

Curriculum Vitae of Haridas Pai

Name: Haridas Pai

Designation: Research Scientist III (from 15th December 2021)

Affiliation: Extreme Light Infrastructure - Nuclear Physics (ELI-NP), IFIN-HH.

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Personal Details:

Date of Birth: 21st May 1984

Nationality: Indian

Sex: Male

Marital Status: Married

Language known: English, Hindi, Bengali

Permanent Address: Village- Bidyasagar, P.O.- Lat Beliara, Dist- Bankura,

PIN- 722157, West Bengal, India.

Academic Qualification:

Examination	Subject	Year of passing	University	Division
Master of Science (MSc.)	Physics	2007	Visva-Bharati, University, Santinikatan, West Bengal, India.	1 st
Pre-Doctorate Course	Physics	2008	VECC/ Homi Bhaba National Institute	1 st
Ph. D.	Physics Experimental nuclear physics (<i>gamma ray spectroscopy</i>)	Degree awarded 2013 January (<i>Thesis Submitted on 21st June 2012.</i>)	VECC/ Homi Bhaba National Institute	-----

National Eligibility test for Ph. D. : JEST 2007 with 94.6 percentile.

Title of Ph. D. Thesis: “Study of nuclear structure near the $Z = 82$ and $N=82$ shell closures”.

Previous positions held:

2007-2009: *Junior Research Fellow, at Variable Energy Cyclotron Centre, Kolkata, India.*

2009-2012: *Senior Research Fellow, at Variable Energy Cyclotron Centre, Kolkata, India.*

Aug 2012- Sept 2012: *APS-IUSSTF Physics Student Visitation Program,
at Argonne National Laboratory, USA.*

October 2012 – Dec 2012: *Visiting Fellow, at IPN Orsay, France.*

February 2013 – March 2016: *Postdoctoral Fellow, at Technische Universität Darmstadt, Germany.*

April 2016 – July 2016: *Visiting scientist, at Variable Energy Cyclotron Centre, India.*

Sept 2016 – Sept 2021: *Ramanujan Fellow at Saha Institute of Nuclear Physics, India.*

Awards: 1) APS-IUSSTF Physics Student Visitation Program (2012).
2) **Ramanujan Fellow** (20/05/2016)

Experience in Computer programming and simulation: Fortran, C, C++, nptool, Geant4 (familiar).

Experience in gamma-ray spectroscopy analysis software: RADWARE, INGASORT, LAMPS, DAMM, TV, GO4, Root.

Experience in Nuclear data evaluation: I have evaluated ^{189}Pb and ^{189}Tl . Evaluated data are available in ENSDF.

Detector handling and operation:

- 1) **Gamma detector:** Clover HPGe, Single crystal HPGe, LEPS, AGATA detector, BaF₂.
- 2) **Charged particle detector:** Double-sided Si strip, X3 detector.
- 3) **Neutron detector:** Liquid scintillator (BC501A) based neutron TOF detectors.

Annealing: I was actively involved in the annealing of HPGe and LEPS detectors during my Ph. D.

Participation in the major experimental setup

A) **Setting up of INGA:** I have actively worked in setting up of INGA array at IUAC, New Delhi, TIFR, Mumbai, and, VECC, Kolkata. The INGA array moves between different accelerator centers in India. During the course of my Ph.D. work, the INGA array moved from VECC, Kolkata to IUAC, New Delhi, and then from IUAC Delhi to TIFR, Mumbai.

B) **Setting up of PreSPEC-AGATA experiment:** I was actively involved in PreSPEC-AGATA experimental campaign at GSI. The PreSPEC-AGATA campaign is the predecessor of HISPEC (High-resolution in-beam γ -ray spectroscopy with exotic relativistic ion beams.) which is one of the major pillars of NUSTAR. In this campaign I was mainly involved in the preparation of experiments, setting up of AGATA array, detector testing, and disassembling of the setup.

C) **Setting up of NRF (nuclear resonance fluorescence) experiment:** I also actively worked in setting up of NRF experiment at Technische Universität Darmstadt and in High-Intensity gamma-ray Source (HI γ S) at Triangle Universities Nuclear Laboratory (TUNL), Duke, in Durham, NC, USA.

