Study of $^6$He - d reactions at the ACCULINNA-2 separator

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OUTLINE

- Flerov Laboratory of Nuclear Reactions
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- Research motivation
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- Research motivation
- Experimental setup
- Beam quality
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- Conclusions
FLEROV LABORATORY OF NUCLEAR REACTIONS
78% of $^6\text{He}$
26 AMeV
$10^5$ pps
Two loosely bound nuclei

Why $^6$He And Deuterium?

Calculated differential cross section

- elastic scattering $^7$Li(d,d)$^7$Li by C.M. Perey & F.G. Perey

$2^+$ state of $^6$He
Why $^6$He And Deuterium?

- Two loosely bound nuclei
- Extended spatial structure

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2+ state of $^6$He
Why $^6$He And Deuterium?

- Two loosely bound nuclei
- Extended spatial structure
- Comparison with $^7$Li(d,d)$^7$Li and with $^6$He(p,p)$^6$He

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2+ state of $^6$He
Why $^6\text{He}$ And Deuterium?

- Two loosely bound nuclei
- Extended spatial structure
- Comparison with $^7\text{Li}(d,d)^7\text{Li}$ and with $^6\text{He}(p,p)^6\text{He}$
- Great opening for further studies - $d(^6\text{He},^5\text{H})^3\text{He}$ and $d(^6\text{He},^7\text{He})p$
Why $^6$He And Deuterium?

- Two loosely bound nuclei
- Extended spatial structure
- Comparison with $^7$Li(d,d)$^7$Li and with $^6$He(p,p)$^6$He
- Great opening for further studies - d($^6$He,$^5$H)$^3$He and d($^6$He,$^7$He)p
- No data yet

Calculated differential cross section

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2+ state of $^6$He
No agreement on 2nd excited state energy level

SEARCH FOR 2ND EXCITED STATE OF $^6$He

- No agreement on 2nd excited state energy level
- Possibility to obtain spectrum of excited states

dE-E in the Right Telescope
dE-E in the Right Telescope
dE-E in the Right Telescope

ΔE – E plot in right telescope

Energy loss in Si [MeV]

Energy loss in CsI [arb. units]
DEUTERIUM IDENTIFICATION

\[ \Delta E - E \text{ in coincidence with } He \]
Angle-Angle relation for elastic scattering
Angle-Angle relation for elastic scattering
Angle-Angle relation for elastic scattering
COUNTS PER ANGLE

![Diagram showing the counts per angle with data points for different angle ranges.]
CONCLUSIONS

- Clean beam with high intensity (higher soon!)
- Early results in agreement with theoretical predictions
- ACCULINNA 2 group ready for future, more complicated experiments
BEAM COMPOSITION

2H - 0.11%
4He - 0.06%
7Li - 0.15%
8Li - 18%
9Be - 1%
3H - 2%
6He - 78%
COINCIDENCE WITH $^4$He

Left telescope coincidences with $^4$He
Angle-Angle relation in coincidence with $^4$He

$^2$H angle [deg]

$^4$He angle [deg]
COINCIDENCE WITH $^4$He

Left telescope coincidences with $^4$He
Angle-Angle relation in coincidence with $^4\text{He}$

$^2\text{H}$ angle [deg] vs. $^4\text{He}$ angle [deg]
COINCIDENCE WITH $^4\text{He}$
Angle-Angle relation in coincidence with $^4\text{He}$