Ain Shams University
Faculty of Education
Physics Department

"A Hybrid Technique Modeling for High Energy Hadron-Nucleus Interactions"

Thesis

Submitted for the Degree of Doctorate of Teacher's Preparation in Science (Physics).

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Abstract

The present thesis is devoted to study theoretically the high energy hadron- nucleus interactions at high energies.

The Research plan is prepared as follows:

1-Collecting the available experimental data for hadron- nucleus interactions at high energies.

2-Study of the proposed computational models which explain these interactions.

3-Study of the artificial neural network (ANN) model to describe hadron- nucleus interactions at high energies.

4-Study of the genetic programming (GP) model to describe Hadron- nucleus interactions at high energies.

5-Applying the evolutionary neural network model (hybrid technique, HT) to explain the corresponding measurements.

6-Comparison between the models predictions and the corresponding experimental data.

7-Prediction of the experimental data using ANN, GP and HT model.

Key Words: Particle Physics, ANN Model, GP Model, HT Model.

Summary

The present work presents a theoretical treatment for studying hadron nucleus (h-A) interactions at high energies in the framework of three models. First model, the artificial intelligence (AI) technique which contains the neural network (NN) model for modeling and simulation these interactions and also prediction the collisions of experiments that have not been made yet with describing them by mathematical function obtained from this model. Second, the evolutionary computation which contains the genetic programming (GP) model. Third, the combination between the artificial intelligence and the evolutionary computation, evolutionary neural networks (ENN) model or what is called hybrid technique (HT).

In the first and second chapters we showed the international scientific experiments of the collisions of the positive and negative hadrons with different nuclei at different energies. Also, we showed the different theoretical models which can be applied on these interactions with a brief explanation of the bases of these models.

The results in the last three chapters in the dissertation are summarized as follows:

In the framework of neural network (NN) model, the changes in the characteristics of the interactions of hadron-nucleus (h-A) interactions were extracted at different energies. The multiplicity distribution of charged and negative pions were calculated and compared with the corresponding experimental data which show a good fitting especially in the high energies.