Data acquisition system: I have worked with CAMAC, VME, and DIGITAL (DSP) data acquisition systems.

Theoretical calculation: Total Routhian Surfaces (TRS) calculation

Research Experience in INDIA during Ph. D:

As a part of my thesis work, I have studied nuclear structure physics through gamma-ray spectroscopy. Mainly, the structure of nuclei near the $N = 82$ and $Z = 82$ shell closures in the mass region $A \sim 130$ and mass region $A \sim 190$ have been investigated. The high spin spectroscopy of $^{198,195}\text{Bi}$ ($Z = 83$) and $^{194,197}\text{Tl}$ ($Z = 81$) nuclei near the $Z = 82$ and odd-odd ^{134}Cs nucleus near the $N = 82$ shell closure have been studied in detail in my thesis work.

A variety of structural phenomena are expected in both the above regions. Because of the proximity of the spherical shell closures, the angular momentums are mostly generated, in these nuclei, by particle-hole excitations. The valence protons and the neutrons of the above nuclei near the shell closures occupy the high- j orbitals. So, different kinds of collective and single-particle excitations, including magnetic rotation and chiral doublet bands are expected for near-spherical and triaxial nuclei. We have observed that onset of deformation sets in for the Bi isotopes, with Z value just above the magic number 82, at neutron number $N = 112$ (^{195}Bi). $\pi h_{9/2}$ and $\pi i_{13/2}$ orbitals are the intruder orbital for Tl nuclei. In our study, we have established rotational band structures based on intruder $\pi h_{9/2}$ orbital in odd- A and odd-odd Tl isotopes. The intruder $\pi i_{13/2}$ orbital was also identified in ^{197}Tl . Moreover, magnetic rotational bands have been identified and characterized in the odd-odd nuclei ^{194}Tl and ^{198}Bi nuclei. The $\pi h_{11/2} \otimes \nu h_{11/2}$ band has been identified and characterized for the first time in ^{134}Cs ($N=79$). In our study, we have observed a change in the structure of the band built on this unique parity $\pi h_{11/2} \otimes \nu h_{11/2}$ orbitals in ^{134}Cs compared to its lighter odd-odd isotopes while approaching the neutron magic number. The principal axis cranking and the tilted axis cranking calculations have been performed for these nuclei to understand the different band structures in these nuclei. These calculations indicate a change in shape from stable triaxiality to gamma-soft in Cs isotopes at $N = 79$ which seems to be responsible for the change in the above band structure.

The experiments were carried out using INGA (Indian National Gamma Array) detector array. INGA consisted of 24 clover HPGe detectors. This array is being used phase-wise manner among the three heavy ion accelerator centers (VECC, Kolkata, TIFR, Mumbai, and IUAC, Delhi) in India. At the time of the above experiments, 15 clovers were there in the INGA array. Moreover, a small setup consisting of a clover HPGe, large volume (50%) single crystal HPGe and LEPS HPGe detectors, at VECC, Kolkata were also used to study the spectroscopy of ^{197}Tl using the alpha beam. LEPS detectors were used to detect low-energy transitions. The level schemes were constructed from the analysis of

- γ - γ Matrices and γ - γ - γ cubes.
- The DCO ratio and Polarization measurements have been done for spin-parity (J^π) assignments of the levels.

Apart from the thesis work, I have also participated in various other experiments done by various other groups including the charged particle experiments.

Research Experience at abroad:

1) Argonne National Laboratory, USA:

I have visited the Physics Division at Argonne National Laboratory during the period **August 12 – September 24, 2012**, as a part of the APS-IUSSTF Physics Student visitation program (**award**). During my stay, I have worked under the supervision of **Dr. Robert V.F. Janssens**. During this visit, I worked on the **digital data acquisition system for the Gammasphere**. First of all, I have checked the energy resolution and timing of the HPGe detector with the data from the ^{60}Co source for different leading-edge thresholds. An analysis is performed for four microseconds of integrating time. It has been observed that energy and time resolution becomes poor for a higher threshold. I have also carried out the same exercise for two microseconds integrating times. It has also been observed that energy resolution and timing become improved when the smoothness of the baseline of trace increases. As a result of these investigations, proper settings for the optimal operation of the device were determined. Apart from this work, I had also started analysis of Gammasphere + FMA data.

