Resolving discrepancies in predicted excitation functions for the production of element 120

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There is significant disagreement among predictions of excitation functions for the production of element 120. This may be caused by differences in the mass model being used to predict excitation functions of element 120. The goal of this current work is to resolve differences among predicted excitation energies by correcting them to a standardized mass model. For this purpose, the mass table of P. Möller *et al*. [1] was used as a standard, and preliminary results are reported here.

Published excitation functions for the production of element 120 were collected from a literature search and digitized using the Graph Grabber application [2]. The sum of projectile energy in the center of mass frame E_{cm} [3] and the Q-value for compound nucleus formation Q_{CN} gives the compound nucleus excitation energy E_{CN}^* [4]. Q_{CN} is equal to the sum of the mass excesses of the reactants minus the sum of the mass excesses of the products, and therefore varies based on the mass model that was used. Q_{CN} was calculated using each individual paper's reference mass model and replaced with a new value calculated according to our standard mass model. This causes an energy shift in most cases, although any corresponding change in cross section was outside the scope of the current study. Figs. 1-6 show the "before and after" excitation functions for the 3n-5n exit channels.

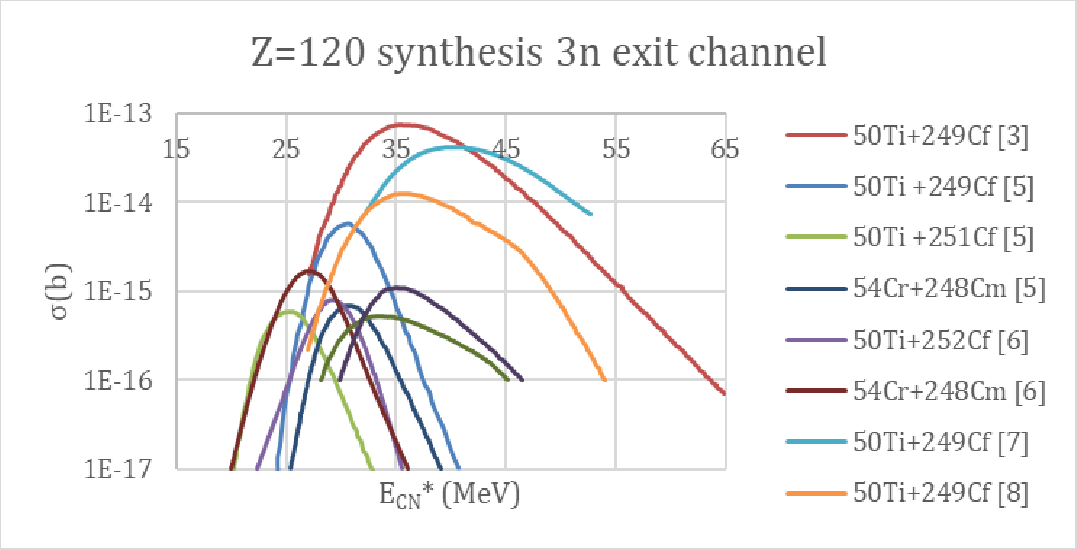

Fig. 1. Compiled raw excitation functions from Refs. [3,5-8] for the 3n exit channel.

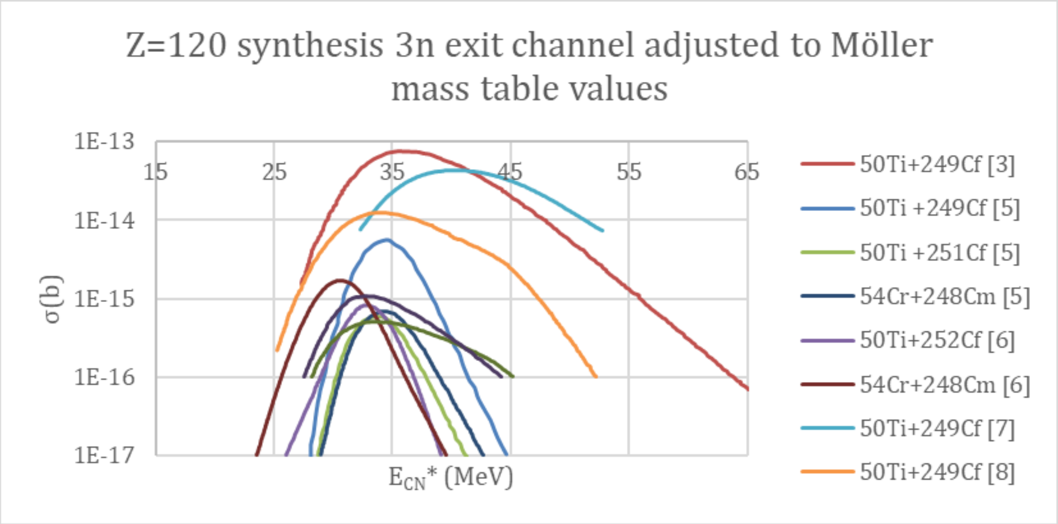

Fig. 2. Compiled excitation functions from Refs. [3,5-8] for the 3n exit channel adjusted using P. Möller *et al.* [1].

