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Warsaw macro-micro model and random walk method for calculating the fusion probability of superheavy elements

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One of the important, ongoing goals in nuclear physics is the creation of superheavy elements with Z=119 and Z-120. The experiments which try to achieve this objective are very time-consuming, because of the low production cross sections. Theoretical calculations may give valuable insight into choosing the most effective reactions and bombarding energies for experimentalists.
In this talk, a new method for predicting the probability of fusion of superheavy elements will be presented. The approach uses a random walk algorithm, in which the shape evolution is governed by the density of states above the multidimensional potential energy surface (PES). The PESs were calculated within the latest version of the Warsaw macroscopic-microscopic model [1], with rotational energy included.
Three cold fusion reactions will be examined in detail: 48Ca+208Pb, 50Ti+208Pb and 54Cr+208Pb. The calculated probabilities of fusion for these reactions will be shown. The influence of angular momentum and excitation energy on ratios of symmetric and asymmetric divisions will be demonstrated. Future improvements to the method will also be discussed.

[1] P. Jachimowicz, M. Kowal, and J. Skalski, At. Data. Nucl. Data. Tables. 138, 101393 (2021).

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