

Mesure de précision des paramètres solaires de mélange de neutrinos avec le système des sPMTs de JUNO et test de l'unitarité de la matrice PMNS

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TODO

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Remerciements

Introduction

Chapter 1

Neutrino physics

The neutrino, or ν for the close friends, a fascinating and invisible particle. Some will say that dark matter also have those property but at least we are pretty confident that neutrinos exists.

1.1 Historic of the neutrino

1.1.1 First theories

1.1.2 Discovery

1.1.3 Milestones and anomalies

1.2 Modern theory

1.3 Oscillation

1.4 Open questions

Chapter 2

The JUNO experiment

2.1 Neutrinos physics in JUNO

- 2.1.1 Identification of the mass hierarchy
- 2.1.2 Precise measurement of the oscillations parameters
- 2.1.3 Background in the neutrinos reactor spectrum
- 2.1.4 Supernovae burst neutrinos
- 2.1.5 Diffuse supernovae neutrinos background
- 2.1.6 Atmospheric neutrinos
- 2.1.7 Geoneutrinos
- 2.1.8 Beyond standard model neutrinos interactions

2.2 The JUNO detector

2.2.1 Central Detector (CD)

Acrylic containment sphere

Liquid scintillator

Large photo-multipliers (LPMTs)

Small photo-multipliers (SPMTs)

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2.2.2 Veto detector

Cherenkov in water pool

Top tracker

2.3 State of the art of the IBD reconstruction

Chapter 3

Machine learning and Artificial Neural Network

3.1 History of the Machine learning

3.2 Boosted Decision Tree (BDT)

3.3 Artificial Neural Network (NN)

3.3.1 Fully Connected Deep Neural Network (FCDNN)

3.3.2 Convolutional Neural Network (CNN)

3.3.3 Graph Neural Network (GNN)

3.3.4 Adversarial Neural Network (ANN)

Generative Adversarial Network (GAN)

In deriveable system

Reinforcement Learning (RL)

Random Search (RS)

Bayesian Optimization

Chapter 4

Image recognition for IBD reconstruction with the SPMT system

Chapter 5

Graph representation of JUNO for IBD reconstruction with the LPMT system

Chapter 6

Reliability of machine learning methods

Chapter 7

Discrimination of e^+/e^- events in JUNO

Chapter 8

Conclusion