# Dr Paramasivan Arumugam

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## Present Position

**Professor** at Department of Physics, IIT Roorkee, Since 16 December 2019

## Previous Employments

- **Organising Chairperson of GATE 2025,** from 16 May 2024 to 28 May 2025.
- **Vice-Chairperson of GATE-JAM,** IIT Roorkee, from 16 May 2023 to 15 May 2024.
- **Dean of International Relations,** IIT Roorkee, from 11 March 2020 to 31 January 2023.
- **Associate Dean of International Relations,** IIT Roorkee, from 05 February 2018 to 10 March 2020.
- **Associate Professor** at Department of Physics, IIT Roorkee, from 04 April 2014 to 16 December 2019.
- **Assistant Professor** at Department of Physics, IIT Roorkee, from 24 July 2008 to 03 April 2014.
- **Post-Doctoral Fellow** at Centro de Física das Interacções Fundamentais, Instituto Superior Técnico, Lisbon, from May 2005 to July 2008.
- **Visiting Scientist** at RIKEN, Wako Campus, Saitama, Japan, from 1 to30 August 2005.
- **Post-Doctoral Fellow** at Institute of Physics, Bhubaneswar, from July 2003 to May 2005.
- **Research Fellow** at Department of Physics, M.S. University, Tamilnadu, from October 1998 to June 2003.

## Research Interests

**Theoretical Nuclear Physics:**

Proton emission, Giant resonances, Hot and rotating nuclei, Covariant DFT, Clustering

**Neutron Stars:**

Exotic content, Unified Equation of State, Glitches, Pulsar search with radio telescopes

**Quantum Information & Computing:**

Gravity mediated gain, nuclear reactions, quantum simulation, algorithms

## Academic Degrees

**Ph.D.** in Nuclear Physics

Thesis topic: "Effect of Excitation on Giant Dipole Resonance"
Affiliation: Department of Physics, Manonmaniam Sundaranar University
Tirunelveli – 627 012, India
Thesis submitted on 31 Dec 2002; Degree awarded on 10 Oct 2003

**M.Sc.** in Physics (Specialization in Nuclear Physics)

Affiliation: Department of Physics, M. S. University, Tirunelveli, India
Year of completion: 1998 % of marks: 77.86

**'O'-level** course in Computer Science

Affiliation: Department of Electronics (DOE), Govt. of India.
Year of completion: 1997 % of marks: Between 72 & 80

**B.Sc.** in Physics (with Mathematics and Chemistry as ancillary subjects)

Affiliation: The M.D.T. Hindu College (M. S. University), Tirunelveli, India
Year of completion: 1996 % of marks: 83.04

## Summary of Scientific Activity

Publications in refereed journals: 86
Publications in conference proceedings: 105
Chapters in book: 7
Books edited: 1
Invited talks: 43
Other talks in conferences abroad: 6
Seminars at important institutions: 20
Supervision of Ph.D./M.Phil./M.Sc. thesis: 17/3/19
Conferences organized: 14

## Fellowships Received

1. Post-Doctoral Fellowship from FCT, Govt. of Portugal, from Oct. 2006 to July 2008.
2. Post-Doctoral Fellowship from CFIF, IST, Lisbon, from May 2005 to Sep. 2006.
3. Post-Doctoral Fellowship from IoP, Bhubaneswar, India, from July 2003 to May 2005.
4. Senior Research Fellowship from CSIR, Govt. of India, from August 2002 to June 2003.
5. Junior Research Fellowship from DST, Govt. of India, from October 1998 to March 2001.

## Talks Delivered

### (a) Invited talks

1. "Quantum Computing and Information through Nuclear Physics" – International Conference on Nuclear Structure and Nuclear Reaction (ICNSNR-2025), Aligarh Muslim University, Aligarh, Uttar Pradesh, May 5-7 (2025).

2. "Quantum Computing Relevant to Nuclear Physics" – International Conference on Frontiers in Gamma Ray Spectroscopy (FIG2025), TIFR, Mumbai, India, March 09-12 (2025).

3. "Quantum Computing and Information relevant to Nuclear Physics" – National Conference on Contemporary Research & New Advances in Frontier Physics - 2025, Fakir Mohan University, Balasore, March 21-22 (2025).

4. "Quantum Computing for nuclear physics and some with nuclei" – Visitor Program at the Department of Physics and Astrophysics, University of New Delhi, Delhi, February 19-20 (2025).

5. "Physicists are best suited for Quantum Computing" – Research Training School in Physics (RTSP-2025), Department of Physics, CUSAT, Cochin, Kerala, India, February 3-5 (2025).

6. "Quantum Computing for Nuclear Physics" – 68$^{th}$ DAE Symposium on Nuclear Physics, Indian Institute of Technology Roorkee, Uttarakhand, December 07-11 ( 2024).

7. "I. Independent particle model and rotating nuclei and II. Covariant Density Functional Theory", 4 lectures and 2 tutorials in IUAC School on "Nuclear Models for Structure studies", Inter University Accelerator Centre, New Delhi, October 17-20, (2023).

8. "Pulsar Timing Arrays: Neutron Stars & Gravitational Waves" – Workshop on Bridging the Gaps: Interdisciplinary Collaborations in Constraining the Physics of Finite Nuclei, Neutron Stars, and Dark Matter, NIT Rourkela, 3-7 July (2023).

9. "Chirality and its correlations with single-particle states" – International Conference on Proton-Emitting Nuclei (PROCON2023), Warsaw, June 25-30 (2023).

10. "Microscopic description of triaxially deformed odd-odd proton emitters" – International Conference on Shapes and Symmetries in Nuclei: from Experiment to Theory (SSNET22), Orsay, Paris Region, France, May 30 - June 3 (2022).

11. "Microscopic description of triaxially deformed odd-odd proton emitters" – Centenary Celebration Conference on Nuclear Structure and Nuclear Reactions, Aligarh Muslim University, March 2-4 (2020).

12. "Quantum Tunneling and Correlations in Atomic Nuclei" – 2nd International Conference on Mathematical Modeling and Computational Methods in Science and Engineering (ICMMCMSE-2020), Alagappa University, Karaikudi, Tamilnadu, January 22-24 (2020).

13. "Microscopic description of proton emission from deformed nuclei" – International symposium on "Fundamentals of Nuclear Particle Decay, KTH Royal Institute, Stockholm, Sweden, August 28-30 (2019).

14. "Microscopic description of proton emission from triaxial odd-odd nuclei" – 6th International Conference on Proton-Emitting Nuclei, (Chaired by Alex Brown) Michigan State University, USA, June 3-7 (2019).

15. "Dense matter properties probed through neutron stars" – Lecture at "*Research Training School in Physics (RTSP) – 2019*", Department of Physics, Cochin University of Science and Technology, Kerala, January 14-16 (2019).

16. "Nilsson Model" – Set of four lectures and two tutorials in the *"School cum Collaboration meeting on Computational Nuclear Structure and Reactions"*, Saha Institute of Nuclear Physics, Kolkata, January 02-28 (2018).

17. "Covariant density functional theory" – Set of four lectures and tutorials in the *SERC school on "Nuclear Physics from New Perspectives"*, Department of Physics, Bharathiar University, Coimbatore, Tamil Nadu, February 07-27 (2017).

18. "Unified description of structure and decay of proton emitters" – Workshop on *Isomer Studies at the Focal Plane of HYRA*, Inter University Accelerator Centre, New Delhi, September 19 (2016).

19. "Hot and rotating nuclei" – 4 Lectures and 3 Tutorials in the *"SERC School on Modern Microscopic Approaches in Nuclear Physics"*, Kashmir University, Kashmir, May 17-June 6 (2016).

20. "Proton emitters relevant to astrophysics" – Workshop on *Recent trends in nuclear structure and its implication to nuclear astrophysics*, Puri, January 04 – 08 (2016).

21. "Low energy nuclear physics: An outlook" – Short Term Course on *"Advances in Nuclear and Particle Physics: Present and Future"*, National Institute of Technology, Jalandhar February 8-12 (2016).

22. "Proton emission from odd-odd nuclei" – *XXII Nuclear Physics Workshop "Marie & Pierre Curie"*, Kazimierz Dolny, Poland, September 22-27 (2015).

23. "Theoretical description of odd-odd proton emitters" – *Fifth International Conference on Proton-emitting Nuclei*, PROCON2015, Lanzhou, China July 6 – 10 (2015).

24. "Proton emission from deformed nuclei" – *Nuclear Physics Meet*, Institute of Physics Bhubaneswar, June 26 – 30 (2015).

25. "Phase transitions in warm and rotating nuclei" – *International conference on "Frontiers in Gamma-Ray Spectroscopy – 2015" (FIG15)*, Variable Energy Cyclotron Centre, Kolkata, February 18-20 (2015).

