Barrier distributions

A. Trzcińska for Barrier collaboration

The investigation of the barrier height distributions (BD) is a long lasting project of our group. Our studies performed at HIL were focused on the ^{20}Ne as a projectile. We have used back scattering method in order to determine BDs.
According to the Coupled Channels predictions properties of this extremely deformed projectile should determine the shape of the barrier distribution for the system consisting of ^{20}Ne and any target. Due to the deformation of the projectile BD of such systems should have a structure (clearly seen two maxima). Our studies have shown that only for few systems the predictions of the CC calculations were confirmed by the experimental results. In other studied cases the predicted structure of the BD was smoothed out.
The non-collective reaction channels (single particle excitations in the case of nuclei with high level density or transfers in systems with high transfer cross section) not taken into account in the CC calculations are possible explanation for the observed discrepancy. Among the studied by us systems there are also such in which transfer reactions cannot be the responsable for the BD smoothing. According to our hypothesis the BD smoothing in such systems is caused by partial dissipation of kinetic energy into heat of the system (single particle excitations). The proper treatment of such "open systems" requires taking the dissipation into account.
The obtained results triggered the new theoretical works aiming in taking into account single particle excitations in such cases (K. Hagino, S. Yusa *et al.*). The influence of the single particle excitations on the fusion process seems to be confirmed by calculations performed with the use of code merging CC and Random Matrix Theory (RMT) approaches.
As a next step we plan to study directly fusion and influence of dissipation on this process. To this end we will use the Wien Filter (velocity filter) recently built in collaboration with LNS Catania. The device is under tests now and we expect that it should be ready for work in the end 2019. We plan to bring it to HIL and install in ICARE chamber (after some necessary modifications of the chamber).