SUB-BARRIER FUSION OF SI+SI SYSTEMS: DOES THE DEFORMATION OF ^{28}SI PLAY A ROLE ?

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This contribution reports on the results of measurements of near- and sub-barrier fusion cross sections in the system ^{30}Si + ^{30}Si performed at the Laboratori Nazionali di Legnaro of INFN. The ^{30}Si beam of the XTU Tandem accelerator in the range E_{lab}= 47-90 MeV, was delivered on a metallic ^{30}Si target (50μg/cm^2) enriched to 99.64% in mass 30, and using the beam electrostatic deflector for the detection of evaporation residues.

The excitation function is shown in the figure (left) together with the previous data on ^{28}Si + ^{28}Si and the Coupled Channels calculations performed using the M3Y+rep. potential, taking into account the low lying 2^+ and 3^- excitations. The ^{28}Si + ^{28}Si cross sections are largely underestimated at low energies. In a recent work a weak imaginary potential was found to be necessary to fit the data, probably simulating the oblate deformation of this nucleus. On the contrary, the data on ^{30}Si + ^{30}Si are nicely reproduced by the present calculations (^{30}Si has a spherical shape).

The slopes of the excitation functions (center panel) are below the L_{CS} limit even at low measured energies, so that there is no evidence for hindrance. In this representation the cross section difference between the two cases is highlighted. Even above the barrier the two systems behave differently and this is best seen comparing the two barrier distributions (right panel) where the high energy peak observed for ^{28}Si + ^{28}Si is not found for ^{30}Si + ^{30}Si. This is presumably due to the stronger couplings present in ^{28}Si and this is the object of further theoretical analysis.

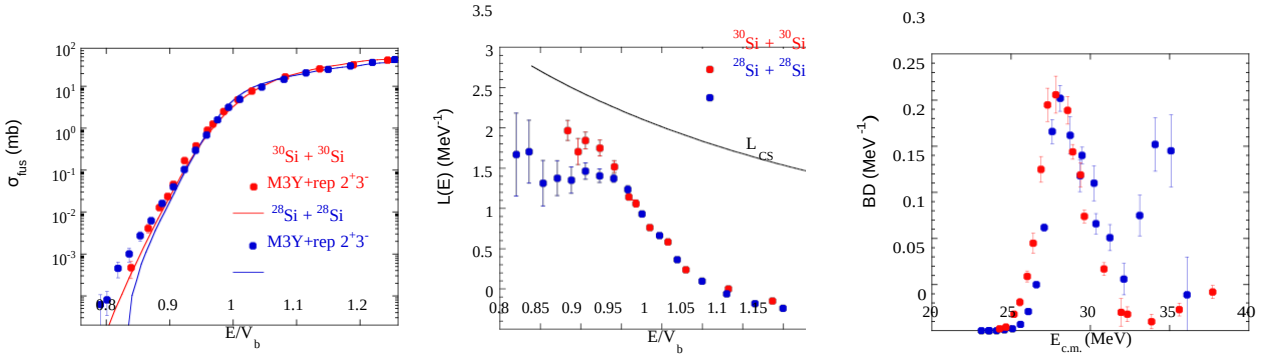

FIG. 1: Fusion excitation function (left) and barrier distribution (right) of ^{30}Si + ^{30}Si and ^{28}Si + ^{28}Si (see text). The center panel shows the slope L(E)=dln(Eσ)/dE of both systems.