26. "The links between Neutron Stars and low energy nuclear phenomena" – National Conference on Emerging Challenges in Nuclear and Many-body Physics, Jammu University, Jammu, November 10-11 (2014).

27. "Clustering, Heavy Cluster, spontaneous fission decays and search for Super Heavy Elements" – *DAE-DST Vision meeting for Drawing Roadmap for High Energy and Nuclear Physics Research*, BARC/HBCSE, Mumbai, August 24-25 (2014).

28. "Nuclear Structure Models", 7 Lectures and 8 hours of computer sessions in the *"Nuclear Structure School"*, Inter University Accelerator Centre, New Delhi, April 21-26 (2014).

29. "Selected problems in nuclear structure feasible to study with the aid of HPC", – *HPC User Workshop*, Inter University Accelerator Centre, New Delhi, March 1-2 (2013).

30. "Interesting features of warm nuclei studied through GDR" – *PARIS INDIA Collaboration meeting*, Tata Institute of Fundamental Research, Mumbai, January 10-12 (2013).

31. "Influence of higher order couplings, hyperons and antikaons in the RMF description of neutron stars" – International Conference on Recent Trends in Nuclear Physics, Chitkara University, Barotiwala (H.P.), India. November 19-21, (2012).

32. "Nonadiabatic effects in odd-odd deformed proton emitters" – *The 4$^{th}$ International Conference on Proton Emitting Nuclei and Related Topics*, Bordeaux, France, June 6-10, (2011).

33. "Yet to be observed features of hot and rotating nuclei" – *Workshop on Nuclear Physics using LINAC Booster at IUAC*, New Delhi, India, January 21 - 22, (2011).

34. "Giant dipole resonance in warm and rotating nuclei" – *Theme meeting on Nucleus Nucleus Collisions Around Fermi Energy,* Variable Energy Cyclotron Centre, Kolkata, India, December 16 – 17, (2010).

35. "Precise structure information from proton emission studies" – *National Seminar on Contemporary Trends in Nuclear Physics*, Aligarh, India, October 20 – 21, (2010).

36. "Nuclear structure models: Possibilities with HPC", - HPC User Workshop, Inter University Accelerator Centre, New Delhi, May 24-25 (2010).

37. "Open access codes and theory support at Roorkee" – *School cum Workshop on Nuclear Yrast and Near-Yrast Spectroscopy*, Roorkee, India, October 26-30, (2009).

38. "From finite nuclei to neutron stars in effective field theoretical approach" – *Current Trends in Physics*, Chandigarh, India, March 30 – 31 (2009).

39. "Relativistic mean field study of clustering in nuclei" – *DAE Symposium on Nuclear Physics*, Roorkee, India, December 22 – 26 (2008).
40. "Mean field of triaxial nuclei and application to proton emission" – *Orientation course on Exotic Radioactive Decay and Shell Model*, Roorkee, India, December 21 (2008).
41. "Triaxially deformed proton emitters" – *International conference on Proton Emitting Nuclei and related topics* PROCON07, Lisbon, June 18 (2007).
42. "Nuclear properties at high spin and low temperature" – *International Workshop on Nuclear Structure at the Extremes: New Directions*, Shimla, India, March 21–24 (2005).
43. "GDR in hot rotating nuclei with exact treatment of fluctuations" – *Workshop on Relativistic Mean Field Theory in Nuclear Physics*, Bhubaneswar, India, July (2004).

## (b) Other talks in conferences abroad

1. "Pairing fluctuations and giant dipole resonance" – *5th International Conference on Collective Motion in Nuclei under Extreme Conditions (COMEX5)*, Krakow, Poland, September 14-18 (2015).
2. "Neutron stars with hyperons and antikaons: An extended relativistic mean field study" – *Conference on Nuclear Physics in Astrophysics VI*, Lisbon, Portugal, May 19-24 (2013).
3. "Antikaons in extended relativistic mean field study of neutron stars" – *Conference on Nuclear Structure and Dynamics*, Opatija, Croatia, July 9-13 (2012).
4. "EoS from relativistic Mean Field Theory" – 44$^{th}$ Karpacz Winter School of Theoretical Physics on *The Complex Physics of Compact Stars,* Ladek Zdroj, Poland, 18-29 February (2008).
5. "Nonadiabatic quasiparticle description of triaxially deformed proton emitters" – *International Nuclear Physics Conference* INPC 2007, Tokyo, June 5 (2007).
6. "Giant dipole resonance in rapidly rotating hot nuclei with exact treatment of fluctuations" – XXXIX Zakopane School of Physics, *International Symposium on Atomic Nuclei at Extreme Values of Temperature, Spin and Isospin*, Zakopane, Poland, September (2004).

## (c) Seminars at important places

1. "Atomic nuclei as a testing ground for quantum algorithms and a quantum information resource" – Academic Talk, Xiamen University Malaysia, Kuala Lumpur, June 12 (2025).
2. "Nuclear processes relevant to information & computing" – Summer Training Program in Physics (STPIP-2023), Bharthiar University, Coimbatore, India June 3-17 (2023).
3. "Astrophysical phenomena explored through atomic nuclei" – Institute of Theoretical Physics and Astrophysics IFTiA Seminar (online), Uniwersytet Gdański, Gdańsk, Poland, April 22 (2021).
4. "Implications of Nuclear Physics on Nuclear Astrophysical Reactions" – VIT-IIT Physics Lecture series (online), Vellore Institute of Technology, March 31 (2021).

5. "Unified approach to nuclear many-body problem: Some fragmented efforts" – Seminar at Yukawa Institute, Kyoto University, Japan, November 14 (2018).
6. "Neutron Stars: Transforming the modus operandi in Nuclear Models" – Indian Physics Association Lecture at IIT Roorkee, October 8 (2012).
7. "Neutron Stars: Complementing Nuclear Models" Seminar at Dept. of Physics, IIT Roorkee, July 26 (2012).
8. "Exotic Phases in Neutron Stars" – Seminar at Centre for Fundamental Interactions in Physics, IST, Lisbon, Portugal on June 25 (2013).
9. "Neutron Stars: Correlations with low energy nuclear phenomena" – Seminar at Centre for Fundamental Interactions in Physics, IST, Lisbon, Portugal on July 5 (2012).
10. "Tools for contemporary research in Physics" – Interaction meeting with students of Sambalpur University, Burla, India, November 6 (2009).
11. "Physics of drip-line nuclei and proton emission" – Theoretical Physics Seminar Circuit seminar at Institute of Physics, Bhubaneswar, India, October 1 (2009).
12. "Unified description of finite nuclei, infinite matter and neutron stars" – Seminar at National Institute of Technology, Hamirpur, HP, India, August 31 (2009).
13. "GDR as a probe for phase and shape transitions in nuclei" – Seminar at Indian Institute of Technology, Roorkee, India, September 3 (2007).
14. "Proton emission from drip-line nuclei" – Seminar at Institute of Physics, Bhubaneswar, India, August 21 (2007).
15. "GDR as a probe for phase and shape transitions in nuclei" – Seminar at Variable Energy Cyclotron Centre, Calcutta, India, August 24 (2007).
16. "Warm and rapidly rotating nuclei – New perspectives" – Seminar at Physics Department, CFIF, Instituto Superior Tecnico, Lisbon, Portugal, May 31 (2005).
17. "Giant dipole resonance in hot rotating nuclei" – Talk in *Commemoration of 60$^{th}$ Birthday of Prof. A. Ansari*, Bhubaneswar, India, January 31 (2005).
18. "Giant dipole resonance and Jacobi transition" – Seminar at *Institute of Physics*, Bhubaneswar, India, August 2004.
19. "Giant dipole resonance and shape fluctuations in excited nuclei" – Seminar at Department of Physics, *Indian Institute of Technology, Roorkee*, India, September 2003.
20. "Study of rapidly rotating hot nuclei" – Group seminar at *Department of Physics, Panjab University*, Chandigarh, India, April 2003.
21. "Giant dipole resonance in excited nuclei" – Seminar at *Institute of Physics*, Bhubaneswar, India, April 2003.

# Research Contributions

## (a) Books edited

1. Proton-Emitting Nuclei and related topics – Editors: L. S. Ferreira and P. Arumugam, AIP Conference Proceedings Vol. 961, 50 (2007) ISBN: 978-7354-0475-5.

