A.I for Nuclear Physics Workshop

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Project Description

I work in the field of Nuclear Astrophysics primarily understanding the s-process reactions which are responsible for the creation of heavy elements beyond iron. The project I am currently working on is about calculating the low-energy cross-section for the reaction ^{25}Mg(α,n) ^{28}Si.

In the present work, I am using deuterated liquid scintillator detectors combined with spectrum unfolding to make an improved measurement of the ^{25}Mg(α,n) ^{28}Si reaction cross-section at low energies.

The significance of the reaction is that it plays an important role in determining the available neutron flux for the s-process nucleosynthesis.

Solving the Spectrum Unfolding Problem using A.I

- The process of extracting the neutron spectrum is known as spectrum unfolding. A natural approach to solve the unfolding problem is direct matrix inversion, however, it usually introduces larger noise in the final unfolded neutron spectrum than that which is present in the data and results in non-physical negative count rate , since the response matrix R is highly ill-conditioned.
- By using Artificial Neural Networks(ANN) to unfold the neutron spectrum we can overcome the drawback associated with this ill-conditioned problem.
- The inputs for the spectrum unfolding code (which uses MLEM algorithm) are the response matrix, a light output spectrum to unfold and the energy threshold.
- Since the count rate is very low for low incident α energies , hence using MLEM method gives less accurate prediction of number of neutrons received in an energy group.
- Validation of result : I am comparing the cross-section values with the previous measurements done on the same reaction. Also, comparing the neutron data with the gamma ray data.
- Status of Project: My project is at the starting stage of data analysis.

- Collaborators : Oak Ridge National Lab and University of Notre Dame

Preliminary Plots