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Use of 86 MeV/N ^{12}C projectiles for studying the dissipative phenomena in nuclear collisions

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One important problem in dissipative collisions between complex nuclei is to understand the loss of kinetic energy and the various modes for transferring it to intrinsic states. Since one deals with statistical theory, the concepts of canonical ensemble and nuclear temperature are very important. In most of the experiments made with less than 10 MeV/N, the nuclear temperature in the composite system (or in the compound nucleus) was of the order of 2-4 MeV. It is interesting to increase this quantity and make it vary in a wide range, and therefore higher bombarding energies are necessary.

Our proposal is to study the gross features of the effect of the nuclear temperature increase, between 2 and 10 MeV. Using the simple relation $E^* = aT^2$, the bombarding energy of 86 MeV/N of ^{12}C ions corresponds to various temperatures for different targets: 9.9 MeV for Ni, 7.9 MeV for Ag, and 6.6 MeV for Er. Since these values are rather high, we would like to degrade the beam energy down to around $\lesssim$ 50 MeV/N in order to cover a range of temperatures down to 4 MeV, for one of the targets.

In this experiment, we would like to identify the z-value of all products (projectile-like, target-like, and evaporation residues from a possible compound nucleus) to measure their angular distributions, and the multiplicity of particles evaporated in coincidence with a given z product. From both the spectra of evaporated particles, and residue angular distributions, we hope to be able to distinguish between various reaction processes and possibly reach the limits (in temperature and/or incident energy) for a compound nucleus formation.

The experimental device is mainly made of telescopic detector systems, which seems the simplest way in a first approach, to obtain a large set of information.

A more detailed proposal will follow soon.