## (b) In refereed journals

### (b1) Letters:

1. New proton emitter $^{188}$At implies an interaction unprecedented in heavy nuclei
   Henna Kokkonen, Kalle Auranen, Pooja Siwach, P. Arumugam, Andrew D. Briscoe, Sarah Eeckhaudt, Lidia S. Ferreira, Tuomas Grahn, Paul T. Greenlees, Pete Jones, Rauno Julin, Sakari Juutinen, Matti Leino, Ari-Pekka Leppänen, Enrico Maglione, Markus Nyman, Robert D. Page, Janne Pakarinen, Panu Rahkila, Jan Sarén, Catherine Scholey, Juha Sorri, Juha Uusitalo, and Martin Venhart
   *Nat. Commun.* **16**, 4985 (2025).

2. Probing Modified Gravity with Entanglement of Microspheres
   Ankit Kumar, Y-K. Lim, P. Arumugam, T. Złośnik, and T. Paterek
   *Phys. Rev.* **D**, **109**, L101501 (Letters) (2024) .

3. Probing triaxiality beyond the proton drip line: Spectroscopy of $^{147}$Tm
   K. Auranen, P. Siwach, P. Arumugam, A. D. Briscoe, L. S. Ferreira, T. Grahn, P. T. Greenlees, A. Herzán, A. Illana, D. T. Joss, H. Joukainen, R. Julin, H. Jutila, M. Leino, J. Louko, M. Luoma, E. Maglione, J. Ojala, R. D. Page, J. Pakarinen, P. Rahkila, J. Romero, P. Ruotsalainen, M. Sandzelius, J. Sarén, A. Tolosa-Delgado, J. Uusitalo, and G. Zimba
   *Phys. Rev.* **C**, **108**, L011303 (Letters) (2023).

4. Fine structure in the odd-odd proton emitter $^{144}$Tm
   Pooja Siwach, P. Arumugam, S. Modi, L.S. Ferreira and E. Maglione
   *Phys. Rev.* **C**, **105**, L031302 (Letters) (2022).

5. Interpretation of $^{108}$I as an odd-odd -deformed proton emitter
   Pooja Siwach, P. Arumugam, S. Modi, L.S. Ferreira and E. Maglione
   *Phys. Rev.* **C 103**, L031303 (Letters) (2021).

6. Chirality in $^{136,138}$Pm
   Pooja Siwach, P. Arumugam, L.S. Ferreira and E. Maglione
   *Phys. Lett.* **B 811**, 135937 (2020).

7. Collective enhancement in nuclear level density
   G. Mohanto, A. Parihari, P. C. Rout, S. De, E. T. Mirgule, B. Srinivasan, K. Mahata, S. P. Behera, M. Kushwaha, D. Sarkar, B. K. Nayak, A. Saxena, A.K. Rhine Kumar, A. Gandhi, K Sangita, N. Deb and P. Arumugam
   *Phys. Rev.* **C 100**, 011602 (Rapid communication) (2019).

8. Effects of Coriolis and residual neutron-proton interactions in the proton emission from $^{130}$Eu
Monika Patial, P. Arumugam, A.K. Jain, E. Maglione and L.S. Ferreira,
*Phys. Lett.* **B 718**, 979 (2013).

9. Evidence of antimagnetic rotation in odd-A $^{105}$Cd
D. Choudhury, A. K. Jain, M. Patial, N. Gupta, P. Arumugam, *et al*,
*Phys. Rev.* **C 82**, 061308 (Rapid communication) (2010).

10. Proton emission, gamma deformation, and the spin of the isomeric state of $^{141}$Ho
P. Arumugam, L.S. Ferreira and E. Maglione
*Phys. Lett.* **B 680**, 443 (2009).

11. Fine structure in proton radioactivity: An accurate tool to ascertain the breaking of axial symmetry in $^{145}$Tm
P. Arumugam, L.S. Ferreira, and E. Maglione
*Phys. Rev.* **C 78,** 041305(R) (Rapid communication) (2008).

12. Clustering in superheavy nuclei within the relativistic mean field approach
B.K. Sharma, P. Arumugam, S.K. Patra, P.D. Stevenson, R.K. Gupta, and W. Greiner
*J. Phys. G* **32**, L1 (2006).

13. Applicability of shape parameterizations for giant dipole resonance in warm and rapidly rotating nuclei
P. Arumugam, A.G. Deb and S.K. Patra
*Europhys. Lett.* **70**, 313 (2005).

14. Versatility of field theory motivated nuclear effective Lagrangian approach
P. Arumugam, B.K. Sharma, P.K. Sahu, S.K. Patra, T. Sil, M. Centelles and X. Viñas
*Phys. Lett.* **B 601**, 51 (2004).

### (b2) Regular articles:

15. A quantum algorithm for the linear response of nuclei
Nifeeya Singh, Abhishek and P. Arumugam,
*Indian J. Phys.* **99**, 03627 (2025).

16. Study of nuclear structure in 122Ba from DCO Ratio and Polarization measurements
Bharti Rohila, Ashok Kumar, Diwanshu, Chetan Sharma, Amit, Subodh, H. Arora, Mehak Narula, Nabeel Salim, P. Arumugam, Mohammad Anser, H. P. Sharma, Anand Pandey, S. K. Chamoli, Kaushik Katre, Yashraj, R. P. Singh, and S. Muralithar
*Eur. Phys. J. A* **61**, 136 (2025).

17. Integrating physics insights into machine learning: a case study with giant dipole resonance
Manish Kumar Bairwa, Abhishek, R. Balasubramanian and P. Arumugam,
*Phys. Scr.* **100,** 056010 (2025).

18. Quantum Simulation of Nuclear Linear Response
Nifeeya Singh, Abhishek, Pooja Siwach and P. Arumugam,
*IEEE Quantum Computing and Engineering*, **2**, 367, (2024).

19. Correlations and signaling in the Schrödinger–Newton model
Jacek Aleksander Gruca, Ankit Kumar, Ray Ganardi, P. Arumugam, Karolina Kropielnicka and Tomasz Paterek.
*Classical and Quantum Grav.,* **41**, 245014, (2024).

20. The ORT and the uGMRT Pulsar Monitoring Program: Pulsar Timing Irregularities & the Gaussian Process Realization.
Himanshu Grover, Bhal Chandra Joshi, Jaikhomba Singha, Erbil Gügercinoğlu, P. Arumugam, Debades Bandyopadhyay, James O. Chibueze, Shantanu Desai, Innocent O. Eya, Anu Kundu, Johnson O. Urama.
*Publications of the Astronomical Society of Australia, **41**, 102, (2024).*

21. Improving DM estimates using low-frequency scattering-broadening estimates.
Jaikhomba Singha, Bhal Chandra Joshi, M. A. Krishnakumar, Fazal Kareem, Adarsh Bathula, Churchil Dwivedi, Shebin Jose Jacob, Shantanu Desai, Pratik Tarafdar, P. Arumugam, Swetha Arumugam, Manjari Bagchi, Neelam Dhanda Batrz, Subhajit Dandapat, Debabrata Deb, Jyotijwal Debnath, A Gopakumar, Yashwant Gupta, Shinnosuke Hisano, Ryo Kato, Tomonosuke Kikunaga, Piyush Marmat, K. Noblesoz, Avinash K. Paladi, Arul Pandian B., Thiagaraj Prabu, Prerna Rana, Aman Srivastava, Mayuresh Surnis, Abhimanyu Susobhanan , Keitaro Takahashi
*Mon. Not. Royal Astr. Soc. **535**, 1, (2024).*

22. Comparing recent PTA results on the nanohertz stochastic gravitational wave background
G. Agazie, J. Antoniadis, A. Anumarlapudi, A.M. Archibald, P. Arumugam, *et al*, (The International Pulsar Timing Array Collaboration)
*Astrophysical Journal* **966**, 105 (2024).

23. Nuclear structure constraints on nucleosynthesis
Lídia S. Ferreira, Pooja Siwach, P. Arumugam, Enrico Maglione
*Il Nuovo Cimento* **47 C**, 55 (2024).

24. Multiband extension of the wideband timing technique
A.K. Paladi, C. Dwivedi, P. Rana, K. Nobleson, A. Susobhanan, B.C. Joshi, P. Tarafdar, D. Deb, S. Arumugam, A. Gopakumar, M.A. Krishnakumar, N.D. Batra, J. Debnath, F. Kareem, P. Arumugam, M. Bagchi, A. Bathula, S. Dandapat, S. Desai, Y. Gupta, S. Hisano, D. Kharbanda, T. Kikunaga, N. Kolhe, Y. Maan, P.K. Manoharan, J. Singha, A. Srivastava, M. Surnis, K. Takahashi
*Mon. Not. Royal Astr. Soc.* **527**, 213 (2024).

25. The second data release from the European Pulsar Timing Array - II. Customised pulsar noise models for spatially correlated gravitational waves
J. Antoniadis, P. Arumugam, *et al*, (EPTA Collaboration and InPTA Collaboration)
*Astr. & Astro Phys.* **678**, A49 (2023).