2) IPN Orsay, France:

I was involved in an experiment with ISOL type beam. Mainly in this time, we have been able to study beta delayed neutron of neutron-rich $^{83,84}\text{Ga}$ and the structure of these nuclei.

3) High-Intensity gamma-ray Source (HIγS) at Triangle Universities Nuclear Laboratory (TUNL), Duke, in Durham, NC, USA:

I visited the High-Intensity gamma-ray Source (HIγS) facility at Triangle Universities Nuclear Laboratory during the period of January 28 – to February 27, 2015. Mainly in this time, we have performed parity measurements of $^{50,54}\text{Cr}$, ^{50}Ti , and ^{54}Fe and a “scissors mode” study of ^{150}Sm .

4) ILL, Grenoble, France (October 2015):

I was involved in an experiment using the ILL nuclear reactor. We have measured the beta decay of ^{96}Y and ^{136}I to measure the branching ratio of the E1 state (Pygmy state).

Brief summary of Postdoctoral work:

As a part of my postdoctoral work I studied Low-lying electric and magnetic dipole strengths ($E1$ and $M1$, respectively) of atomic nuclei through nuclear resonance fluorescence (NRF) measurement, using bremsstrahlung at the superconducting Darmstadt linear electron accelerator S-DALINAC. Low-lying electric and magnetic dipole strengths ($E1$ and $M1$, respectively) of atomic nuclei have drawn considerable attention in the last decade. The concentration of $E1$ strength below or in the vicinity of the particle separation energy is usually denoted as pygmy dipole resonance (PDR), whose structure is currently under debate. Polarization of dipole transitions is measured at High-Intensity gamma-ray Source (HIγS) at Triangle Universities Nuclear Laboratory (TUNL) in Durham, NC, USA. The results of dipole strengths of $^{50, 52, 54}\text{Cr}$ have been published in Physical Review C. On the other, hand I was actively involved in PreSPEC-AGATA experiment campaigns at GSI and analyzed relativistic Coulomb excitation of ^{208}Po data set from these campaigns.

Research activity as a Ramanujan fellow:

My research activities were following.

- Two experiments have been performed at TIFR (the high spin structure of ^{142}Tb (**chirality**)) and VECC (low spin structure of ^{114}Te (**gamma band**)) respectively, as a principal investigator (**PI**). Another beamtime has been approved at IUAC, Delhi (as a **PI**) to study the structural phenomena (**magnetic rotational band**) of ^{202}Bi with increasing angular momentum using the INGA.
- Development of Recoil Filter type Detector to study the nuclear structure phenomenon of heavy and light nuclei produced in fusion-evaporation reactions using INGA array. In this context characterization of low-cost (~ 5 euro) BPW21 Si Photodiode had been carried out. It was found that BPW21 can be used for the detection of charged particles such as alpha particles, fission fragments, and beta particles.
- **One Ph. D student (Dr. Prithwijita Ray) was trained by me.**
- **Facility for Research in Experimental Nuclear Astrophysics (FRENA):**

In the first phase of the project a low energy high current accelerator was installed, the infrastructure of which was under development at that time on the SINP campus. Periodic supervision of the progress of work along with the commissioning of various service facilities required for the running of the machine has been looked after by FRENA Working Group (FWG). Being a member of FWG, I was involved in the fabrication and installation of some of the items which are necessary for the machine installation. In the second phase, planning is in progress for the utilization of the high current beam from the FRENA machine. Among the various proposals, I was particularly interested to study the astrophysical gamma process responsible for the production of p-nuclei in a stellar environment. My aim was to prepare a setup for studying these P nuclei through the angular distribution method and I was working on it.

Current responsibility:

Presently, I am working on The Extreme Light Infrastructure Silicon Strip Array (ELISSA) which is a new silicon-strip detector array under construction at ELI-NP. Several reactions important for the astrophysical p-process, Big Bang Nucleosynthesis and supernova explosion have been selected for the first measurement campaigns.

Teaching Experience:

- a) I taught advanced, nuclear practical classes of under Graduates students at the Technische Universität Darmstadt, Germany.
- b) Experimental methods and techniques in the nuclear experiment course were taught by me in the Post MSc class of SINP, Kolkata.

