DECLARATION BY THE CANDIDATE

I, Abinash Medhi, hereby declare that the thesis "***EXPLORING THE EFFECTS OF SCALAR NON STANDARD INTERACTION IN NEUTRINO OSCILLATIONS AND ASSOCIATED DETECTOR SIMULATION & INSTRUMENTATION***" being submitted to the Department of Physics, Tezpur University under the School of Sciences in partial fulfillment for the award of the degree of Doctor of Philosophy in Physics. This is an original work carried out by me and it has not been previously considered for the award of any degree, diploma, associateship, fellowship or and other similar title or recognition from any University, Institute or other organization.

Abinash Medhi

DATE: 06/04/2024

PLACE: Tezpur University

ABINASH MEDHI

Registration Number: TZ203936 of 2023

Roll Number: PHP19101

Department of Physics, Tezpur University

TEZPUR UNIVERSITY

Napaam, Sonitpur, Assam–784 028, INDIA

Dr. Moon Moon Devi
Assistant Professor
Department of Physics

Room No. 153
Phone: +91-3712-27-5565
E-mail: devimm@tezu.ernet.in, devi.moonmoon@gmail.com

April 6, 2024

CERTIFICATE BY THE SUPERVISOR

This is to certify that the thesis entitled ""**Exploring the Effects of Scalar Non Standard Interaction in Neutrino Oscillations and Associated Detector Simulation & Instrumentation**"", submitted to the School of Science, Tezpur University in partial fulfillment for the award of the degree of Doctor of Philosophy in Physics, is a record of research work carried out by **Mr. Abinash Medhi (PHP19101)** under my supervision and guidance.

All help received by him from various sources have been duly acknowledged.

No part of this thesis has been submitted elsewhere for award of any other degree.

Mr. Abinash is a highly motivated student and he has shown excellent dedication during the course of his thesis–work. I wish him all the best for his future endeavors.

Sincerely Yours,

Moon Moon Devi.

Moon Moon Devi

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दूरभाष / **Telephone : 022-2278 2000** वेबसाईट / **Website : www.tifr.res.in**

CERTIFICATE BY THE CO-SUPERVISOR

This is to certify that the thesis entitled **"Exploring the Effects of Scalar Non Standard Interaction in Neutrino Oscillations and Associated Detector Simulation & Instrumentation"** submitted to the **School of Sciences** Tezpur University in partial fulfillment for the award of the degree of Doctor of Philosophy in **Physics** is a record of research work carried out by **Mr. Abinash Medhi** under my supervision and guidance.

All help received by him from various sources have been duly acknowledged.

No part of this thesis has been submitted elsewhere for award of any other degree.

Date: April 06, 2024
Place: Mumbai

(Dr. Bheesette Satyanarayana)
Co-Supervisor
Scientific Officer (H)
Tata Institute of Fundamental Research
Mumbai, Maharashtra, India

TEZPUR UNIVERSITY

(A Central University established by an Act of Parliament)
DISTRICT: SONITPUR:: ASSAM:: INDIA
Napaam, Tezpur-784028
Fax: +91-3712-267-005 | 006; Ph: +91-3712-273332; email : adm@agnigarh.tezu.ernet.in

CERTIFICATE OF THE EXTERNAL EXAMINER AND ODEC

This is to certify that the thesis entitled **"Exploring the Effects of Scalar Non Standard Interaction in Neutrino Oscillations and Associated Detector Simulation & Instrumentation"** submitted by **Abinash Medhi (Registration No: TZ203936 of 2023 and Enrolment No. PHP19101)** to the Tezpur University in partial fulfillment of requirement of the Ph.D. degree in the discipline of **Physics** under the school of **Sciences** has been examined by us on **08/05/2024** and found to be satisfactory.

The external examiner and the members of the ODEC have recommended that the thesis is found suitable in the oral defense evaluation without further examination. The committee recommends the award of the doctoral degree to the candidate.