26. The second data release from the European Pulsar Timing Array III. Search for gravitational wave signals
J. Antoniadis, P. Arumugam, *et al*, (EPTA Collaboration and InPTA Collaboration)
*Astr. & Astro Phys.* **678**, A50 (2023).

27. Giant dipole resonance and its fine structures in $^{144-152}$Nd,$^{152}$Sm studied within the linear response theory
Abhishek Sharma, P. Arumugam, and A.K. Rhine Kumar
*Phys. Scr.* **98**, 035303 (2023).

28. Noise analysis of the Indian Pulsar Timing Array data release I
Aman Srivastava, Shantanu Desai, Neel Kolhe, Mayuresh Surnis, Bhal Chandra Joshi, Abhimanyu Susobhanan, Aur ́elien Chalumeau, Shinnosuke Hisano, Nobleson K., Swetha Arumugam, Divyansh Kharbanda, Jaikhomba Singha, Pratik Tarafdar, P. Arumugam, Manjari Bagchi, Adarsh Bathula, Subhajit Dandapat, Lankeswar Dey, Churchil Dwivedi, Raghav Girgaonkar, A. Gopakumar, Yashwant Gupta, Tomonosuke Kikunaga, M. A. Krishnakumar, Kuo Liu, Yogesh Maan, P. K. Manoharan, Avinash Kumar Paladi, Prerna Rana, Golam M. Shaifullah, and Keitaro Takahashi
*Phys. Rev.* **D 108**, 023008 (2023).

29. Continuous-Variable Entanglement through Central Forces: Application to Gravity between Quantum Masses
Ankit Kumar, T. Krisnanda, P. Arumugam, and T. Paterek
*Quantum* **7**, 1008 (2023).

30. Pulsar timing irregularities and neutron star interior in the era of SKA: an Indian outlook
J. Singha, B.C. Joshi, D. Bandyopadhyay, H. Grover, S. Desai, P. Arumugam, and S. Banik
*J. Astrophys. Astr.* **43**, 81 (2022).

31. Nanohertz gravitational wave astronomy during SKA era: An InPTA perspective
B.C. Joshi, A. Gopakumar, A. Pandian, T. Prabu, L. Dey, M. Bagchi, S. Desai, P. Tarafdar, P. Rana, Y. Maan, N.D. Batra, R. Girgaonkar, N. Agarwal, P. Arumugam, A. Basu, A. Bathula, S. Dandapat, Y. Gupta, S. Hisano, R. Kato, D. Kharbanda, T. Kikunaga, N. Kolhe, M.A. Krishnakumar, P.K. Manoharan, P. Marmat, A. Naidu, S. Banik, K. Nobleson, A.K. Paladi, D. Pathak, J. Singha, A. Srivastava, M. Surnis, S.C. Susarla, A. Susobhanan, and K. Takahashi
*J. Astrophys. Astr.* **43**, 98 (2022).

32. Quantum computation of nuclear observables involving linear combinations of unitary operators
Pooja Siwach and P. Arumugam
*Phys. Rev.* **C 105**, 064318 (2022).

33. Pasta properties of the neutron star within effective relativistic mean-field model
Vishal Parmar, H.C. Das, Ankit Kumar, Ankit Kumar, M.K. Sharma, P. Arumugam, and S.K. Patra
*Phys. Rev.* **D 106**, 023031 (2022).

34. Effects of triaxiality and residual np interaction in the proton emission from $^{140}$Ho
Pooja Siwach, P. Arumugam, S. Modi, L.S. Ferreira, and E. Maglione
*Phys. Rev.* **C 106**, 044322 (2022).

35. Low-frequency wideband timing of InPTA pulsars observed with the uGMRT
K. Nobleson, N. Agarwal, R. Girgaonkar, A. Pandian, B.C. Joshi, M.A. Krishnakumar, A. Susobhanan, S. Desai, T. Prabu, A. Bathula, T.T. Pennucci, S. Banik, M. Bagchi, N.D. Batra, A. Choudhary, S. Dandapat, L. Dey, Y. Gupta, S. Hisano, R. Kato, D. Kharbanda, T. Kikunaga, N. Kolhe, Y. Maan, P. Marmat, P. Arumugam, P.K. Manoharan, D. Pathak, J. Singha, M.P. Surnis, S.C. Susarla, and K. Takahashi

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50. Nonadiabatic quasiparticle description of proton emission from the odd-odd nucleus $^{130}$Eu – Monika Patial, P. Arumugam, A.K. Jain, E. Maglione, L.S. Ferreira, *DAE Symp. on Nucl. Phys.* at New Delhi, **57**, 214 (2012).
51. Giant dipole resonance in compound nucleus $^{144}$Sm – Ish Mukul, I. Mazumdar, P. Arumugam, J. Gehlot, D. A. Gothe, Maninder Kaur, A. K. Rhine Kumar, N. Madhavan, G. Mohanto, S. Nath, P. Sugathan, and A. Roy, *DAE Symp. on Nucl. Phys.* at New Delhi, **57**, 284 (2012).
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53. Theoretical studies of exotic drip-line nuclei – L.S. Ferreira, E. Maglione, P. Arumugam, and N. Yu, *IX Latin American Symposium on Nuclear Physics and Applications*, AIP Conf. Proc. **1423**, 35 (2012), DOI: 10.1063/1.3688778.

54. Atlas of nuclear isomers and spin systematics – Monika Patial, Bhoomika Maheshwari, Monalisha Dhibar, A.K. Jain, P. Arumugam, and Balraj Singh, *National Conference on Advances in Physics,* Roorkee, India, February 24–25 (2012), Book of abstracts, p. 103.

55. Theoretical description of proton decay by nonadiabatic approach – Monika Patial, P. Arumugam, A.K. Jain, E. Maglione and L.S. Ferreria, *National Conference on Advances in Physics,* Roorkee, India, February 24–25 (2012), Book of abstracts, p. 105.

56. Description of neutron star observables using extended RMF models with kaons – Neha Gupta and P. Arumugam, *National Conference on Advances in Physics,* Roorkee, India*,* February 24–25 (2012), Book of abstracts, p. 107.

57. Isoscalar giant quadrupole resonance in hot and rotating nuclei – A.K. Rhine Kumar, Aarti Malhotra and P. Arumugam, *National Conference on Advances in Physics,* Roorkee, India*,* February 24–25 (2012), Book of abstracts, p. 113.

58. Kaon condensation in neutron stars studied with recent RMF models – Neha Gupta and P. Arumugam, *DAE Symp. on Nucl. Phys.*, Vishakapatnam, India, **56**,740 (2011).

59. Non-adiabatic approach for odd-odd proton emitters – Monika Patial, P. Arumugam, A.K. Jain, E. Maglione and L.S. Ferreria, *DAE Symp. on Nucl. Phys.,* Vishakapatnam, India, **56**, 222 (2011).

60. Role of thermal shape fluctuations on isoscalar giant quadrupole resonance in hot and rotating nuclei – A. K. Rhine Kumar, Aarti Malhotra and P. Arumugam, *DAE Symp. on Nucl. Phys.,* Vishakapatnam, India, **56**, 436 (2011).

61. Pasta structures in neutron stars – Neha Gupta, I. S. Shabnam and P. Arumugam, *DAE Symp. on Nucl. Phys.,* Vishakapatnam, India*,* **56**, 702 (2011).

62. Nonadiabatic effects in odd-odd deformed proton emitters – M. Patial, P. Arumugam, A. K. Jain, E. Maglione, and L. S. Ferreira, *The 4th International Conference on Proton Emitting Nuclei and Related* Topics, AIP Conf. Proc. **1409**, 111 (2011), DOI:10.1063/1.3664160.

63. Assigning $\gamma$ deformation from fine structure in exotic nuclei – L.S. Ferreira, E. Maglione and P. Arumugam, *Frontiers in Nuclear Structure, Astrophysics, and Reactions: Finustar 3*, AIP Conf. Proc. **1377**, 121 (2011) DOI:10.1063/1.3628367.

64. Nuclear Structure Studies of Exotic Nuclei nuclei – L.S. Ferreira, E. Maglione, P. Arumugam, *Second International Ulaanbaatar Conference on Nuclear Physics and Applications*, AIP Conf. Proc. **1342**, 17 (2011). DOI: 10.1063/1.3583161.

65. Empirical determination of all parameters in phenomenological description of giant dipole resonance – Neha Gupta, Ishwar Das, and P. Arumugam, *DAE Symp. on Nucl. Phys.,* Pilani, India*,* **55**, 234 (2010).