Reviewer of international journal: Europhysics Letters (EPL), Vacuum

Jury members for selecting the best presentations/posters:

India International Science Festival (IISF 2019) from November 5-8, 2019 at Kolkata.

Schools and Conferences Attended:

- Quark Matter – 2008, Jaipur, Rajasthan. – February.
- Workshop on Cyclotrons: “Rising Expectations and Mounting Challenges”, VECC, Kolkata. - June 25 - 26, 2008.
- SERC School, IUAC, New Delhi, India - September 1 - 20, 2008.
- FIG09 TIFR, Mumbai India - March 2 - 4, 2009.
- School cum Workshop on “NUCLEAR YRAST AND NEAR YRAST STATES”, IIT, Roorkee, India - October 26 - 30, 2009.
- International Symposium on nuclear physics, BARC, Mumbai, India - December 8 - 12, 2009.
- Physics with FAIR: "Indian Perspective", VECC, Kolkata - March 8 - 10, 2010.
- “NUCLEAR STRUCTURE AND DECAY DATA: THEORY AND EVALUATION”. ICTP, Italy - 11-15 October 2010.
- NNCAFE-2010: VECC, KOLKATA - December 16 - 17, 2010.
- “DAE Symposium on Nuclear Physics”, BITS, PILANI - December 20 - 24, 2010.

- “Research Scholars Workshop”, UGC-DAE CSR, KC, Jadavpur University Salt Lake Campus - January 6-7, 2011.
- National Workshop on “NUCLEAR PHYSICS USING ION BEAMS FROM CYCLOTRONS at VECC” - August 24 – 26, 2011.
- School cum Workshop on ANUP at Goa – November 07-18, 2011.
- “DAE Symposium on Nuclear Physics”, Andhra University, Visakhapatnam - December 26 - 30, 2011.
- “Frontiers in Gamma-Ray Spectroscopy - 2012”, New Delhi, March 5th - 7th, 2012.
- “Workshop on Nuclear Structure Studies with INGA at VECC using light ion beams”, VECC, Kolkata, 2012, May 22-23.
- “Nuclear Structure 2012 (NS12)”, Argonne National Laboratory, August 13-17, 2012.
- “Nustar Week 2012”, Variable Energy Cyclotron Centre, 8-12 October 2012.
- “Nuclear Structure Week”, Institut für Kernphysik, Technische Universität Darmstadt, Germany, 9-12 April 2013.
- DPG Meeting, Frankfurt, Germany, 17-21 March 2014.
- EGAN workshop, GSI Darmstadt, Germany, on June 23-26, 2014.
- Nustar annual meeting 2015, GSI Darmstadt, Germany, on March 2-6, 2015.
- DPG Meeting, Heidelberg, Germany, 23-27 March 2015.
- CRC meeting, TUD Darmstadt, 8-12 June 2015.
- DPG Meeting, TUD Darmstadt, 14-18 March 2016.
- “DAE Symposium on Nuclear Physics”, SINP, Kolkata, India - December 5 - 9, 2016
- “DAE Symposium on Nuclear Physics”, Thapar University, Punjab, India - December 20 - 24, 2017.
- SLENA 2020, School cum Workshop in Low Energy Nuclear Astrophysics, SAHA INSTITUTE OF NUCLEAR PHYSICS, KOLKATA, INDIA, 10-14 February 2020.

Invited talk delivered in Symposium/Conference

1. “Nuclear Resonance Fluorescence of Cr isotopes: Onset of the Pygmy Dipole Resonance”. 22/12/2017, DAE-BRNS Symposium on Nuclear Physics, Thapar University.

2. **“Nuclear experiment using gamma-ray spectroscopy”**. 18/02/2020, Recent Trends in Physics, Bankura University, Bankura, West Bengal, India.

3. **“Study of low-lying dipole strength through nuclear resonance fluorescence”**. 9th September 2021, Workshop on Nuclear Photonics and Research Opportunities at ELI-NP, IIT Ropar, Punjab, India.

Talks delivered:

1) **“Experimental Study of nuclear structure near $Z = 82$ and $N=82$ shell closures”**. 22/09/2009, Physics Group Seminar, VECC.

