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A surface Coalescence model

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The production of heavy clusters in nuclear reactions is a mechanism that until now is not well understood despite its importance and its wide variety of applications: radiation protection, space and engineering design, medical physics, the design of accelerators and others. According to the Exciton Cascade Model (CEM), there are three possible ways of producing high energy heavy clusters. The first mechanism is through the coalescence of the nucleons produced in the Intra-Nuclear Cascade (INC), the second way is through the pre-equilibrium model, and the last one is the so-called Fermi break-up.
In this work, a new theoretical approach is developed based on the INC model, which allows explaining the formation of light clusters through a first principles coalescence criterion that does not depend directly on experimental parameters and, at the same, can reproduce the experimental data. It is considered a semi-classical Wigner's distribution function in phase space. The calculations have been assessed for the production of deuterons in p-197Au collisions in an energetic range of 2 –10 GeV and the results obtained for the deuteron emission probabilities, and the total cross section is shown and compared with the experimental data.

Authors: Ms BELL HECHAVARRIA , Ailec (Radio Isotopic Center); Mr ARREBATO VILLAR, Denys Yen (Higher Institute of Technology and Appled Science); Dr GUZMAN MARTINEZ , Fernado (Higher Institute of Technology and Appled Science)

Presenter: Ms BELL HECHAVARRIA , Ailec (Radio Isotopic Center)

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