NUCLEAR SEMINAR SERIES

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4:00 pm - Rm 123 NSH

Radiative capture reactions via indirect method $^{12}C(\alpha, \gamma)^{16}O$

Many radiative capture reactions of astrophysical interest occur at such low energies that their direct measurement is hardly possible. Until now the only indirect method, which was used to determine the astrophysical factor of the astrophysical radiative capture process, was the Coulomb dissociation. In this talk I address another indirect method, which can provide information about resonant radiative capture reactions at astrophyically relevant energies. The method can be considered an extension of the Trojan horse method for resonant radiative capture reactions. The idea of the suggested indirect method is to use the indirect reaction A(a,sy)F to obtain information about the radiative capture reaction A(x, y)F, where a = (sx) and F = (x A). The main advantage of using the indirect reactions is the absence of the penetrability factor in the channel x + A, which suppresses the low-energy cross sections of the A(x, y)F reactions and does not allow one to measure the reactions at astrophysical energies. The indirect method requires coincidence measurement of the triple differential cross ection, which is a function of the photon scattering angle, energy, and the scattering angle of the outgoing spectator particle s. Angular dependence of the triple differential cross section at fixed scattering angle of the spectators is the angular y-s correlation function. Using the indirect resonant radiative capture reaction, one can obtain information about important astrophysical resonant radiative capture reactions such as (p, y), (a, y), and (n, y) on stable and unstable isotopes. The indirect technique make accesible low-lying resonances, which are close to the threshold, and even bound states located at negative energies. In this talk after general introduction I will demonstrate the application of the indirect reaction ^{12}C(6LI,dy)^{16}O proceeding through 1- and 2+ subthreshold bound tates and resonance to obtain the information about the ^{12}C(a,y)^{16}O radiative capture at the astrophyically most effective energy 0.3 Me V, which is impossible using standard direct measurements. Feasibility of the suggested approach is discussed.

PHYSICS

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