Nuclear Physics Seminar

Heavy-ion fusion reactions below the Coulomb barrier: structure effects and astrophysics implications

MONDAY

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4:00 P.M.

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Fusion-evaporation is the dominant reaction mechanism in medium-mass heavy-ion collisions around the Coulomb barrier. At these energies and at moderate sub-barrier energies, enhancement of the fusion cross-sections was observed whereas hindrance of the fusion cross- section has been identified in many systems at deep sub-barrier energies. Fusion cross-sections around the Coulomb barrier have been discussed extensively to be driven by couplings of the relative motion of the colliding nuclei to their low energy surface vibrations and/or stable deformations. The corresponding coupled-channel calculations and the distributions of barriers have revealed to be a powerful tool to better understand the role of couplings to collective degrees of freedom of the target and projectile.

The strong sensitivity of the sub-barrier fusion probability to the structure of the colliding nuclei will be discussed as well as recent results on the influence of particle transfer channels on the fusion cross-sections in medium mass systems like Ca+Ca and Ca+Ni.

At extreme sub-barrier energies, a surprising dependence of the process on fundamental properties of the nuclear matter is found, such as its incompressibility. In this energy region, for lighter systems like C+C and C+O, nuclear fusion is strongly connected to astrophysics, as it is an essential step in the synthesis of the chemical elements in stars. Experimental work on resonances observed in these systems will be presented.