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ADVANCED APPLICATION OF THE QUASI-FREE REACTION MECHANISM TO NUCLEAR ASTROPHYSICS

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Quasi-free reactions (QFR) in heavy ion nuclear collisions at low energy have been widely investigated since 70's and general properties of nuclear structure have been inferred in the framework of the simple plane-wave impulse approximation PWIA and distorted-wave Born approximation DWBA[1]. In most cases it has been possible to deduce the inter-cluster wave function and momentum distribution of several light nuclei such as ^{6}Li, ^{2}H, ^{7}Li. More recently a method has been proposed to study two-body processes by means of a suitable three-body reaction proceeding through the QFR mechanism [2,3,4].

We show that this method can be used to measure two-body cross sections at very low energies (1 keV<E<1 MeV) overcoming the problems tipically encountered in direct measurements due to the presence of the Coulomb barrier. Several experimental results and validity tests are shown and discussed for astrophysically relevant reactions such as ^{7}Li(p,α)^{4}He, ^{6}Li(d,α)^{4}He, ^{6}Li(p,α)^{3}He, ^{12}C(α,α)^{12}C.

In this framework the astrophysical factor S(E) can be determined by-passing the screening effect due to the electron clouds, so providing an important tool in order to measure the screening potential U_e. Perspectives and in-progress experiments will be discussed.

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