Moon Moon Devi		Rukmani Mohanta
Dr. Moon Moon Devi	**Dr. Satyanarayana Bheesette**	**Prof. Rukmani Mohanta**
(Supervisor)	**(Co-supervisor)**	**(External Examiner)**

LIST OF PUBLICATIONS

❑ **Publications: Peer-reviewed [to be included in the thesis]**

1. **A. Medhi**, D. Dutta, and M.M. Devi. "Exploring the effects of Scalar Non-Standard Interactions on the CP violation sensitivity at DUNE", JHEP 06, 129 (2022), arXiv:2111.12943.
2. **A. Medhi**, M. M. Devi, and D. Dutta, Imprints of scalar NSI on the CP-violation sensitivity using synergy among DUNE, T2HK and T2HKK, JHEP 01 (2023) 079, arXiv:2209.05287.

❑ **Publications: Under review [to be included in the thesis]**

1. **A. Medhi**, A. Sarker, M. M. Devi, Scalar NSI: A unique tool for constraining absolute neutrino masses via ν-oscillations, arXiv:2307.05348.

❑ **Conference proceedings**

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❍ **Collaboration paper**

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2. D. Bezboruah, D.S. Chattopadhyay, M.M. Devi, **AM**, A. Sarker. "Exploring scalar NSI through analytic neutrino probabilities".

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Abinash Medhi

(Abinash Medhi)

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Abbreviations

AGN	**A**ctive **G**alactic **N**uclei
BSM	**B**eyond the **S**tandard **M**odel
CC	**C**harge **C**urrent
CMB	**C**osmic **M**icrowave **B**ackground
CERN	The European Organization for Nuclear Research
CKM	**C**abibbo **K**obayashi **M**askawa
CPT	**C**harge **P**arity **T**ime reversal
CP	**C**harge Conjugation **P**arity
DUNE	**D**eep **U**nderground **N**eutrino **E**xperiment
EFT	**E**ffective **F**ield **T**heory
eV	**E**lectron **V**olt
GALLEX	**GALL**ium **EX**periment
GRBs	Gamma Ray Bursts
HK	**H**yper **K**amiokande
HO	**H**igher **O**ctant
ICARUS	**I**maging **C**osmic **A**nd **R**are **U**nderground **S**ignals
IH	**I**nverted **H**ierarchy
INO	**I**ndia-based **N**eutrino **O**bservatory
JUNO	**J**iangmen **U**nderground **N**eutrino **O**bservatory
KATRIN	**K**arlsruhe **T**ritium **N**neutrino **E**xperiment
KamLAND-Zen	**Kam**ioka **L**iquid Scintillator **A**nti- **N**eutrino **D**etector-**Xen**on
keV	**K**ilo **E**lectron **V**olt
KGF	**K**olar **G**old **F**ield

LBL	**L**ong **B**aseline **E**xperiment
LHC	**L**arge **H**adron **C**ollider
LH	**L**eft **H**anded
LIV	**L**orentz **I**nvariance **V**iolation
LO	**L**igher **O**ctant
LSND	**L**iquid **S**cintillator **N**eutrino **D**itector
MiniBOONE	**Mini Boo**ster **N**eutrino **E**xperiment
MINOS	**M**ain **I**njector **N**eutrino **O**scillation **S**earch
MSW	**M**ikheyev **S**mirnov **W**olfenstein
NSI	**N**on **S**tandard **I**nteraction
NC	**N**eutral **C**urrent
NH	**N**ormal **H**ierarchy
NOνA	**N**uMI **O**ff-axis ν_e **A**ppearance
NDBD/ $0\nu\beta\beta$	**N**eutrinoless **D**ouble **B**eta **D**ecay
PMNS	**P**ontecorvo **M**aki **N**akagawa **S**akata
POT	**P**roton-**O**n-**T**arget
RENO	**R**eactor **E**xperiment for **N**eutrino **O**scillation
RH	**R**ight **H**anded
RL	**R**esonant **L**eptogenesis
RPC	**R**esistive **P**late **C**hamber
SSM	**S**tandard **S**olar **M**odel
SAGE	**S**oviet **A**merican **G**allium **E**xperiment
SSB	**S**pontaneous **S**ymmetry **B**reaking
SM	**S**tandard **M**odel
Super-K	**Super K**amiokande
SNO	**S**udbery **N**eutrino **O**bservatory
T2HK	**T**okai to **H**yper **K**amiokande
T2HKK	**T**okai to **H**yper **K**amiokande to **K**orea
T2K	**T**okai **to K**amioka
TeV	**T**era **E**lectron **V**olt

Dedicated to my Parents
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