Declaration

I, ***Miss Sayanti Dasgupta*** (Roll No: PHP18116 and Registration No: TZ201058 of 2019, Department of Physics, School of Science, Tezpur University) *hereby declare that the thesis entitled, "***Analytical study of acoustic waves and instabilities in compact astroobjects***", submitted in partial fulfillment of the requirements for the award of degree of* **Doctor of Philosophy (Ph. D.)***, is a genuine record of original research investigations by me during my academic journey period.*

Any part of texts, figures and results by other researchers in any form, which are properly used in a dignified way herein, are suitably and honestly cited in order to give the main credits to the originators and pioneers.

I also hereby declare that the works compiling this thesis have not been submitted anywhere in part, or in full, for the award of any other degree, diploma, or recognition from any other academic institution or organization.

Date: 17-05-2023

Place: Tezpur

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Certificate

*This is to certify that the proposed thesis entitled, "***Analytical study of acoustic waves and instabilities in compact astroobjects***", submitted to the School of Sciences, Tezpur University, in partial fulfillment of the requirements for the award of degree of* ***Doctor of Philosophy (Ph. D.)*** *in Physics is a genuine record of original research investigations carried out by* ***Miss Sayanti Dasgupta*** *under my constant supervision and guidance.*

All the cooperation, support and help received by her throughout this academic journey from various sources have been thankfully acknowledged.

It is further stated that no part of the contents compiled in this thesis has been submitted elsewhere for the award of any other degree, diploma, or recognition.

Date: 17-05-2023
Place: Tezpur

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Department of Physics
Tezpur University

Dedications

I dedicate my thesis to my parents,

Mrs. Suchana Dasgupta (Maa)
Mr. Simanta Dasgupta (Baba)

&

my elder sister
Mrs. Shabnam Dasgupta (Dada)

Acknowledgements

During the life changing course of Ph. D. journey, I received a great deal of support from many people, without whom this journey would not have been completed. This thesis compilation would remain incomplete without mentioning their names. Therefore, I take this opportunity to express my sincere gratitude to ***all those people*** *for their endless help, moral support, and cooperation during this academic journey.*

At the very outset, I take this privilege to express that I am highly indebted to my academic supervisor, ***Prof. Pralay Kumar Karmakar****, for his continuous guidance, support, and encouragement during this study. I express my heartfelt gratitude to him for keeping me highly motivated and focussed during the course of my study. This thesis would never have been completed without his long hours of dedication and fruitful discussions which helped me in shaping my scientific studies directed towards compiling my thesis.*

I extend my gratitude to my doctoral committee members, ***Prof. Dambarudhar Mahanta*** *and* ***Dr. Rajib Biswas*** *for their active cooperation, constructive feedbacks and discussions during my periodic Ph. D. progress presentations. I would also like to thank* ***Prof. Nidhi Bhattacharya****, Head of the Department of Physics, Tezpur University, for extending helps during my Ph. D. period.*

I am grateful to the entire fraternity of Tezpur University for extending all the necessary cooperation during my Ph. D. period. Also, the financial supports received from the University in the form of institutional fellowship are thankfully acknowledged.

I consider myself fortunate to have supportive lab-mates, seniors, and friends. I take this opportunity to thank ***Papari Das****,* ***Pranamika Dutta****,* ***Dhrubajit Kalita****,* ***Dawroichuh Challam****,* ***Pankaj Sarma****,* ***Tanushree Bezbaruah****,* ***Souvik Das****,* ***Subham Dutta****,* ***Jonmoni Dutta,*** *and* ***Mritunjoy Das*** *for their constant support and motivation during the journey.*

I would also like to take this opportunity to express my sincere gratitude to ***Dr. Saradi Bora****, Head of the Department of Physics, Sadiya College, and* ***Mr. Digen Das****, Assistant Professor, Sadiya College for extending all kinds of necessary support and* *help for the successful compilation of my thesis during my work period at Sadiya College, Chapakhowa, Assam. I would also like to thank my colleagues and friends from Sadiya College for keeping my spirit high during completion of my thesis.*

*No journey is ever complete without constant support from the family. I consider myself beyond blessed to have an extremely supportive family. Even though 'thank you' would be an understatement, I take this opportunity to express my heartfelt gratitude to my mother, (**Mrs. Suchana Dasgupta**), father (**Mr. Simanta Dasgupta**), elder sister (**Mrs. Shabnam Dasgupta**), and brother-in-law (**Mr. Sumit Dutta**), for always encouraging me to complete the journey undertaken. I would also like to thank **Ujjaini Chakrabarty**, **Lohita Raulo**, **VLC Fanai**, **Dr. Aparajita Roy**, **Dr. Kumari Pallavi** for being my family at the university hostel during my Ph. D. journey. I consider myself blessed to have had friends who have always cheered me on, not only during this journey, but in all walks of life. For this, I would like to thank **Sudipta Paul**, **Mamata Upadhyay**, **Dhananjay Pandit**, and **Rajiv Gupta**. Last but not the least, I would like to thank all my friends and seniors from the Department of Physics, Tezpur University, Tezpur.*

