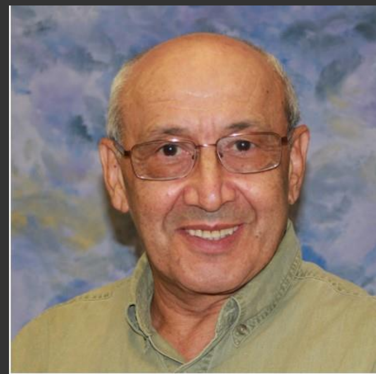
Thursday

Jun. 15st

At 3:30pm



Astrophysical Radiative Capture Processes via Indirect Method: $^{12}C(\alpha,\gamma)^{16}O$

Abstract:

In the last few months we heard quite a few talks about new facilities aimed at advancing nuclear astrophysics. These are underground labs, high-intensity gamma-ray sources, high-intensity radioactive beam facilities. Can our Institute compete with these new facilities? In this talk we will discuss this issue. Our main tool are indirect techniques in which the Cyclotron Institute is one of the world leaders.

Introduction will be given to indirect methods and their comparison with direct results for two famous cases. The main part of the talk is devoted to the new indirect method, which we suggest: indirect radiative capture reactions (IRCR).

Many radiative capture reactions of astrophysical interest occur at such low energies that their direct measurement is hardly possible. In this talk we address the IRCR method, which can provide a powerful indirect technique to obtain information about radiative capture reactions at astrophysically relevant energies. The idea of the indirect method is to use the indirect reaction A(a, s γ)F to obtain information about the radiative capture reaction $A(x,\gamma)F$, where a = (s x) and F = (xA). The main advantage of using the IRCR is the absence of the penetrability factor in the channel x + A, which suppresses the low-energy cross sections of the A(x, γ)F reactions and does not allow to measure these reactions at astrophysical energies. The indirect method requires coincidence measurements of the triple differential cross section, which is a function of the photon scattering angle, energy and scattering angle of the outgoing spectator-particle s.

Using IRCR one can obtain the information about important astrophysical resonant radiative capture reactions, like $(p,\gamma),(\alpha,\gamma)$ and (n,γ) on stable and unstable isotopes. The indirect technique makes accessible low-lying resonances, which are close to the threshold, and even subthreshold bound states located at negative energies. In this talk after discussing the general ideas of the IRCR we demonstrate the application of the indirect reaction 12C(6Li, d)16O proceeding through 1– and 2+ subthreshold bound states and resonances to obtain the information about the "holy grail" reaction 12C (α,γ) 16O at astrophysically most effective energy 0.3 MeV what is impossible using any standard direct measurements.

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Refreshments will be served at 3:15pm