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Exam Advanced Nuclear Physics   16/01/2017 9:00

Question: Nuclear Reactions

These questions will be evaluated on 20 points. You require a minimum of 7/20 points on this part to pass the course. The points will be rescaled to a weight of 6 towards your final grade for the course. You are not allowed any book or notes. You may use a calculator and the given list of formulas for this part of the examination. Please use the attached sheets for your answer; any additional sheet will be discarded.

Consider the data in the figure, which refer to the elastic scattering of ^{16}O on ^{74}Ge at an incident energy $E_{lab} = 56\,$MeV (data from M. Lozano and G. Madurga, Nucl. Phys. A 334 (1980) 349).
[O: $Z = 8$; Ge: $Z = 32$; for the interaction radius use $R = 1.6\,\text{fm} \times (A_1^{1/3} + A_2^{1/3})$.]
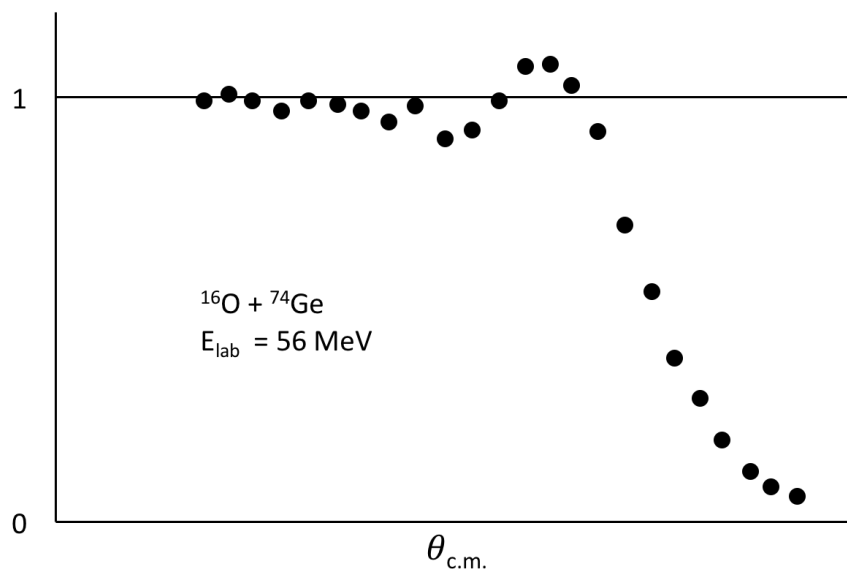
- (1/20) Add the label to the *y* axis.

- (5/20) Which model describes the behaviour of the data? Explain and justify quantitatively why it applies in this case.

- (5/20) Use the model that you discussed previously to add the expected values of $\theta_{\text{c.m.}}$ on the *x* axis.

- (5/20) Use the sharp cut-off model to calculate the *reaction* cross section integrated on all angles (pay attention to the units).

- (4/20) If the beam intensity was $I = 10^{10}$ particles per second and the target thickness was $\rho \Delta x = 50\,\mu\text{g/cm}^2$, how many elastic scattering events would you measure in a minute, in a detector covering a solid angle $d\Omega = 0.01$ sr placed at the critical angle.
  [For the calculation use: $e^2 = 1.44\,$MeV fm.]