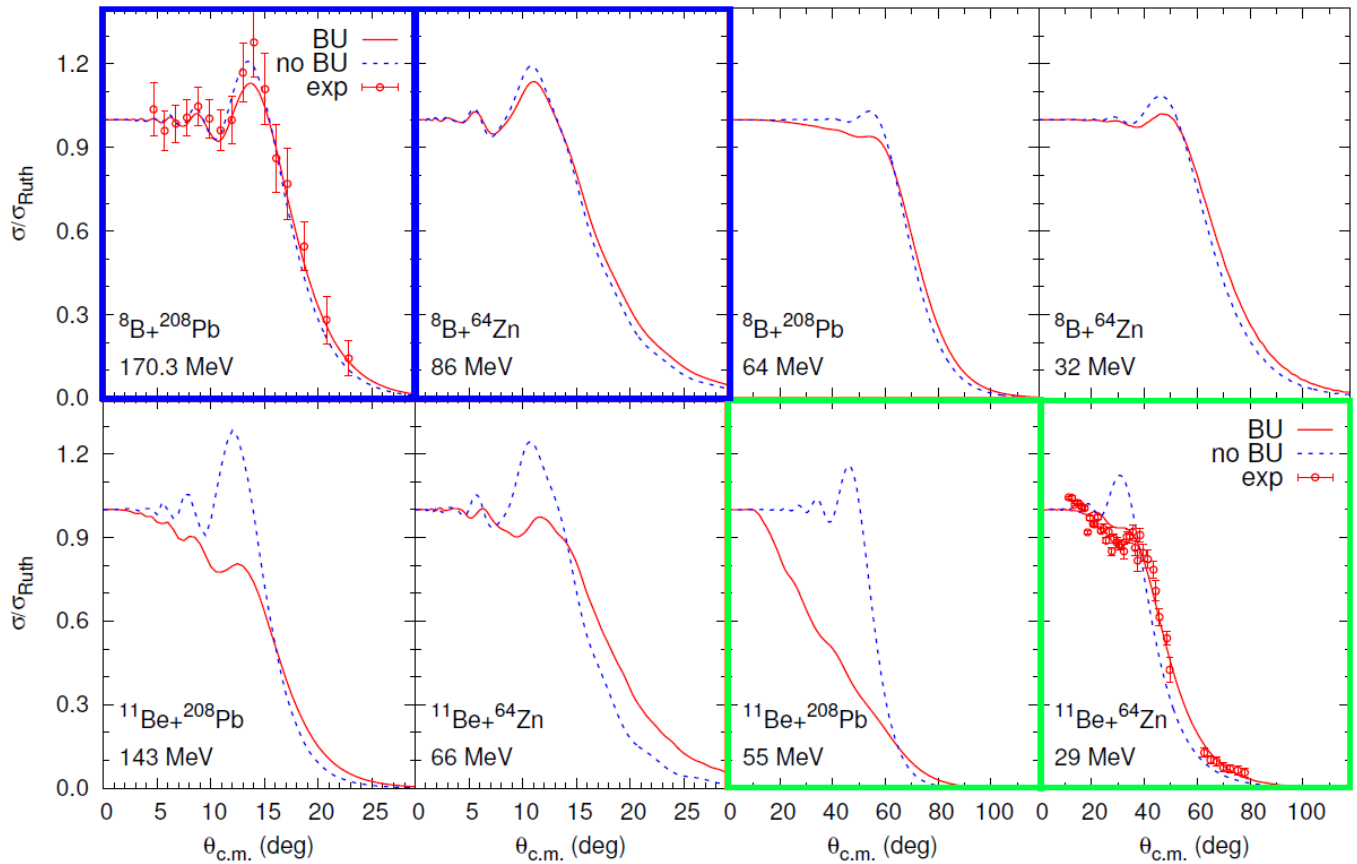
For neutron-rich projectiles, the breakup coupling effect is remarkable.

CDCC calculations for ^{8}B and ^{11}Be - energy



At lower energies, the breakup coupling effect is stronger.

