## Heavy Ions Fusion Reactions and the Nucleus-Nucleus Potential

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This contribution, after a short outline of the semi-classical model [1] that is used to calculate the probability for two ions to overcome the Coulomb barrier and form a composite system, will address to the different factors that influence the behavior of the excitation function. In particular will focus on the shape of the nucleus-nucleus potential at short distances and on the different processes that are responsible for the hindrance to fusion found at energies above the coulomb barrier

It is shown that, in the low energy region, a slight modification of the potential and the use of the WKB approximation provide a simple explanation for the non-exponential behavior of the fusion cross section [2]. The fusion hindrance found in the high energy region is discussed in terms of Deep Inelastic Collision that are not taken into account by the simple coupled channel codes used in the analysis of the fusion reactions.

The semi-classical model of Ref. [1], incorporates, on the same footing, the degrees of freedom associated with the excitation of surface modes and with the transfer of nucleons. The model has been successfully applied to the calculations of fusion excitation functions barrier distributions and multi-nucleon transfer reactions.



Figure 1: (Left) two possible ion ion potentials for the  ${}^{60}Ni + {}^{89}Y$  reactions that have the same exponential tail and the same parabolic approximation. The corresponding fusion cross sections are shown on the right hand side.

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- [2] C.L. Jiang *et al.*, Phys. Rev. Let. **89**,052701(2003).
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