2) **“Generation of angular momentum by different modes of excitation in near-spherical nuclei”**. 29/09/2010, Physics Group Seminar, VECC.

3) **“Study of nuclear structure near $Z = 82$ and $N=82$ shell closures”**. 07/01/2011, at UGC-DAE CSR, KC, Jadavpur University Salt Lake Campus (Reserach Scholars Workshop).

4) **“Gamma-spectroscopy of ^{197}Tl with alpha beam”**. August 24 – 26, 2011.

National Workshop on “NUCLEAR PHYSICS USING ION BEAMS FROM CYCLOTRONS at VECC”.

5) **“Coexistence of different band structures in odd-odd ^{194}Tl ”**, “DAE Symposium on Nuclear Physics”, Andhra University, Visakhapatnam - December 26 - 30, 2011.

6) **“High spin structure of nuclei near $N, Z = 82$ shell closures”**, University of Cologne, Germany, 27-04-2012.

7) **“Study of nuclear structure near the $Z = 82$ and $N = 82$ shell closures”**, GANIL, France, 02-05-2012.

8) **“Nuclear Structure Studies in the Vicinity of $Z = 82$ and $N = 82$ Shell Closures”**, IPN Orsay, France, 04-05-2012.

9) **“Study of band structures in nuclei near $N, Z = 82$ shell closures”**, K.U.Leuven, Belgium, 08-05-2012.

10) **“Probing the nuclear structure near the $Z = 82$ and $N = 82$ shell closures”**, University of Valencia, Instituto de Fisica Corpuscular, Spain, 10-05-2012.

11) **“Band structures of nuclei near $N, Z = 82$ shell closures”**, University of Notre Dame, Notre Dame, IN 46556, USA, 10-09-2012.

12) **“Experimental study of nuclear structure in the vicinity of $Z = 82$ and $N = 82$ Shell Closures”**, Physics Division, Argonne National Laboratory, USA, 21-09-2012.

13) **“Low-lying dipole strength in the $N = 28$ shell-closure nucleus ^{52}Cr ”**, DPG Meeting, Frankfurt, Germany, 17-03-2014.

- 14) “Investigation of Low-lying dipole strength in the $N = 28$ shell-closure nucleus ^{52}Cr ”, TIFR, India, 14-10-2014.
- 15) “Study of Low-lying dipole strength through NRF in the $N = 28$ shell-closure nucleus ^{52}Cr and recent PreSPEC-AGATA campaign at GSI”, IIT-Ropar, India, 16-10-2014.
- 16) “Study of Low-lying dipole strength via real photon scattering in the $N = 28$ shell-closure nucleus ^{52}Cr and recent PreSPEC-AGATA campaign at GSI”, VECC-Kolkata, India, 21-10-2014.
- 17) “Low-lying dipole strengths of ^{50}Cr ”, DPG Meeting, Heidelberg, Germany, 24-03-2015.
- 18) “Study of low-lying dipole strength in the mass 50 region”, TIFR, India, 03-08-2015.
- 19) “Study of nuclear structure near the $Z = 82$ and $N = 82$ shell”, TIFR, India, 04-08-2015.
- 20) “Study of Low-lying dipole strength in the ^{50}Cr and ^{52}Cr ”, BARC, India, 06-08-2015.
- 21) “Low-lying dipole strengths of $^{54,50}\text{Cr}$ ”, DPG Meeting, TUD, Darmstadt, Germany, 15-03-2016.
- 22) “Study of Low-lying dipole strength in Cr isotopes”, SINP, Kolkata, India, 24-11-2016.
- 23) “Study of structural phenomena with increasing angular momentum in ^{202}Bi ”, IUAC, Delhi, India, 18-12-2016.
- 24) “Study of structural evolution with increasing angular momentum in ^{142}Tb ”, TIFR, Mumbai, India, 10-06-2017.
- 25) “Nuclear structure studies in the mass $A \sim 140$ region and the upcoming FRENA facility”, University of Cologne, Germany, 10-07-2017.