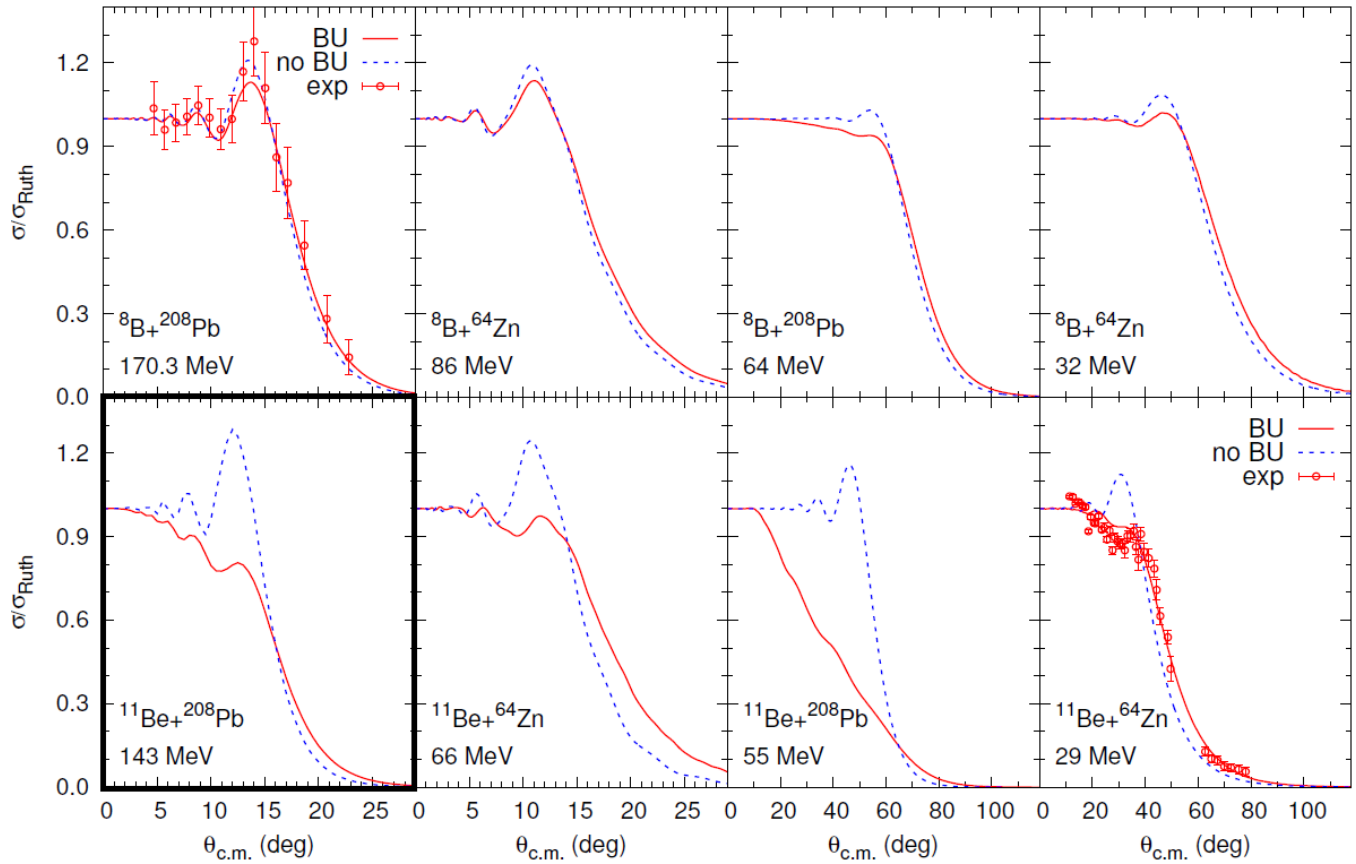
CDCC calculations for ^{8}B and ^{11}Be - target



For ^{8}B: no influence;

For ^{11}Be: the coupling effect is stronger on heavier target.

CDCC calculations for ^{8}B and ^{11}Be



More experimental data ! !

More theoretical efforts ! !

Summary

- A measuremental method was presented at RIBLL. The elastic scattering angular distributions of ^{8}B and ^{9,10,11}C on ^{nat}Pb target were measured at above-barrier energies.
- The measured data shows that the Coulomb Nuclear Interference Peak (CNIP) is not suppressed, in contract to what was observed in the scattering of ^{11}Be.
- The effect of the breakup on elastic scattering was studied to investigate the influence of valance, energy and target.

Collaborators

- Institute of Modern Physics, Chinese Academy of Sciences:
  Jiansong Wang, Junbing Ma, Peng Ma, Shilun Jin, Qi Wang
- China Institute of Atomic Energy (CIAE):
  Chengjian Lin, Xinxing Xu, Huiming Jia
- Beihang University:
  Danyang Pang
- The Andrzej Sołtan Institute ,Warsaw, Poland:
  N. Keeley, K. Rusek
- M. S. University of Baroda, India:
  S. Mukherjee

Thanks for your attention!