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Oscillations in the fusion excitation function of ^{28}Si + ^{28}Si above the barrier

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The fusion excitation functions of light heavy-ion systems like ^{12}C,^{16}O + ^{12}C,^{16}O show oscillatory structures above the Coulomb barrier, sometimes caused by resonances. They may also be due to the penetration of successive centrifugal barriers well separated in energy. Those structures are best revealed by plotting the derivative of the excitation function [1]. CC calculations based on a shallow potential in the entrance channel reproduce nicely the oscillations. This implies some consistency with fusion hindrance at far sub-barrier energies, because the ion-ion potential directly influences both effects.

In heavier systems, the amplitude of oscillations decreases and the peaks get nearer to each other. This makes the measurements very challenging. We have performed a first experiment for ^{28}Si + ^{28}Si, by measuring fusion cross sections in an energy range of $\simeq$15 MeV above the barrier, with 0.5 MeV lab-energy steps. Previous data marginally suggest the presence of oscillations in this system [2]. The beam was accelerated by the XTU Tandem of the LNL onto 50 μg/cm^2 targets, and fusion-evaporation residues were detected near 0^o. Preliminary results are shown in the figure.

It is remarkable to note that three regular oscillations are clearly observed. The predicted oscillatory structure of Ref.[1] (full line in the figure) is in good agreement with the observations. The final result of the experiment, together with our recent data down to far sub-barrier energies, will be analyzed within the CC model, and will provide a stringent test for the calculations, in particular for the choice of the ion-ion potential, and for the possible relation of the observed structures with resonances.

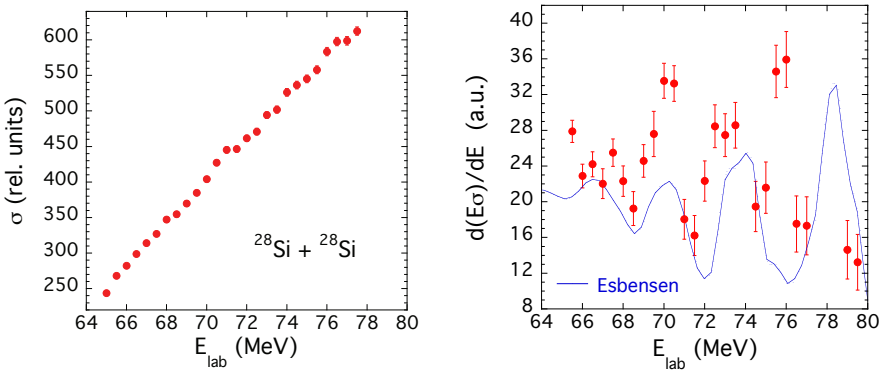

Figure 1: *(left) Fusion cross sections of ^{28}Si + ^{28}Si; statistical uncertainties are close to 1% for all points. (right) Energy-weighted derivative of the excitation function, compared to the prediction of Ref.[1].*

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