Scientific visits (short):

- ❖ GSI, Germany.
- ❖ University of Cologne, Germany.
- ❖ GANIL, France.
- ❖ IPN Orsay, France.
- ❖ K.U.Leuven, Belgium.
- ❖ University of Valencia, Instituto de Fisica Corpuscular, Spain.
- ❖ University of Notre Dame, USA.
- ❖ Argonne National Laboratory, USA.
- ❖ ILL, Grenoble, France.

List of Publication:

Five major publications:

- 1) **H. Pai**, G. Mukherjee, A. Raghav, R. Palit, C. Bhattacharya, S. Chanda, T. Bhattacharjee, S. Bhattacharyya, S.K. Basu, A. Goswami, P.K. Joshi, B.S. Naidu, Sushil K. Sharma, A.Y. Deo, Z. Naik, R.K. Bhowmik, S. Muralithar, R.P. Singh, S. Kumar, S. Sihotra, and D. Mehta: “**Structural change of the unique-parity $\pi h_{11/2} \otimes \nu h_{11/2}$ configuration in ^{134}Cs** ”, **Phys. Rev. C 84, 041301 (R) (2011)**.
- 2) **H. Pai**, G. Mukherjee, R. Raut, S.K. Basu, A. Goswami, S. Chanda, T. Bhattacharjee, S. Bhattacharyya, C. Bhattacharya, S. Bhattacharya, S.R. Banerjee, S. Kundu, K. Banerjee, A. Dey, T.K. Rana, J.K. Meena, D. Gupta, S. Mukhopadhyay, Srijit Bhattacharya, Sudeb Bhattacharya, S. Ganguly, R. Kshetri, and M.K. Pradhan: “**Onset of deformation at $N = 112$ in Bi nuclei**”, **Phys. Rev. C 85, 064317 (2012)**.
- 3) **H. Pai**, J. Beller, N. Benouaret, J. Enders, T. Hartmann, O. Karg, P. von Neumann-Cosel, N. Pietralla, V. Yu. Ponomarev, C. Romig, M. Scheck, L. Schnorrenberger, S. Volz, and M. Zweidinger: “**Low-lying dipole strength in the $N=28$ shell-closure nucleus ^{52}Cr** ”, **Phys. Rev. C 88, 054316 (2013)**.
- 4) **H. Pai**, T. Beck, J. Beller, R. Beyer, M. Bhike, V. Derya, U. Gayer, J. Isaak, Krishichayan, J. Kvasil, B. L’oher, V. O. Nesterenko, N. Pietralla, G. Mart’inez-Pinedo, L. Mertes, V. Yu. Ponomarev, P.-G. Reinhard, A. Repko, P. C. Ries, C. Romig, D. Savran, R. Schwengner, W. Tornow, V. Werner, J. Wilhelmy, A. Zilges, and M. Zweidinger: “**Magnetic dipole excitations of ^{50}Cr** ”, **Phys. Rev. C 93, 014318 (2016)**.
- 5) **H. Pai**, Rajkumar Santra, Sujib Chatterjee, Dwijendra Das, Subinit Roy: “**Charged particle detection with the low-cost BPW21 Si Photodiode**”, **Nuclear Inst. and Methods in Physics Research, A 955 163363 (2020)**.

- **In refereed journals**

1) **H. Pai**, G. Mukherjee, A. Raghav, R. Palit, C. Bhattacharya, S. Chanda, T. Bhattacharjee, S. Bhattacharyya, S.K. Basu, A. Goswami, P.K. Joshi, B.S. Naidu, Sushil K. Sharma, A.Y. Deo, Z. Naik, R.K. Bhowmik, S. Muralithar, R.P. Singh, S. Kumar, S. Sihotra, and D. Mehta: “**Structural change of the unique-parity $\pi h_{11/2} \otimes \nu h_{11/2}$ configuration in ^{134}Cs** ”, **Phys. Rev. C** **84**, 041301 (R) (2011).

2) T. K. Rana, C. Bhattacharya, S. Kundu, K. Banerjee, S. Bhattacharya, G. Mukherjee, T. K. Ghosh, J. K. Meena, P. Dhara, M. Biswas, **H. Pai**, K. Mahata, Suresh Kumar, K. Ramachandran, P. C. Rout, S. K. Pandit, V. Nanal, R. G. Pillay: “**Cluster emission in $^{13}\text{C} + ^{12}\text{C}$ and $^{12}\text{C} + ^{12}\text{C}$ reactions at ~ 6 MeV/ Nucleon**”, **International Journal of Modern Physics E** vol. **20**, No. **789** (2011).

