

# Subbarrier Fusion of Heavy Ions and Subbarrier Few-Nucleon Transfers: Fusion of Nuclei Far from the Beta-Stability Line

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**Abstract**—A model has been proposed for describing the cross section for the subbarrier fusion of nuclei. The model takes into account coupling to channels featuring low-lying surface vibrational states and nucleon transfers for any reaction  $Q$  value. On the basis of this model, the  $^{32}\text{S} + ^{100}\text{Mo}$ ,  $^{36}\text{S} + ^{96}\text{Mo}$ ,  $^{28,30}\text{Si} + ^{58,62,64}\text{Ni}$ , and  $^{16,18,20,22,24}\text{O} + ^{58}\text{Ni}$  fusion reactions have been analyzed in detail. The proposed model provides a good description of the experimental fusion cross sections, the mean angular momentum of a compound nucleus, and its variance for reactions featuring ions that lie near the beta-stability line. It has been shown that these quantities are substantially enhanced owing to few-neutron transfers in reactions characterized by a large positive value of  $Q$ . For the potential describing the interaction of heavy ions at distances smaller than those that correspond to the point of touching, a parametrization has been proposed that is independent of the nuclear shape. The mechanism according to which nucleon transfer between the ions involved is enhanced at subbarrier energies because of coupling to low-lying excited states has been investigated.