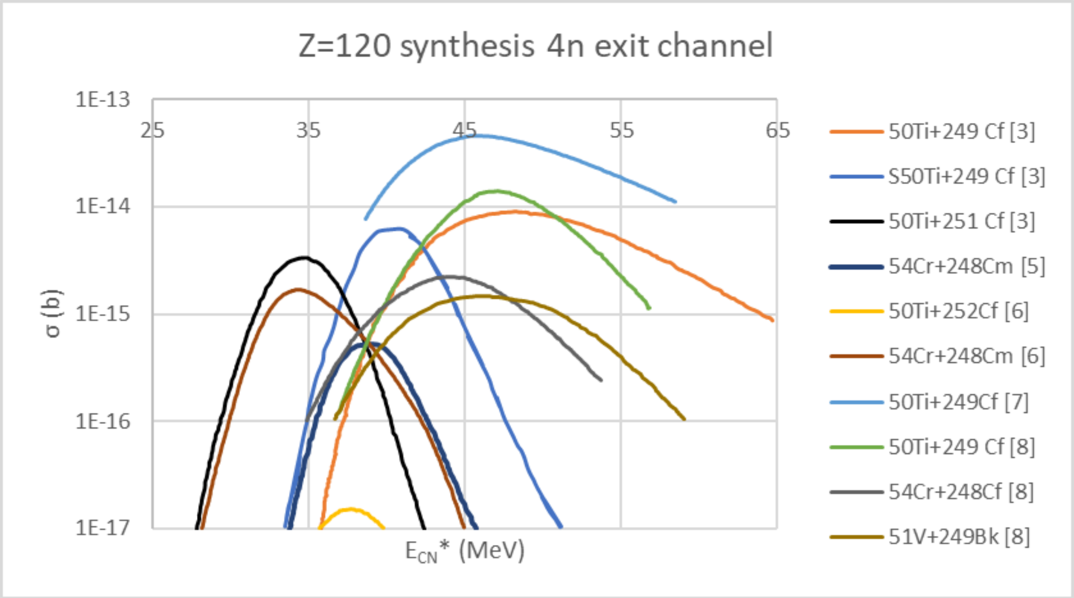

Fig. 3. Compiled raw excitation functions from Refs. [3,5-8] for the 4n exit channel.

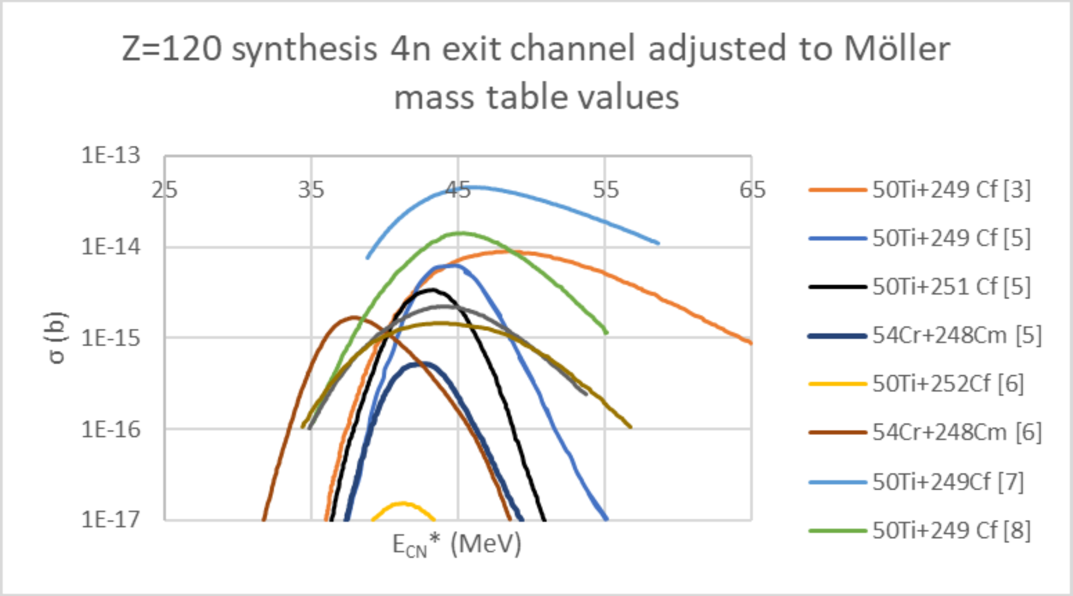

Fig. 4. Compiled excitation functions from Refs. [3,5-8] for the 4n exit channel adjusted using P. Möller *et al.* [1].