66. Global Systematics of Spins of Nuclear Isomers – Monika Patial, A. K. Jain, P. Arumugam, Balraj Singh, *DAE Symp. on Nucl. Phys.,* Pilani, India, **55**, 138 (2010).

67. Atlas of Nuclear Isomers – Monika Patial, A. K. Jain, P. Arumugam, Balraj Singh, *DAE Symp. on Nucl. Phys.,* Pilani, India, **55**, 136 (2010).

68. Probing the nuclear structure of drip-line nuclei – L.S. Ferreira, E. Maglione, P. Arumugam, *VIII Latin American Symposium on Nuclear Physics and Applications*, AIP Conf. Proc. **1265**, 41 (2010). DOI: 10.1063/1.3480221.

69. Search for anti-magnetic rotation in $^{105}$Cd – Deepika Choudhury, Monika Patial, Neha Gupta, A.K. Jain, P. Arumugam, et al, *DAE International Symp. on Nucl. Phys.,* Mumbai, India, **54** (2009).

70. Relativistic mean field study of clustering in nuclei – P. Arumugam, *DAE Symp. on Nucl. Phys.,* India, **53**, 11 (2008).

71. Cross-sections using exotic nuclei in Glauber model for relativistic mean field densities – R. Panda, P. Arumugam, S.K. Patra and Raj K. Gupta, *DAE Symp. on Nucl. Phys.,* India, **53**, 327 (2008).

72. Precise identification of non-axial shapes by proton emission studies – P. Arumugam, L.S. Ferreira, and E. Maglione, *International conference* EURORIB08, Giens, France, June 9–13, (2008), Book of abstracts p. 120.

73. The structure and shape of exotic nuclei beyond the proton drip-line – L.S. Ferreira, E. Maglione, P. Arumugam, in "*Nuclear Physics and Astrophysics: From Stable Beams to Exotic Nuclei*", Eds. I. Boztosun, A.B. Balantekin, AIP Conference Proceedings 1072, 191 (2008).

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75. Triaxially deformed proton emitters – P. Arumugam, E. Maglione, and L.S. Ferreira, *International conference on Proton Emitting Nuclei and related topics PROCON07*, Lisbon, June 17-23, (2007).

76. Nonadiabatic quasiparticle description of triaxial proton emitters – P. Arumugam, E. Maglione and L.S. Ferreira, *International Nuclear Physics Conference, INPC2007*, Tokyo, Japan, June 3 – 8, 2007.

77. Nuclear properties at high spin and low temperature – P. Arumugam, *International Workshop on Nuclear Structure at the Extremes: New Directions*, Shimla, India, March 21–24 (2005) Book of Abstracts, p 21.

78. Halo and cluster structure of light nuclei – B.K. Sharma, P. Arumugam, and S.K. Patra, *International Workshop on Nuclear Structure at the Extremes: New Directions*, Shimla, India, March 21–24 (2005) Book of Abstracts, p. 54.

79. Giant dipole resonance and shape transitions in medium heavy mass nuclei – P. Arumugam, A. Ganga Deb and S.K. Patra, *International Workshop on Nuclear Structure at the Extremes: New Directions*, Shimla, India, March 21–24 (2005) Book of Abstracts, p. 59.

80. Relativistic mean field study of clustering in light nuclei – P. Arumugam, S.K. Patra and R.K. Gupta, DAE Symp. on Nucl. Phys., India, **47B**, 74 (2004).

81. Halo structure of exotic nuclei – B.K. Sharma, P. Arumugam and S.K. Patra, *DAE Symp. on Nucl. Phys.,* India, **47B**, 112 (2004).

82. Proton radioactivity from excited nuclei – S.R.K. Venkataraman, P. Arumugam and S.K. Patra, *DAE Symp. on Nucl. Phys.,* India, **47B**, 110 (2004).

83. Applicability of shape parameterizations for giant dipole resonance in warm and rapidly rotating nuclei – P. Arumugam, A.G. Deb and S.K. Patra, *DAE Symp. on Nucl. Phys.,* India, **47B**, 34 (2004).

84. Giant dipole resonance in rapidly rotating hot nuclei with exact treatment of fluctuations – P. Arumugam and S.K. Patra, *XXXIX Zakopane School of Physics, International Symposium on Atomic Nuclei at Extreme Values of Temperature, Spin and Isospin*, Zakopane, Poland, August 31 – 5 September 2004, Book of abstracts, p. 34.

85. GDR in hot rotating nuclei with exact treatment of fluctuations – P. Arumugam, *Workshop on Relativistic Mean Field Theory in Nuclear Physics*, Bhubaneswar, India, July 26–31, 2004, Book of Abstracts, p. 23.

86. Effective field theory Lagrangian approach: A complete relativistic nuclear model – P. Arumugam, B.K. Sharma, S.K. Patra, Tapas Sil, M. Centelles, and X. Vinas, *Workshop on production and utilization of radioactive ion beams from ISOL type facilities*, Puri, India, February 16–19, 2004.

87. Field theory motivated effective Lagrangian approach: towards a complete relativistic nuclear model – S.K. Patra, B.K. Sharma, P. Arumugam, P. K. Sahu, X. Vinas, M. Centelles and T. Sil, *Proceedings of International Nuclear Physics Conference*, Goteborg, Sweden, June 27–July 2, 2004.

88. Giant dipole resonance and Jacobi transition leading to hyperdeformation – P. Arumugam and S.K. Patra, *International Nuclear Physics Conference*, Goteborg, Sweden, June 27–July 2, 2004, Book of Abstracts, p.278.

89. A cluster decay model for proton radioactivity from dripline nuclei – S.R.K. Venkataraman, P. Arumugam, S.K. Patra and Raj K. Gupta, *International Conference on Exotic Nuclei and Atomic Masses*, (ENAM04), Georgia, USA, September 12-16, 2004.

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91. On stability and the similarity of $N = 82$ isotones – P. Arumugam, S.K. Patra and A. Abbas, *DAE Symp. on Nucl. Phys.,* India*, **46B**, 60 (2003).*

92. Giant dipole resonance as a probe for hyperdeformation through Jacobi transition – P. Arumugam and S.K. Patra, *DAE Symp. on Nucl. Phys.,* India*,* **46B**, 156 (2003).

93. Effective field theory: A complete relativistic nuclear model – P. Arumugam, B.K. Sharma, P.K. Sahu and S.K. Patra, *DAE Symp. on Nucl. Phys.,* India, **46B**, 402 (2003).

94. Phase transition in an effective field theory – B.K. Sharma, P. Arumugam, P.K. Sahu and S.K. Patra, *DAE Symp. on Nucl. Phys.,* India, **46B**, 402 (2003).

95. Effect of excitation on giant dipole resonance – P. Arumugam, *DAE Symp. on Nucl. Phys.,* India, **45B**, 566 (2002).

96. Level densities and single-particle distributions in hot nuclei – G. Shanmugam and P. Arumugam, *DAE Symp. on Nucl. Phys.,* India, **44B**, 106 (2001).

97. Role of fluctuations on giant dipole resonance cross sections – G. Shanmugam and P. Arumugam, *DAE Symp. on Nucl. Phys.,* India*,* **44B**, 142 (2001).

98. Pairing fluctuations in the high-K isomer $^{178}$W – G. Shanmugam and P. Arumugam, *DAE Symp. on Nucl. Phys.,* India*,* **44B**, 144 (2001).

99. Role of fluctuations on giant dipole resonance – G. Shanmugam and P. Arumugam, Proceedings of the Workshop on Physics with Large Gamma Array coupled with Recoil Separator, Varanasi, September (2001).

100. Role of fluctuations on shape transitions in zirconium isotopes – G. Shanmugam and P. Arumugam, *DAE Symp. on Nucl. Phys.,* India, **43B**, 126 (2000).

101. Inclusion of temperature dependent shell corrections in Landau theory for hot rotating nuclei – G. Shanmugam and P. Arumugam, *Proceedings of the International Workshop on Physics with Multi Detector Arrays,* Calcutta, November 2000, p.26.

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104. Giant Dipole Resonance as a probe for detecting Jacobi Transition in the Zirconium Isotopes - G. Shanmugam, P. Arumugam and V. Ramasubramanian, *DAE Symp. on Nucl. Phys.* India, **41B**, 100 (1998).

105. Rotational co-existence in selenium isotopes – G. Shanmugam, V. Ramasubramanian and P. Arumugam, *International Workshop on Rare Nuclear Processes*, New Delhi, November 16 –20, 1998, Book of abstracts, p.47.

