Exciton model calculations up to 200 MeV: the optical model shows the way

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We present a pre-equilibrium model for nucleons with incident energies from 7 to 200 MeV, for nuclides in the mass range $24 \leq A \leq 209$. This is accomplished by means of a global parameterization for the two-component exciton model [1] which, together with the complementary compound and direct reaction mechanisms, enables to describe continuum energy spectra over the whole emission energy range. A new energy-dependent form for the average squared matrix element M^2 is proposed, which is physically justified by the optical model. The imaginary part of the optical potential forms a direct measure for the probability to be absorbed into non-elastic channels. As such it may be related to the nucleon-nucleon interaction in matter and, hence, to the collision probability of a particle inside the nucleus. This collision probability is exactly the quantity one aims to describe phenomenologically with the aid of an average squared matrix element in exciton calculations. Recently, a new global optical model has come on the market [2]. This optical model is valid up to 200 MeV and, consequently, can be used to guide the development of a new matrix element parameterization, which removes problems encountered with older parameterizations that apply in more restricted energy ranges. The model, furthermore, contains surface effects which depend on the type of projectile and the target mass. This is inspired by the work by Kalbach [3], but deviates in the parameterizations used. Another feature that enables the large energy range of our analysis is the generalization of multiple pre-equilibrium processes up to any order of particle emission. To constrain our parameterization as much as possible and to assess the performance of our model, we have compared it with an extensive experimental data collection of (n,xn), (n,xp), (p,xn) and (p,xp) spectra.

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