Sergey P Avdeev, J Laser Opt Photonics 2021, Volume 08

Sergey P Avdeev

Joint Institute for Nuclear Research, Russia

Emission time of the intermediate mass fragments in C(22 GeV) + Au collisions

Multifragmentation of gold target induced by 22 GeV carbon beam has been studied with the 4π setup FASA located on external beam of superconducting accelerator NUCLOTRON in Dubna. It was studied the multiple emission of intermediate mass fragments (IMF), which are heavier than α-particles but lighter than fission fragments.

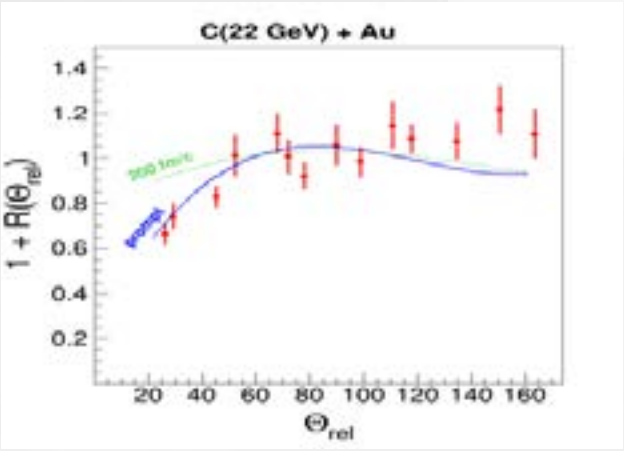
It was found that charge distribution of IMF is very well described by the combined intranuclear cascade model (INC) and statistical multifragmentation model (SMM). INC model described the fast stage of interaction and gives the distributions of the nuclear remnants in charge, mass and excitation energy. The second stage of interaction is described by the SMM. Within the SMM the probability of different decay channels of the excited remnant is proportional to their statistical weight. The break-up volume determining the Coulomb energy of the system. Thermal expansion before the break-up is assumed. The break-up density is ρb = ρ0/3, ρ0 is the normal nuclear density. The final stage of the INC + SMM model is the multibody Coulomb trajectory calculations for all charged particles in the exit channel made on an event-by-event basis. As a result, the fragment charge, mass, energies and momenta are obtained and can be compared with the experimental data. The general trend of the IMF charge distribution is also well reproduced by a power law $Y(Z) \sim Z^{-\tau}$.

The correlation function in respect to the relative angle exhibits a minimum at Θrel = 0 arising from the Coulomb repulsion between the coincident fragments. The magnitude of this effect drastically depends on the time scale of emission, since the longer the time distance between the fragments, the larger their space separation and the weaker the Coulomb repulsion. In this work experimental correlation function in respect to the relative angle is compared to that obtained by the multibody Coulomb trajectory calculations with the various decay time of fragmenting system. The analysis has been performed starting with the initial break-up conditions given by the combined INC + SMM model (using HybriLIT platform of LIT, JINR).

It was found a good agreement of measured and calculated correlation function for prompt break-up which is in accordance with the scenario of a simultaneous multibody decay of a hot and expanded nuclear system.

Key words: fragments, multifragmentation, target, decay, nuclei, correlation

Images/graphs:



Relative angle correlation function for IMF produced in C + Au collisions at 22 GeV.

Points - experimental data. Solid line – INC + SMM calculations with prompt secondary disintegration. Doted line corresponds to INC + SMM calculations with mean time of secondary disintegration 200 fm/c.

Biography

Vladimir Valentinovich Egorov has his expertise in theoretical molecular and chemical physics. Education: National Research Nuclear University MEPhI, Faculty of Theoretical and Experimental Physics (1966 – 1972), Moscow, USSR. He has completed his PhD from Theoretical Department of Institute of Chemical Physics, USSR Academy of Sciences (1981), and he has completed his Phys & Math Sci degree from Institute of Physical Chemistry, Russian Academy of Sciences (2004). He is leading researcher at FSRC "Crystallography and Photonics", Russian Academy of Sciences, Moscow, Russia. He is working on the development of a fundamentally new physical theory – quantum-classical mechanics and its applications in physics, chemistry, biology and biomedicine.