## Highlighted Citations

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- Astron. & Astrophys. **553**, A22 (2013): Phase transitions in dense matter and the maximum mass of neutron stars – N. Chamel, A. F. Fantina, J. M. Pearson and S. Goriely
- Rev. Mod. Phys. **89**, 015007 (2017): Equations of state for supernovae and compact stars – M. Oertel, M. Hempel, T. Klähn, and S. Typel
- Rev. Mod. Phys. **84**, 567 (2012): Radioactive decays at limits of nuclear stability – M. Pfützner, M. Karny, L. V. Grigorenko, and K. Riisager
- Prog. Part. Nucl. Phys. **105**, 214 (2019): Recent developments in radioactive charged-particle emissions and related phenomena – C. Qi, R. Liotta, and R. Wyss
- Rep. Prog. Phys. **82**, 056301 (2019): Pairing in excited nuclei: a review – N. Quang Hung, N. Dinh Dang, and L. G. Moretto
- Phys. Rep. **681**, 1 (2017): Approximate universal relations for neutron stars and quark stars – K. Yagiab and N. Yunes
- Phys. Rev. Lett. 128, 112501 (2022): Nanosecond-Scale Proton Emission from Strongly Oblate-Deformed $^{149}$Lu – K. Auranen *et al.*
- Phys. Rev. Lett. 127, 202501 (2021): Solving the Puzzles of the Decay of the Heaviest Known Proton-Emitting Nucleus $^{185}$Bi – D. T. Doherty *et al.*
- Phys. Rev. Lett. 120, 212502 (2018): Puzzling Two-Proton Decay of $^{67}$Kr – S. M. Wang and W. Nazarewicz
- Phys. Rev. Lett. 119, 192503 (2017): Discovery of $^{72}$Rb: A Nuclear Sandbank Beyond the Proton Drip Line – H. Suzuki *et al.*
- Phys. Rev. Lett. 114, 092301 (2015): Hyperon Puzzle: Hints from Quantum Monte Carlo Calculations – D. Lonardoni, A. Lovato, S. Gandolfi, and F. Pederiva

## Details of Theses Supervised

| Sl. | Title of PhD thesis | Year | Name of the scholar |
|---|---|---|---|
| 1. | Relativistic Mean Field Description of Exotic Phases in Neutron Star | 2013 | Neha Gupta (Faculty, VMO Univ., Kota) |
| 2. | Proton Emission from Two Quasiparticle States in Deformed Odd-Odd Nuclei (Co-supervisor: Prof. A.K. Jain) | 2013 | Monika Patial (Post-doc, KTH, Stockholm) |
| 3. | Giant Resonance built on Excited States of Nuclei | 2015 | A.K. Rhine Kumar* (Faculty, CUSAT, Kochi) |
| 4. | Microscopic Description of Triaxially Deformed Proton Emitters | 2017 | Swati Modi (Faculty, BIT Sindri, Dhanbad) |
| 5. | Microscopic Description of Deformed Odd-Odd Proton Emitters | 2021 | Pooja Siwach* (Post-doc, Univ. Wisconsin) |
| 6. | Microscopic Description of Giant Dipole Resonances | 2023 | Abhishek (Post-doc, Univ. Surrey) |
| 7. | Entanglement Dynamics in Quantum Continuous-Variable States (Co-supervisor: Prof. Tomasz Paterek) | 2023 | Ankit Kumar (Post-doc, ICTQT, Poland) |
| 8. | Theoretical and Precision Timing Studies of Neutron Stars | 2023 | Jaikhomba Singha (Post-doc, Univ. CapeTown) |
| 9. | Reinforcing Nuclear Models with Modern Techniques and Data | Ongoing | Manish Kumar Bairwa |
| 10. | Nuclear Processes for Quantum Information and Quantum Simulation of Atomic Nuclei | Ongoing | Nifeeya Singh |
| 11. | To be decided (Quantum Information) | Ongoing | Ashutosh Singh |
| 12. | To be decided (Pulsars & Radio Astronomy) | Ongoing | Himanshu Grover |
| 13. | To be decided (Pulsars & Radio Astronomy) | Ongoing | Adya Shukla |
| 14. | To be decided (Time Dependent Proton Emission) | Ongoing | Ankit Kumar Das |
| 15. | To be decided (Quantum Information and Proton Emission) | Ongoing | Mehak |
| 16. | To be decided (Temperature Dependence in Giant Resonances) | Ongoing | Nabeel salim |
| 17. | To be decided (Quantum Batteries) | Ongoing | Soniya |

*** CVK Baba award (Indian Physics Association) for the best thesis presentation in Nuclear Physics – 2015 & 2021**

| Sl. | Title of MSc thesis | Year | Name of the student |
|---|---|---|---|
| 1. | Systematics in the depth of Woods-Saxon potential studied using proton emission data | 2009 | Jasmine Sethi |
| 2. | Giant Quadrupole Resonance | 2011 | Aarti Malhotra |
| 3. | Neutron Star and Equation of State | 2011 | Shabnam. I. S. |
| 4. | Quark Hadron Phase Transition in Neutron Stars | 2012 | Bhumika Thakur |
| 5. | Fission in rapidly Rotating Nuclei | 2013 | Vinay Suram |
| 6. | Clustering in Atomic Nuclei | 2014 | Anu Kundu |
| 7. | Towards a formal Description of Pairing in Giant Dipole Resonance | 2015 | Garima Arora |
| 8. | Microscopic Description of Giant Dipole Resonance | 2016 | Rajiv G Pereira |
| 9. | A Qualitative Study of Rotating Neutron Stars | 2017 | Ankit Kumar |
| 10. | Searching for Pulsars using the upgraded GMRT | 2017 | Boris Kalita |
| 11. | Deformation in a Rotating Gravitating Object at Large Angular Momentum | 2019 | Mohit Kumar |
| 12. | Modeling the Rotation of Neutron Stars | | Priyansh Peelwan |
| 13. | Equation of State based on Phenomenological Relativistic Mean Field Theory of Single and Double Fluid Neutron Stars | 2022 | Piyush Marmat |
| 14. | Neutron Star Structure with Two Fluid Equation of State | 2023 | Bhavnesh Bhat |
| 15. | Pulsars and their use as astrophysical tools | 2023 | Harshini Paranjape |
| 16. | Pulsar population synthesis tools | 2024 | Mohak Patil |
| 17. | Machine learning for nuclear data | 2024 | Shubham Sudarshanam |
| 18. | Instruments for Radio Astronomy: Construction and Applications. | 2025 | Kaustav Bhattacharjee |
| 19. | Quantum Computing of Non-Hermitian Systems | 2025 | Tanya Keshari |

| SI. | Title of BTech thesis | Year | Name of the student |
|---|---|---|---|
| 1. | Pasta phases in neutron stars in extended relativistic mean field model | 2019 | Prince Yadav |
| 2. | Coulomb mediated mixing in two mode gaussian quantum states | 2020 | Aman Nayak and Saksham Sarwari |
| 3. | Modified Newtonian Dynamics | 2022 | Agrima Darshan |
| 4. | Jaynes-Cummings Model | 2022 | Vaibhav Singh |
| 5. | Multivariate Analysis of Pulsars | 2024 | Tushar Choudhary |
| 6. | Pulsar Glitch Modeling and Neutron Star Equation of States | 2025 | Niraj |

| SI. | Title of Summer Project | Year | Name of the student |
|---|---|---|---|
| 1. | A detailed study of equation of state in RMF formalism (DST INSPIRE) | 2021 | Sukrit Jaiswal |
| 2. | Identification of Pulsar Timing Irregularities using Bayesian Model (DST INSPIRE) | 2022 | Ayush Pandey |
| 3. | Neutron star equation of state and various observational constraints (IITR SPARK) | 2022 | S Mullai Vaneshwar |
| 4. | Phenomenological modelling of pulsar glitches (IITR SPARK) | 2023 | Kunj Panchal |
| 5. | Bayesian Inference for Pulsar Glitches (DST INSPIRE) | 2024 | Swathi Raveendran |
| 6. | Simulation of Multi-dimensional Tunneling | 2025 | Satyam Patel |

Supervised three M.Phil. theses for the students of Manonmaniam Sundaranar University, Tirunelveli.

| SI. | Title of MPhil thesis | Year | Name of the scholar |
|---|---|---|---|
| 1. | Hexadecapole deformations in excited nuclei | 2004 | A. Sivagami Sundari |
| 2. | Clustering aspects in heavy nuclei | 2005 | E. Kumar |
| 3. | Macroscopic description of giant dipole resonance | 2005 | R. Swarnalatha |

## Collaborators

Other than the students listed above and those frequently co-authored publications

