$Q_{optimal}$ value in Two-body mode of the Kinematics Calculator

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Information-theoretic analysis of energy disposal in heavy-ion transfer reactions

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proximation, one neglects this recoil effect (and sets $\theta_i = \theta_f$) then the orbit matching condition $D_f = D_i$ leads to the optimal Q value[9]:

$$Q_{\mathrm{opt}} = [(Z_b Z_B - Z_a Z_A)/Z_a Z_A]E_i \,, \qquad (5.3)$$

or $\rho = 0$ and $s = Z_b Z_B / Z_a Z_A$, where the reaction is $a + A \rightarrow b + B$. The neglect of recoil effects is reflected in that (5.3) predicts no kinetic energy loss

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Transfer reactions in inverse kinematics: An experimental approach for fission investigations

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to ground-state Q value, Q_{gg}, is displayed in Fig. 7(b). An exponential decrease with $-Q_{gg}$ has been observed in earlier works [38,39], although large deviations have been found and the need of a Coulomb correction term has been pointed out [38]. Systematics for the different charges are limited in our case to ^{13,14}C and ^{8,9,10}Be isotopes. The first clearly confirms that the number of transferred nucleons is a more appropriate ordering parameter for the description of the cross sections.

C. Total excitation-energy distributions

The most probable total excitation-energy, E_x, in the exit channel can be obtained as the difference between the ground-state to ground-state and an effective Q value, $Q_{\rm opt}$,

$$E_x = Q_{gg} - Q_{\rm opt}, \quad Q_{\rm opt} = E_{i,\rm c.m.} - E_{f,\rm c.m.}. \tag{5}$$

In this expression, $E_{i,\rm c.m.}$ and $E_{f,\rm c.m.}$ are the initial and the most probable final kinetic energies for a given transfer channel, in the center of mass.

distance of closest approach, D, and collisions near the grazing angle are dominated by Coulomb forces, the orbit matching condition, $D_i = D_f$, leads to [40]

$$Q_{\rm opt} = \frac{Z_3 Z_4 - Z_1 Z_2}{Z_1 Z_2} E_{i,\rm c.m.}, \tag{6}$$

where $Z_{1,2,3,4}$, are the atomic numbers of the projectile, target, actinide, and targetlike nucleus, respectively. This expression is used in our work as reference, although it must be taken into account that no energy loss, i.e., $E_{i,\rm c.m.} = E_{f,\rm c.m.}$, is predicted when a mass transfer is not accompanied by a charge transfer.

In the present work, the total excitation energy available in the exit channel was derived from Eq. (5), using the energy and the angle of the targetlike nucleus measured by the SPIDER telescope.

Figure 8 shows the reconstructed total excitation-energy distributions for ^{238}U + ^{12}C inelastic and multinucleon transfer reactions. The elastic peak was fitted to a Gaussian function in order to separate the inelastic component, which rapidly decreases with the excitation energy.

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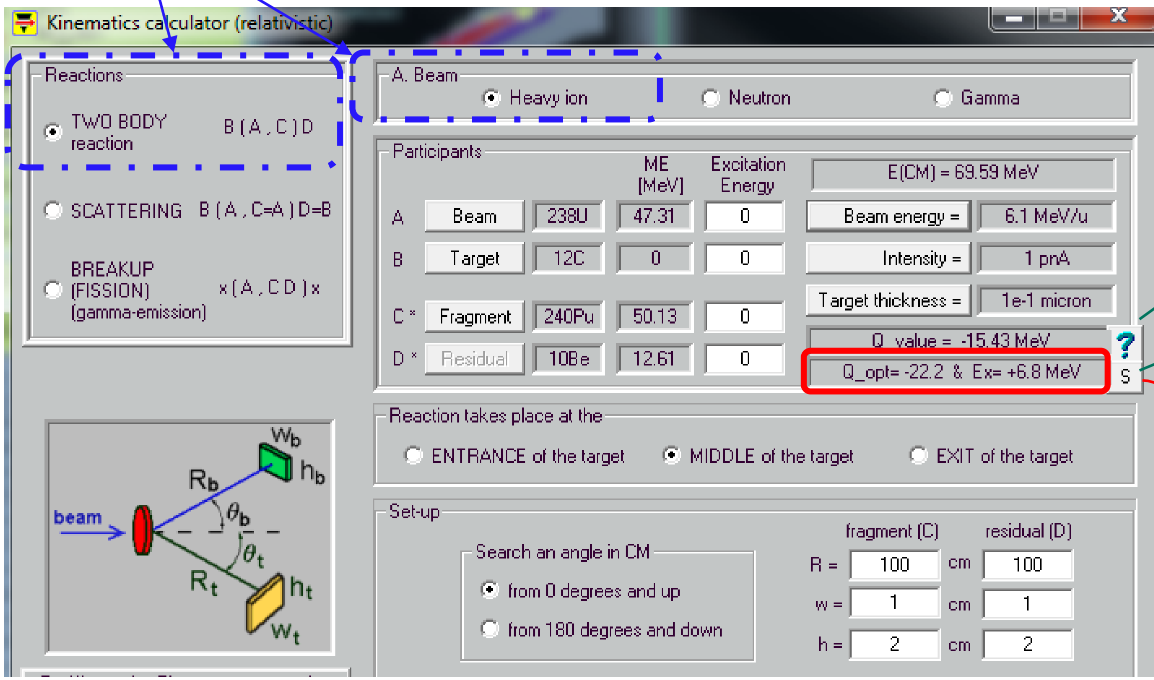
Q optional and Total Excitation energy are calculated in this mode



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