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De-excitation of moderately excited compound nucleus for heavy-ion collisions at intermediate energies

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Heavy-ion collisions at intermediate energies generate emission sources with a large distribution of excitation energies that can reach up to 10 MeV per nucleon. Evaporation models based on Weisskopf and Hauser-Feshback theories are used to de-excite these sources. Parameters used in evaporation models come from low energy experiments and must be extrapolated to de-excite high excitation energy emission sources. A better understanding of the dependence on excitation energy for these parameters is necessary. Fusion reactions give a way to study the de-excitation of emission sources with known excitation energy. The ISAC-II accelerator at TRIUMF was used to accelerate beams of
25Na, 25Mg, 20Ne and 22Ne. Experimental data was collected using the HERACLES multidetector for these reactions: 25Na+12C, 25Mg+12C at 9.2 MeV per nucleon and
20Ne+12C and 22Ne+12C at 11.7 MeV per nucleon. For nuclear reactions in this mass and energy range, reaction mechanisms include binary collisions and fusion-evaporation events. Compound nuclei produced by fusion in these reactions have an excitation energy between 2.5 and 3.3 MeV per nucleon. This excitation energy range is characteristic of emission sources produced at intermediate energies. Experimental data is compared to simulations. Antisymmetrized Molecular Dynamics (AMD) is used to simulate the dynamical phase of the collision and GEMINI++ for the de-excitation. This analysis will constrain the excitation energy dependences in evaporation models.

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