Date: *Sayanti Dasgupta*

Place: Tezpur

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ACADEMIC PROGRAMS PARTICIPATED

A. Seminars/Conferences

1. North-East Meet of Astronomers (NEMA-V), Tezpur University, Assam, India, 2019.
2. 12th International Conference on Plasma Science and Applications (ICPSA), Lucknow University, Lucknow, India, 2019.
3. 13th International Conference on Plasma Science and Applications (ICPSA), Ravenshaw University, Cuttack, Odisha, India, 2020.
4. National Conference on Emerging Trends in Physics (NCETP), Tezpur University, Assam, India, 2021.
5. National Conference on Chandra's contribution in plasma astrophysics, Jawaharlal Nehru University, New Delhi, India, 2021.
6. National Space Science Symposium (NSSS), IISER Kolkata, West Bengal, India, 2022.
7. National Conference on Physical Sciences (NCPS), Department of Physics, DHSK College, Dibrugarh and Manipur University, 2022.
8. URSI Regional Conference on Radio Science (URSI-RCRS), IIT Indore, India, 2022.

LIST OF RESEARCH PUBLICATIONS

A. International and National Refereed Journal of Scientific Repute

[1] **Dasgupta, S.** and Karmakar, P. K. The Jeans instability in viscoelastic spherical astrophysical fluid media. *Astrophysics and Space Science*, 364: 213, 2019. (UGC-Care listed)

DOI: https://doi.org/10.1007/s10509-019-3706-x

[2] **Dasgupta, S.** and Karmakar, P. K. Propagatory dynamics of nucleus-acoustic waves excited in gyrogravitating degenerate quantum plasmas electrostatically confined in curved geometry. *Scientific Reports*, 11:19126, 2021. (UGC-Care listed)

DOI:10.1038/s41598-021-98543-2

[3] **Dasgupta, S.** and Karmakar, P. K. Relativistic ion-acoustic waves in electrospherically confined gyromagnetoactive quantum plasmas. *Chinese Journal of Physics*, 76: 299-309, 2021. (UGC-Care listed)

DOI: https://doi.org/10.1016/j.cjph.2021.12.005

[4] **Dasgupta, S.** and Karmakar, P. K. Acoustic modal instability in relativistic gyromagnetoactive ultra-dense quantum fluids. *Journal of Astrophysics and Astronomy*, 43:60, 2022. (UGC-Care listed)

DOI: https://doi.org/10.1007/s12036-022-09836-5

[5] **Dasgupta, S.**, Atteya, A. and Karmakar, P. K. Acoustic stability of a self-gravitating cylinder towards astrostructure formation. *Scientific Reports*, 13:7163, 2023. (UGC-Care listed)

DOI: 10.1038/s41598-023-34415-1

[6] **Dasgupta, S.**, Atteya, A., and Karmakar, P. K. Modal stability of low-frequency nucleus-acoustic waves in completely degenerate white dwarf cores and their nearly degenerate surroundings. *Chinese Journal of Physics*, 83: 539-557, 2023. (UGC-Care listed)

DOI: https://doi.org/10.1016/j.cjph.2023.04.004

[7] **Dasgupta, S.** and Karmakar, P. K. A theoretical study of heavy nucleus-acoustic waves in white dwarf core environments. *Pramana-Journal of Physics*, 97:148, 2023. (UGC-Care listed)

DOI: https://doi.org/10.1007/s12043-023-02625-x

B. Conference Proceedings

[1] Karmakar, P. K. and **Dasgupta, S.** A perceptive overview of nucleus-acoustic waves in degenerate quantum astroplasmas. In *URSI Regional Conference on Radio Science* (URSI-RCRS 2022), pages 1-4, IIT Indore, Madhya Pradesh, India, 2022. DOI: https://www.ursi.org/proceedings/2022/RCRS2022/papers/SummaryMsNaw-310822.pdf

C. Book Chapter

[1] **Dasgupta, S.** and Karmakar, P. K. Propagation Of Nucleus-Acoustic Waves Excited In The Cores Of ONeMg White Dwarfs. In *Frontiers in Physical Sciences*, pages 60-72, ISBN: 978-93-93092-29-8. Sunbeam Publication, 2023.