- Prof. G. Shanmugam, (Ph.D. Supervisor), M.S. University, Tirunelveli
- Prof. Suresh K. Patra (Post-Doc host), Institute of Physics, Bhubaneswar
- Prof. Lídia S. Ferreira, (Post-Doc host), Instituto Superior Técnico, Lisbon, Portugal
- Prof. Enrico Maglione, INFN, University of Padova, Italy
- Prof. Nguyen D. Dang, RIBF, RIKEN, Saitama, Japan
- Prof. Raj K. Gupta, Dept. of Physics, Punjab University, Chandigarh
- Prof. Xavier Viñas, Dept. of Physics, Univ. Barcelona, Spain
- Prof. Ashok K. Jain, Dept. of Physics, IIT Roorkee
- Prof. Vandana Nanal, DNAP, TIFR, Mumbai
- Prof. Indranil Mazumdar, DNAP, TIFR, Mumbai
- Prof. Hari Prakash Sharma, Dept. of Physics, BHU, Banaras
- B.K. Sharma, Z. Naik, M. Bhuyan, A.G. Deb, T.K. Jha, R.N. Panda, (Ph.D. Students at Institute of Physics, Bhubaneswar, during the period of joint publications)
- P.K. Sahu, A. Shukla, R. Chandra (Post-Docs at Institute of Physics, Bhubaneswar, during the period of publications)

## Schools/Conferences Organized

| Sl. | Conference Name | Sponsored by | Role | Date |
|---|---|---|---|---|
| 1. | The 40th Annual Meeting of the Astronomical Society of India (ASI) | ARIES and IIT Roorkee | Co-Chair, Local org. comm. | March 25-29, 2022 |
| 2. | Physics Cases and Instrumentation for the EURISOL-DF, next step towards Eurisol | CERN, EU | Member, Local org. comm. | Nov. 15-16, 2017 |
| 3. | Indo-Japan Accelerator School (IJAS2017) | DST-SERB, Govt. of India | Member, org. comm. | March 9-11, 2017 |
| 4. | SERC School on “Modern theories of Nuclear Structure”, IIT Roorkee | DST-SERB, Govt. of India | Director | Feb. 23-March 5, 2015 |
| 5. | VI International Conference FUSION14 | IUAC, DST, Govt. of India | Member, org. comm. | Feb. 24-28, 2014 |
| 6. | DAE-BRNS Symposium on Nuclear Physics, BARC, Mumbai | DAE-BRNS | Member, org. comm. | Dec. 02-06, 2013 |
| 7. | SERC School on "Modern theories of Nuclear Reactions, IIT Roorkee | DST-SERC, Govt. of India | Co-director | Sep. 23-Oct. 4, 2013 |
| 8. | International Conference on Recent Trends in Nuclear Physics, Chitkara University | DST, DAE, Chitkara Univ. | Member, org. comm. | Nov. 19-21, 2012 |
| 9. | National Conference on Advances in Physics, IIT Roorkee | DAE-BRNS, CSRI, IITR | Co-convenor | Feb. 25-26, 2012 |
| 10. | SERC School on "Modern trends in Nuclear structure and dynamics, IIT Roorkee | DST-SERC, Govt. of India | Co-director | Feb. 06-24, 2012 |
| 11. | Interaction Meeting on Theoretical Nuclear Physics, IIT-Roorkee | DST, Govt. of India | Co-convenor | Sep. 03-05, 2010 |
| 12. | School cum workshop on Nuclear Yrast and Near Yrast States, IIT-Roorkee | DAE-BRNS, UDCSR Kolkata | Secretary | Oct. 26-30-2009 |
| 13. | DAE-BRNS Symposium on Nuclear Physics, Roorkee | DAE-BRNS | Secretary, LOC | Dec. 22-26, 2008 |
| 14. | International Conference on Proton Emitting Nuclei and related topics, Lisbon | FCT, FCG, FLA, Portugal | Member, Org. Comm. | Jun. 17-23, 2007 |

## Sponsored Research Projects

| Sl. | Title of Project | Funding Agency | Financial Outlay | Year of start & period | Name of P.I. and other investigators | Status |
|---|---|---|---|---|---|---|
| 1. | Quantum simulation of atomic nuclei | SERB, DST | ₹34 Lacs | 2023 3 years | P. Arumugam | In Progress |
| 2. | Low-Energy Cost-Effective Tabletop Ion Accelerator | IITR | ₹ 45 Lacs | 2018 3 years | P. Arumugam Puneet Jain, K.L. Yadav Kaushik Pal, R.M. Sai | Completed |
| 3. | Microscopic description of triaxially deformed odd-odd Proton emitters | CSIR | ₹ 10.23 Lacs | 2015 4 years | P. Arumugam | Completed |
| 4. | Mapping the low temperature and low spin phase diagram of atomic nuclei | SERB, DST | ₹ 13.464 Lacs | 2015 4 years | P. Arumugam, A.K. Gourishetty I. Mazumdar, A. Maj M. Kmiecik, K. Mazurek | Completed |
| 5. | SERC School on Nuclear Physics, DST-SERB | SERB, DST | ₹ 13.615 Lacs | 2014 2 years | P. Arumugam, P.C. Srivastava | Completed |
| 6. | Warm and rotating nuclei at the limits of stability | SERB, DST | ₹ 13.32 Lacs | 2012 3 years | P. Arumugam | Completed |
| 7. | Decay spectroscopy of exotic nuclei CERN/FP/123606/2011 | FCT Portugal | € 15,000 | 2011 1 year | L.S. Ferreira, E. Maglione, P. Ring, P. Arumugam, N. Yu | Completed |
| 8. | Exotic decays with relativistic microscopic interactions CERN/FP/109319/2009 | FCT Portugal | € 10,000 | 2010 1 year | L.S. Ferreira, E. Maglione, P. Ring, P. Arumugam | Completed |
| 9. | GDR in warm and rotating nuclei | SRIC, IITR | ₹ 4.0 Lacs | 2009 3 years | P. Arumugam, | Completed |
| 10 | Search for neutron emission in exotic nuclei POCI/FP/81978/2007 | FCT Portugal | € 10,000 | 2007 1 year | L.S. Ferreira, M.C. Lopes, P. Arumugam | Completed |
| 11. | Nuclear Physics beyond the drip-lines PTDC/FIS/68340/2006 | FCT Portugal | € 76,398 | 2007 3 years | L.S. Ferreira, E. Maglione, M.C. Lopes, P. Arumugam, P.M. Walker, A.K. Jain, N.D. Dang | Completed |
| 12. | Single-particle and collective aspects of nuclei at extremes of iso-spin, spin and temperature SFRH/BPD/26642/2006 | FCT Portugal | € 34,390 | 2006 3 years | P. Arumugam, L.S. Ferreira, E. Maglione | Completed |

| Sl. | Title of Project | Funding Agency | Financial Outlay | Year of start & period | Name of P.I. and other investigators | Status |
|---|---|---|---|---|---|---|
| 13. | Effect of excitation on giant dipole resonance CSIR-SRF: 9/652(10)/2002-EMR-I. | CSIR, India | ₹ 0.7 Lacs | 2002 1 year | P. Arumugam | Completed |

## Visits

| Sl. | Host | Period |
|---|---|---|
| 1. | Prof. R. Wyss, International symposium on "Fundamentals of Nuclear Particle Decay", KTH Royal Institute of Technology, Stockholm, Sweden | 25/08/2019 to 01/09/2019 |
| 2. | Prof. L.S. Ferreira, CeFMA, Institutto Superior Tecnico, Lisbon, Portugal | 26/05 /2019 to 23/06/2019 |
| 3. | International office, ESTP Paris, France | 19/09/2019 to 21/09/2019 |
| 4. | International office, University of Strasbourg, France | 21/09/2019 to 26/09/2019 |
| 5. | Prof. T. Paterek, Division of Physics and Applied Physics, School of Physical and Mathematical Sciences. Nanyang Technological University, Singapore | 17/03/2019 to 23/03/2019 |
| 6. | Prof. N. Itagaki, Yukawa Institute for Theoretical Physics, Kyoto University, Japan | 06/11/2018 to 15/11/2018 |
| 7. | Prof. A. Sulaksono, Dep. Fisika, FMIPA, Universitas Indonesia | 29/08/2018 to 31/08/2018 |
| 8. | International office, Nanyang Technological University, Singapore | 25/08/2018 to 28/08/2018 |
| 9. | Gulf Education and Training Exhibition, Dubai | 11/04/2018 to 15/04/2018 |

## Significant Contribution/Innovations Through Research

### (a) Hot and rotating nuclei in Nilsson-Strutinsky approach

Our formalism developed to study hot and rotating nuclei is one among the best and it is the most advanced tool to study giant dipole resonance in such nuclei. A long-standing issue of the order of pairing phase transition has been addressed and we suggest a second order due to the thermal fluctuations in the pairing field. This has fundamental implications in many thermodynamical systems. In contrast to previous predictions, we have proved that with a careful treatment of fluctuations, the giant dipole resonance observation in hot nuclei could be more precise in yielding structure information. This, in turn, leads to the prediction of hyperdeformed states, in few nuclei, which are yet to be observed to bring out the similarity with gravitating rotating stars.

