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Sub-Coulomb alpha transfer reactions in Nuclear Astrophysics[1]

GRIGORY ROGACHEV, Florida State University — Prohibitively small cross section of nuclear reactions at energies, relevant for nuclear astrophysics, require application of indirect techniques to deduce the reaction rates from experimental data. One such technique is sub-coulomb α transfer reaction (^{6}Li,d), which can be used to measure the α particle Asymptotic Normalization Coefficients (ANCs) of sub and near threshold resonances. ANCs, obtained in α transfer reaction, performed at energy below the Coulomb barrier in both exit and entrance channels are model independent. This leads to a reliable evaluation of resonant component contribution into the total rate of nuclear reaction, which involves α particle capture. For example, the rate of ^{13}C(α,n) reaction, which is considered to be the main source of neutrons for s-process in AGB stars, is uncertain by $\sim$300% at stellar temperatures due to large uncertainty, associated with the structure of $1/2^+$ resonance at 6.356 MeV in ^{17}O. Measurements of the ANC (Asymptotic Normalization Coefficient) of this resonance were performed, using α-transfer reaction ^{13}C(^{6}Li,d)^{17}O at sub-coulomb energies. The uncertainty of ^{13}C(α,n) reaction rate at Stellar temperatures was reduced to 20%. Possibility of application of sub-coulomb α transfer reaction for evaluation of rates of other astrophysically important nuclear reactions will be discussed.

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