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The influence of dissipation on the quasielastic barrier distributions of the 20Ne+92,94,95Mo systems

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The Coupled Channels (CC) model successfully explained the strong enhancement of sub-barrier fusion cross sections as well as the observed structures in the barrier distributions for many systems. However, there are several mechanisms whose influence on the fusion is still not clear, as the role of weak (non-collective excitations) reaction channels. The experimental barrier distributions of some systems turned out to be without any structure, in contradiction to theoretical predictions [1,2,3]. Such an effect is caused by a dissipative mechanism, where part of the kinetic energy is dissipated into the excitation of a multitude of internal non-collective levels of the system. This experimental evidence led to the development of a new model able to include the non-collective excitations in the fusion reactions by extending the CC method using the random matrix theory (RMT) [4,5].
Very recently at the Heavy Ion Laboratory (HIL) of the University of Warsaw, a comparative study of the quasielastic barrier distributions of the ^{20}Ne + ^{92,94,95}Mo systems was performed, aiming to study the influence of dissipation due to single-particle excitations on the barrier distribution structure. The theoretical calculations performed within the CC+RMT model are in good agreement with the experimental data, supporting the hypothesis that non-collective excitations can alter the structure of the barrier distributions. However, the ^{94}Mo shows a smoother and wider structure in comparison to the ^{95}Mo, despite the higher level density of the latter. This difference might be due to another mechanism of dissipation, being the projectile-target transfers of light particles. In this perspective, the transfer cross sections for different transfer channels will be measured in a separate experiment at HIL. The measurement would clarify the role of transfer couplings on the shape of barrier distribution and the dynamic of the reactions of the three systems. Details on the recent results and plans for fusion and transfer cross-section measurements at HIL will be discussed in this contribution.

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