### (b) Unified description of finite nuclei and infinite nuclear matter

We have shown for the first time that in a relativistic mean field (RMF) approach, with a systematic inclusion of new interaction terms under the guidance of EFT techniques, and without forcing any change of the parameters initially determined from a few magic nuclei, one can explain finite nuclei and nuclear matter in a unified way with a commendable level of accuracy in both the cases. This approach could be considered as a salient step towards a unified theory for finite nuclei as well as for infinite nuclear matter.

For the first time, we have demonstrated that the clustering structure of several light mass nuclei could be well explained by the RMF theory. We have successfully extended our model to study the reaction cross-sections of exotic nuclei.

### (c) Microscopic rotation particle coupling

So far, the rotation particle coupling has been carried out only with constant/ variable moment of inertia approach for odd-odd nuclei. We have developed a new formalism named as the coupling matrix approach where the matrix elements of the collective Hamiltonian could be directly coupled to the spectrum of the core, leading to an accurate description.

### (d) Microscopic description of proton emission

Recently, we have developed a proper formalism for odd-odd proton emitters, which is more complete especially in treating the residual interactions and the coupling with the daughter nucleus states. Several interesting predictions are made where the role of residual *np* interaction could strongly influence the proton emission process.

### (e) Exotic phases in neutron stars

We have extended the RMF models, which are successful in the finite nuclear regime, to explain the properties of neutron stars (NS) in the presence of exotic matter like that of antikaons and hyperons. We have shown that, for the most massive neutron star, with a precise observation of its radius it is possible to ascertain the presence of exotic cores.

## Important Codes Written Originally

1. Temperature-dependent cranked Nilsson-Strutinsky method
    a) Temperature-dependent liquid drop model
    b) Triaxial Nilsson model
    c) Cranking model for high-spin states
    d) Strutinsky smearing at finite temperature and spin
    e) Temperature and spin-dependent pairing
2. Thermal fluctuation model with orientation fluctuations.
3. Macroscopic model for giant dipole resonances.
4. Finite temperature relativistic Thomas-Fermi model.
5. Particle Rotor Model

    (Triaxial rotor and particle in triaxially deformed ($\beta_2$, $\beta_4$, $\beta_6$, $\gamma$ ) mean field with all nonadiabatic and quasiparticle effects)
6. Proton emission by microscopic approach.

## Interdisciplinary Project Works Done

1. "Programming with GUI - Application to Problems in Physics"

Period: Sep-1997 to Dec-1997.

Using Visual Basic 5.0 as a graphical user interface (GUI), some problems of interest in Physics were tackled. The problems cover various topics in advanced Physics such as small oscillations, Monte-Carlo techniques, Rutherford scattering, Giant Dipole Resonance (GDR) in Nuclei and Chaotic Dynamics, all represented graphically. The effectiveness of MS-Excel as a computing cum graphical tool for scientific purposes was analyzed in the case of low-temperature conductivity study of crystals.

2. “Database Access with Visual Basic 6 – Application to Secondary Structure Prediction by Deviation Parameter (SSPDP)”

Collaborators: S.A. Mugilan and G. Suresh, (Research Scholars at Tirunelveli).
Period: Feb-2001 to Apr-2001.

A software package (SSPDP-MSA) has been developed to predict the given protein structure by the method SSPDP using MS Access 97 as back end and MS Visual Basic 6 as front end. SSPDP-MSA turned out to be a user-friendly tool for the people belonging to the Biophysics, Biochemistry and Biotech research community. The uniqueness of SSPDP-MSA is its graphical output. Amazingly SSPDP-MSA takes a few seconds to analyze a protein whereas the contemporary codes consume several hours.

## National and International Awards

- Selected as one among the best three thesis presentations in the Department of Atomic Energy (DAE) National Symposium on Nuclear Physics, 2002
- Obtained Young Scientist Award (a research grant) from Department of Science and Technology, Govt. of India, in April 2012.

## Membership of Academies

- Life member – Indian Physics Association
- Life member – Indian Association of Physics Teachers
- Life member – Astronomical Society of India
- Associate member – Indian Pulsar Timing Array
- Associate Member – European Centre for Theoretical Studies in nuclear physics and related areas ECT*
- Integrated member of Centro de Física e Engenharia de Materiais Avançados, Instituto Superior Tecnico, Lisbon, Portugal (UID/CTM/04540/2019)

## Participation and Cooperation in International Networks

- Participant in IPTA, NuSTAR and PARIS collaborations
- GMRT observations for pulsar searches

## Scientific Qualifications of Non-academic Nature

- Good expertise in arranging conferences and meeting as I have organized more than 10 such events
- I have written my own DBMS software to handle conference data
- I have working knowledge in system administration over different platforms

## Other Scientific Leadership or Development Work

- I have been an integral part of founding and maintaining the centre for nuclear theory in India (www.cnt.net.in)
- Spokesperson of the Indian working group in mean field theories, DFT/RMF.

## Other Professional Assignments of an Administrative Nature

- Cordinator, Thomso 2017 (Cultural fest of IIT Roorkee)
- Co-Cordinator, Thomso 2016
- Faculty in Charge of the Computer Lab (Since July 2012)
- Deputy Faculty in Charge of the Computer Lab (From 2009 to 2011)
- Webmaster and database in-charge in about 10 conferences/workshops
- Webmaster of the centre for nuclear theory in India (www.cnt.net.in)
- Faculty in Charge for the department timetable (July 2015 – June 2018)
- Department Faculty in Charge of Placement & Training (From July 2010 to June 2011)
- Member, Reports & Website Committee (Since July 2012)
- Exam Coordinator for Physics, Autumn 2012-13
- Faculty Advisor for Physics, Cognizance 2011 (Technical fest of IIT Roorkee)
- Member, Department Research Committee (2010-12)
- Member, Department Academic Programme Committee (2013-15)
- Member, Department Administrative Committee (2016-19)

## Account of Own Pedagogical Experience

I am fond of teaching and I have learnt a lot while teaching during different periods of my career.

During my Ph.D., (1998-2002) I taught one-fourth of the nuclear physics courses. I have taught the following topics during that period for the Masters' students:

- *Accelerators* and *elementary particle physics* in the basic course on Nuclear Physics
- *Detectors* and *angular momentum theory* in the advanced course on Nuclear Physics

After joining at IIT Roorkee, I have been teaching several courses as briefed below.

### For degree students in Engineering (B.Tech.)

Usually, these courses have a large number of students (~100) and we make adequate use of PowerPoint presentations accompanied by explanations in the blackboard. Also, I prefer to frequently issue problem sheets for the students which I found very effective.

- Quantum computing (IPH-305)
- Preparatory courses in Physics (PH-001, PH-002)
- Modern Physics (PH-201)
- Statistical and Quantum Mechanics (PHN-006)

### For degree students in Physics (First 3 years of Integrated M.Sc.)

- Computer Programming (PHN-103)
- Nuclear Physics and Its Applications (PH-308)

### For masters students in Engineering (M.Tech.)

- Simulation and Computer Applications (PH-722)
- Computational Techniques in Programming (PHN-707)

### For masters students in Physics (M.Sc.)

- Nuclear and Particle Physics (PH-542)
- Computational Physics (PH-511)
- Simulation and Computer Applications (PH-615)
- Nuclear Physics II (PH-662)
- Computational Nuclear Physics (PHN-624)
- Quantum Computing for Many-body Systems (PHN-640)
- Advanced Nuclear Physics (PHN-607)

### For graduate students in Physics (Ph.D.)

- Quantum, Statistical and Nuclear Physics (PH-786)
- Numerical Techniques and Computer Programming (PH-789)

### Design of own course materials

1. Courses developed along with my colleagues:
    a) Quantum Computing for Many-body Systems
    b) Introductory Quantum Information Theory
    c) Computational Nuclear Physics (With Dr. Rajdeep Chatterjee)
    d) Nuclear Astrophysics (With Dr. Rajdeep Chatterjee)
    e) Computational Physics (With Dr. Vipul Rastogi)
    f) Computational Techniques and Programming (With Dr. Vipul Rastogi)

2. Course materials developed:
    a) Elementary particle physics
    b) Angular momentum theory
    c) Computational nuclear structure

3. Extensive tutorial/problem sheets are developed for the courses I taught.

## Bio-Data

Date of birth: 31 May 1976,  Nationality: Indian