Analysis of deuteron elastic scattering and induced activation on light and medium nuclei for IFMIF EVEDA

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INTRODUCTION

• Optical Potential - key ingredient of cross-sections calculations
• NO GLOBAL OPTICAL POTENTIAL (OP) for d + Nucleus (A<27)
(basis of TWS-ITM-004.05)
• COMPARATIVE ANALYSIS of global OMPs for d + $^{27}$Al, $^{54,56,58}$Fe, $^{63,65}$Cu, $^{93}$Nb:
Daehnick et al. (1980): A=27-238, E=11.3-90 MeV
Bojowald et al. (1985): $^{27}$Al, $^{93}$Nb, and $^{63,65}$Cu at E=58.7 and 85 MeV
• None of these global OMP describes data at E=15 MeV
• Semi-microscopic OMP by using realistic nucleon-nucleon interaction
Calculations of microscopic $V_o$ optical potential (DF)
$W_o$ and $V_o$ components: local parameters based on data analysis
Data re-analysis with fixed $W_o$ and $V_o$ components
• Average of the local OMP parameters for d+$^{27}$Al,$^{54,56,58}$Fe,$^{63,65}$Cu,$^{93}$Nb:
Phenomenological OMP - cross-sections calculations
• Activation cross sections calculations for d+$^{27}$Al interaction

Nuclear Model Calculations

OPTICAL MODEL: prime tool for all cross section calculations
Phenomenological OMP - global parameter sets: codes default
Microscopic OPs: reduced uncertainties

SCAT 2000 [O. Bersillon]
• pure elastic scattering OP analysis
DFOLD [M. Avrigeanu]
• double folding method
(nucleon, d, $^{27}$Al = TWA9-TTMI-004-D5)

FRESCO - H95 [B. J. Thompson]
• Coupled Reaction Channel
STAPRE - H95 (updated) [V. Avrigeanu, M. Avrigeanu]
• OMP: SCAT2000; GDH / EXCITON; Hauser-Feshbach
TALYS - 1.0 [A. Koning, S. Hilaire, M. Duijvestijn]
• OMP: ECIS97; EXCITON; Hauser-Feshbach

CONCLUSIONS

Starting point: available (d,d) and (d,p) data for $^{d^{27}}$Al,$^{54,56,58}$Fe,$^{63,65}$Cu,$^{93}$Nb
poor description by global OMP parameter sets

Semi-microscopic OMP analysis
U = $p_0$(CD-Bonn)(charge) & $p_0$(charge) & Paris-NN
$W_o$, $V_o$ phenomenological
improved agreement with data adding the dispersion corrections
Phenomenological OMP analysis for $^{27}$Al,$^{54,56,58}$Fe,$^{63,65}$Cu,$^{93}$Nb
agreement with all available measured data
improved description of (d,d) data vs. TALYS default OMPs
improved description of (d,d) data vs. Daehnick+ and Bojowald+ OMPs
improved description of $\sigma_{EL}$ data in comparison with ACSELAM library

Completion of d+$^{27}$Al activation cross sections
OMP average parameter sets
Deuteron break-up mechanism contribution taken into account
Comparison of STAPRE-H / TALYS-1 activation cross secs.

NEED to UPDATE the ACSELAM library