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ENTRANCE-CHANNEL EFFECTS IN ODD-Z TRANSACTINIDE COMPOUND NUCLEUS REACTIONS

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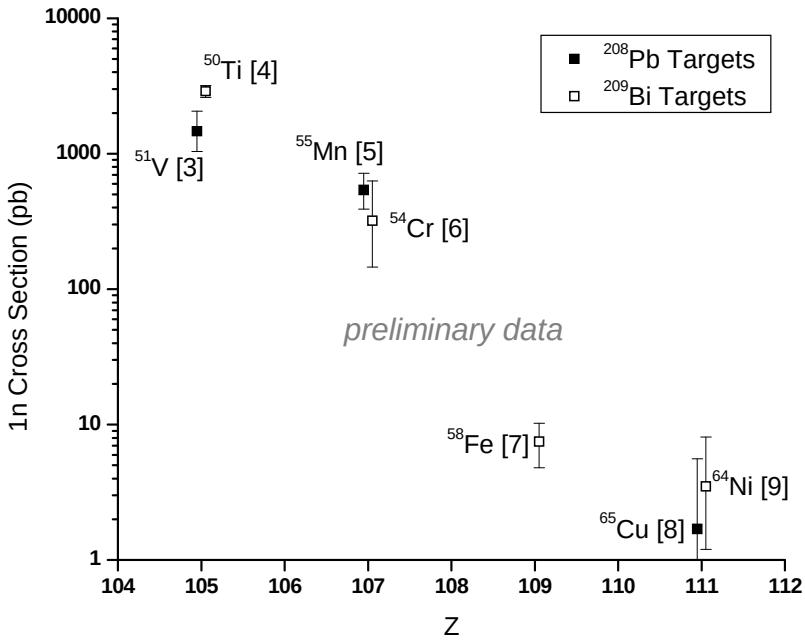
Świątecki, Siwek-Wilczyńska, and Wilczyński's "Fusion By Diffusion" description [1] of transactinide (TAN) compound nucleus (CN) formation utilizes a three-step model. The first step is the "sticking", or capture, which can be calculated relatively accurately. The second step is the probability for the formation of a CN by "diffusion" analogous to that of Brownian motion. Lastly, there exists the probability of the CN "surviving" de-excitation by neutron emission, which competes with fission and other de-excitation modes. This model predicts and reproduces cross sections typically within a factor of two. Producing the same CN with different projectile-target pairs is a very sensitive way to test entrance channel effects on heavy element production cross sections. If the same CN is produced at or near the same excitation energy the survival portion of the theory is nearly identical for the two reactions. This method can be used as a critical test of the novel "diffusion" portion of the model.



The reactions producing odd-Z TAN CN such as Db, Bh, Mt, and Rg (Z = 105, 107, 109, and 111, respectively) were first studied using even-Z projectiles on ^{209}Bi targets (as opposed to odd-Z projectiles on ^{208}Pb targets) because lower effective fissility [2] was expected to lead to larger cross sections. Many odd-Z projectile reactions producing odd-Z CN had not been studied in-depth until very recently. We have completed studies of these reaction pairs with the 88-Inch Cyclotron and the Berkeley Gas-Filled Separator (BGS) at the Lawrence Berkeley National Laboratory (LBNL), see Figure 1. Cross section ratios for several pairs of reactions will be presented and compared with theory.

***Figure 1**: Plot of decreasing 1n cross section as a function of increasing Z. Compound nuclei made with ^{208}Pb or ^{209}Bi targets are denoted by black filled and open squares, respectively. The used projectiles are indicated. Data points are offset slightly in Z for clarity.*

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