Contribution ID: **62** Type: **Oral presentation**

Theoretical description of formation of super-heavy nuclei

Tuesday 28 May 2024 15:10 (30 minutes)

The production of a superheavy element in a fusion reaction schematically proceeds through three stages: (i) the two colliding nuclei come into contact, (ii) the contact configuration evolves into a compact shape, (iii) the fused nucleus cools down by neutron evaporation. We describe the second step in a new method, utilizing the Langevin equation and random walk models. The process is schematically described in the figure below. The two fragments overcome the Coulomb barrier and come in contact (II), where the strong nuclear interaction starts to act. With a large kinetic energy, the fragments approach each other subject to a friction force as well as to a random force, where the friction strength depends on the necking of the combined object (window friction). This process is characterized by drift-dominated dynamics in the center-of- mass direction (III), and all kinetic energy dissipates into heat. With no kinetic energy several shape degrees of freedom can be explored, and the process becomes diffusion dominated (IV). The dynamics in the five shape degrees of freedom here considered is treated as Metropolis random walks. If the inner saddle is crossed a fusion event has taken place (V). Quasi-fission competes with fusion events, and we count the relative number of fusion events, constituting a formation probability. The walks are controlled by calculated angular momentum dependent potential energies as well as level-densities in a large grid in deformation space, implying that nuclear structure plays an important role. We present result of calculated formation probabilities versus excitation energy for different reactions and compare to data.

Authors: ÅBERG, Sven (CERN); ALBERTSSON, M (Lund University/LBNL); CARLSSON, G (Lund University); DØSSING, T (Niels Bohr Institute, University of Copenhagen); RUDOLPH, Dirk (Lund University); MÖLLER, P (Lund University); RANDRUP, Jorgen; RUDOLPH, D (Lund University)

Presenter: ÅBERG, Sven (CERN)