



Iranian Journal of Physics Research, Vol. 18, No. 2, 2018

## Determination of saturation depth in Compton scattering using Artificial Neural Network

S Ashrafi, D Alizadeh and O Jahanbakhsh

Faculty of Physics, University of Tabriz, Tabriz, Iran

(Received 19 April 2016 ; in final form 23 October 2017)

### Abstract

The intensity of Compton scattered  $\gamma$ -ray photons provides useful information about the electron density distribution of a test sample. Because of photon attenuation, the application of this method is limited to a certain depth of the sample (saturation depth). The saturation depth value depends on the energy and intensity of primary photons and on the material of the sample. In this study, we measure the energy spectrum of the scattered photons of 662 keV at  $90^\circ$  with an NaI(Tl) scintillator; we determine the saturation depth of the sample by the Artificial Neural Network (ANN) algorithm. Two sets of samples with known and unknown density are used to train and test the network, respectively. The highest precision (with 0.15% relative error) is achieved by using the Levenbert-Marquardt algorithm with five hidden layers.

**Keywords:** Compton scattering, saturation depth, artificial neural networks, Levenbert-Marquardt algorithm

For full article, refer to the Persian section