3) **H. Pai**, G. Mukherjee, S. Bhattacharyya, M.R. Gohil, T. Bhattacharjee, C. Bhattacharya, R. Palit, S. Saha, J. Sethi, T. Trivedi, Shital Thakur, B.S. Naidu, S.K. Jadav, R. Donthi, A.Goswami and S. Chanda: “**High spin band structures in doubly-odd ^{194}Tl** ”, **Phys. Rev. C** **85**, 064313 (2012).

4) **H. Pai**, G. Mukherjee, R. Raut, S.K. Basu, A. Goswami, S. Chanda, T. Bhattacharjee, S. Bhattacharyya, C. Bhattacharya, S. Bhattacharya, S.R. Banerjee, S. Kundu, K. Banerjee, A. Dey, T.K. Rana, J.K. Meena, D. Gupta, S. Mukhopadhyay, Srijit Bhattacharya, Sudeb Bhattacharya, S. Ganguly, R. Kshetri, and M.K. Pradhan: “**Onset of deformation at $N = 112$ in Bi nuclei**”, **Phys. Rev. C** **85**, 064317 (2012).

5) M. Gohil, K.Banerjee, S.Bhattacharya, C.Bhattacharya, S.Kundu, T.K.Rana, G.Mukherjee, J.K.Meena, R. Pandey, **H. Pai**, T.K.Ghosh, A.Dey, S.Mukhopadhyay, D.Pandit, S.Pal, S.R.Banerjee, T. Bandhopadhyay: “**Measurement and simulation of neutron response function of organic liquid scintillator detector**”, **Nucl. Instrum. Meth. Phys. Res. A** **664**, 304 (2012).

- 6) S. Mukhopadhyay, Deepak Pandit, Surajit Pal, Srijit Bhattacharya, A. De, S. Bhattacharya, C. Bhattacharya, K. Banerjee, S. Kundu, T.K. Rana, G. Mukherjee, R. Pandey, M. Gohil, **H. Pai**, J.K. Meena and S.R. Banerjee: “**Measurement of giant dipole resonance width at low temperature: A new experimental perspective**”, *Physics Letters B* **709**, 9 (2012).
- 7) S. Kundu, C. Bhattacharya, K. Banerjee, T. K. Rana, S. Bhattacharya, A. Dey, T. K. Ghosh, G. Mukherjee, J. K. Meena, P. Mali, S. Mukhopadhyay, D. Pandit, **H. Pai**, S. R. Banerjee, and D. Gupta P. Banerjee, Suresh Kumar, A. Shrivastava, A. Chatterjee, K. Ramachandran, K. Mahata, S. Pandit and S. Santra: “**Complex-fragment emission in low-energy light-ion reactions**”, *Phys. Rev. C* **85**, 064607 (2012).
- 8) K. Banerjee, S. Bhattacharya, C. Bhattacharya, M. Gohil, S. Kundu, T. K. Rana, G. Mukherjee, R. Pandey, P. Roy, **H. Pai**, A. Dey, T. K. Ghosh, J. K. Meena, S. Mukhopadhyay, D. Pandit, S. Pal and S. R. Banerjee: “**Variation of nuclear level density with angular momentum**”, *Phys. Rev. C* **85**, 064310 (2012).
- 9) Aparajita. Dey, S. Kundu, T. K. Rana, K. Banerjee, C. Bhattacharya, M. Biswas, T. K. Ghosh **H. Pai**, G. Mukherjee, J. K. Meena, D. Gupta, S. Bhattacharya, S. Mukhopadhyay, D. Pandit, S. R. Banerjee, Suresh. Kumar, A. Chatterjee, K. Ramachandran, K. Mahata, S. Santra and S. Pandit: “**Study of the 1p transfer channel in the $^{12}\text{C} + ^{27}\text{Al}$ reaction at 6 –7 MeV per nucleon**”, *Phys. Scr.* **T150** (2012) 014011.
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