Nuclear fusion is a reaction, study of which is important in the area of light nuclei (for astrophysics, medicine and in search of the new power production methods) as well as in search of superheavy nuclei. It is used also in medium mass region as a tool for nuclear structure and fundamental problems concerning nuclear reaction studies. This is due to the fact that fusion, especially at low energies, is enabled by the quantum effect of "tunneling" through the Coulomb barrier, probability of which depends on "environment". (In this case the role of "environment" plays the structure of the interacting nuclei). Due to the "environment", in place of a single barrier the distribution of barriers is generated.

It is known since long time that the shape of this distribution depends on structure via so called collective excitations of whole nuclei (rotations and/or vibrations). Basing on our observations we proposed hypothesis that it depends also on "dissipation", meaning the transformation of part of the projectile kinetic energy to "heat" of both interacting nuclei. This results in observed smoothing of barrier distribution.

Taking into account dissipation we enter the area of "dissipative dynamics", concerning irreversible processes, which is poorly explored in nuclear physics. In particular in this area the Schrödinger equation can cease to be sufficient, as it is applicable only for "closed systems" and reversible processes. This is due to the fact that one of results of dissipation is so called "quantum decoherence". Experimental effects found in our previous works are quoted as the first examples in nuclear physics of this phenomenon found at such a low energies (close to the Coulomb barrier).

Still, the used by us model CCRMT, based on Coupled Channels method with stationary Schrödinger equation and statistical Random Matrix Theory, is able to describe at least part of our experimental results. The principal aim of the project is to test the limits of applicability of the model.

In this project we want to do it by two methods, answering the following questions:

- Are the observed in our previous works effects observed also in fusion of ^{16}O, ^{20}Ne, ^{24}Mg, and ^{28}Si with ^{136}Ba and ^{138}Ba isotopes in agreement with our model predictions?
- Does the predicted by us effect of "dissipative fusion enhancement" exist and whether it agrees with our calculations.

To this end we propose performing of 2 experiments using the ^{20}Ne beam delivered by the Heavy Ion Laboratory cyclotron and 6 experiments by means of the ^{16}O, ^{24}Mg and ^{28}Si beams accelerated by the tandem of CIAE (Beijin). Besides, with the help of the PL-GRID infrastructure and the corresponding Chinese facility we will continue the calculations using the CCRMT code, the uniqe program permitting theoretical description of the studied phenomenon.

The Polish side offers the code CCRMT and 3 years of experience in its running, the ^{20}Ne beam and the complete instrumentation necessary for performing the planned experiments. This beam cannot be delivered by the Chinese tandem accelerator.

The Chinese side offers the ^{16}O, ^{24}Mg and ^{28}Si beams as well as the instruments necessary for the fusion studies, which because of lack of the deflector cannot be performed in Warsaw. The corresponding Polish instrument is under construction and the transfer of experience of the Chinese side will be very helpful in our future fusion studies.