Contribution ID: **57** Type: **Poster**

Modelling incomplete fusion of complex nuclei at Coulomb energies: Superheavy element formation

Thursday 5 September 2019 19:10 (20 minutes)

Superheavy elements (SHE) have an atomic number Z ≥ 104, and their existence was predicted almost 50 years ago due to quantum shell effects that influence their stability and decay [1]. SHE production is very challenging (due to very small cross sections in the range of a few picobarns or less), with complete fusion of heavy ions being one of the most successful ways of producing SHEs. The complete fusion mechanism produces neutron-deficient SHEs, making investigation into new methods of production crucial for further progress in SHE research.

The aim of the project is to investigate the incomplete fusion of neutron-rich projectiles with heavy stable targets, following the multi-fragmentation of a projectile at Coulomb energies. This mechanism has not been thoroughly explored yet, and could prove to be an effective way of producing neutron-rich SHE isotopes with low excitation energies [2].

To this aim, a semi-classical dynamical model is being developed by combining a classical trajectory model with stochastic breakup, as implemented in the PLATYPUS code [3], with a dynamical fragmentation theory [4] treatment of two-body clusterisation and decay of a projectile. A finite-difference method solution to the time-independent Schrödinger equation in the charge asymmetry coordinate is being employed by way of diagonalising a tridiagonal matrix with periodic boundary conditions.

Currently, this new model is being tested against existing experimental data [2] and after refinement will ultimately be used to make predictions for producing new SHE isotopes in future experiments planned at the Joint Institute for Nuclear Research in Dubna, Russia, and elsewhere [5].

References:

[1] S. Hofmann at al., Eur. Phys. J. A 52 (2016) 180.
[2] C. Borcea et al., Nucl. Phys. A 415 (1984) 169, and references therein.
[3] A. Diaz-Torres, J. Phys. G 37 (2010) 075109; Computer Physics Communication 182 (2011) 1100.
[4] S.N. Kuklin at al., Eur. Phys. J. A 48 (2012) 112.
[5] C. Borcea et al., "Superheavy Elements: A New Paradigm", Proc. Int. Symp. on Exotic Nuclei (EXON-2016), http://www.worldscientific.com/doi/abs/10.1142/9789813226548_0021

Author: VAN DEN BOSSCHE, Rafael (University of Surrey)

Presenter: VAN DEN BOSSCHE, Rafael (University of Surrey)

Session Classification: Poster Session

Track Classification: Posters