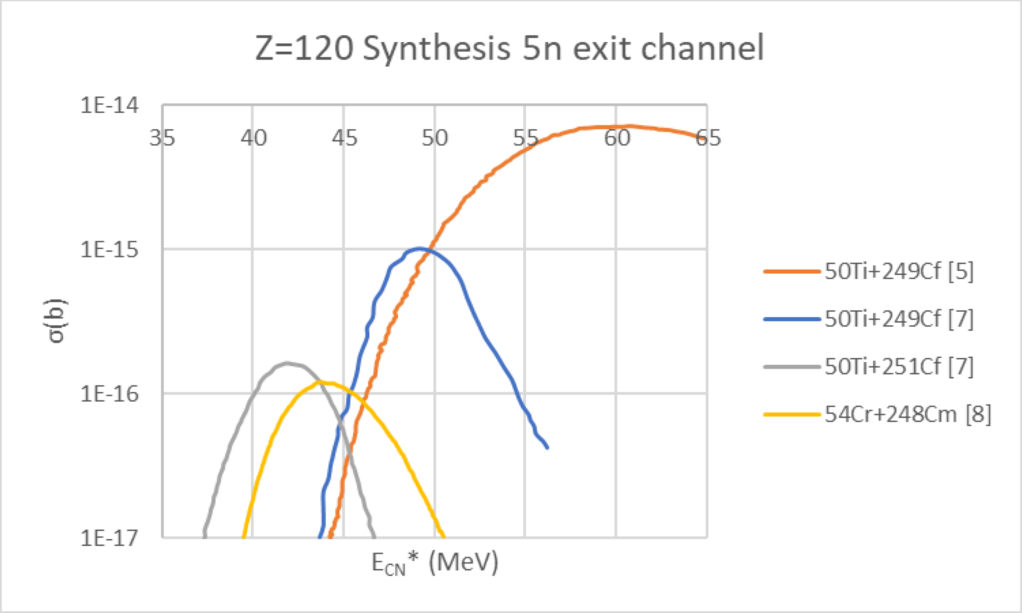

Fig. 5. Compiled raw excitation functions from Refs. [3,5-6] for the 5n exit channel.

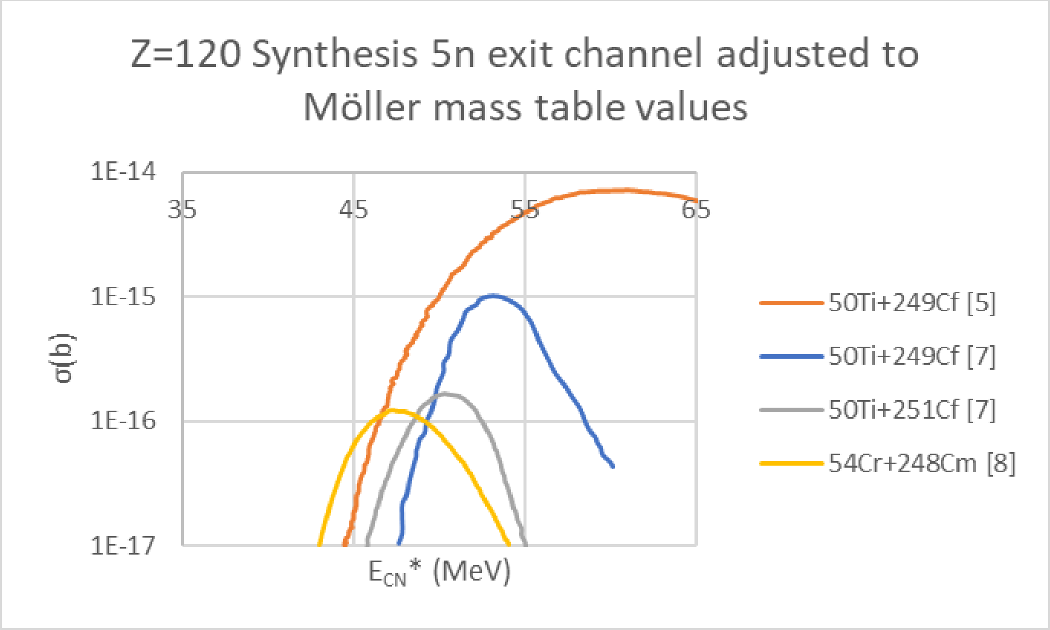

Fig. 6. Compiled excitation functions from Refs. [5,7-8] for the 5n exit channel adjusted using P. Möller *et al.* [1].

Even though the range of predicted optimal excitation energies is wide, the range is narrower after adjusting the Q-value, which suggests that much of the variation is due to differences in mass models. The adjusted data appear to give a higher degree of confidence for selecting the excitation energy that would be optimal for forming the compound nucleus that would lead to the discovery of element 120. This procedure could also be applied to the production of element 119, which has also yet to be discovered.

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