



# Evaluative Report of Saha Institute of Nuclear Physics

## 1. Name of the CI

Saha Institute of Nuclear Physics (SINP), Kolkata

## 2. Year of establishment

Please see para 6 of the 'Profile'.

## 3. Is the CI part of the university

Yes

## 4. Names of programmes offered

SINP offers Ph.D. in Chemical Sciences, Physical Sciences and Life Sciences.

Please also see Appendix 1 of the profile.

## 5. Interdisciplinary programmes

SINP encourages several interdisciplinary research: students trained in particle physics are working in areas of astrophysics, students trained in nuclear physics are working in areas like astrophysics and high energy physics, students from chemical and physical sciences are carrying out multi disciplinary research in bio-physics.

## 6. Courses in collaboration with other universities, industries, foreign institutions, etc.

Doctoral students can work under joint supervision of two guides, where one guide is from SINP and the other one from any of the collaborating institutions with whom HBNI has a formal MoU. In addition, students can also attend credit courses offered at collaborating institutions. For a list of collaborating institutions, please see Para 2.4.10 of 'Criteria-wise Inputs'. In addition, SINP has a MoU with the University of Calcutta.

## 7. Details of programmes discontinued, if any, with reasons



NIL

**8. Examination System**

Semester system

**9. Participation of the department in the courses offered by other departments**

SINP has no rigid boundaries. Students can participate in activities of other disciplines as well.

**10. Number of teaching posts sanctioned, filled and actual (Professors/Associate Professors/ Asst. Professors/ Others)**

Please see para 24 of the Profile.

**11. Faculty profile with name, qualification, designation, area of specialization, experience and research under guidance**

Please see Appendix 1.

**12. List of senior Visiting Fellows, adjunct faculty, emeritus professors**

Please see para 26 of the 'Profile'.

**13. Percentage of classes taken by temporary faculty – programme-wise information :**

NIL

**14. Programme-wise Student Teacher Ratio :**

Varies from 5:1 to 1:1 at various doctoral level courses. For doctoral programmes, the norm of maximum 8 students per faculty is strictly followed.

**15. Number of academic support staff (technical) and administrative staff: sanctioned, filled and actual**

Please see para 24 of the 'Profile'.



## 16. Research thrust areas as recognized by major funding agencies

SINP is engaged in basic and applied research in various areas, such as particle physics, physics of quark-gluon-plasma, nuclear physics, astroparticle physics, cosmology, classical and quantum gravity, string theories, mathematical physics, quantum field theories, various areas of statistical and condensed matter physics, material sciences, surface physics, atomic and plasma physics. In addition, development of detectors for various physics experiments and radiation-based imaging are also being pursued. Some major national and international collaborations are going on in several important experiments of neutrino physics, dark matter search, synthesis of elements, particle physics, material sciences, etc.

In the domain of experimental high energy physics, SINP plays a key role in the ALICE and CMS collaborations of the Large Hadron Collider, CERN. Currently, the 1.1 Million readout channels of the Muon Spectrometer of ALICE are being successfully readout for p-p collisions using the MANAS chip which has been developed in the Institute. Through CMS collaboration, SINP plays a significant role in analyzing the Higgs' data.

SINP is engaged in research in many theoretical and experimental branches of biophysical sciences. Pioneering work on microscopic characterization of infectious microorganisms, cellular architectures and radiation biology are being carried out. Research in various fields of structural biology and spectroscopy has been initiated to understand the interactions of biologically important molecules. Scientists are now actively involved in interdisciplinary areas of basic and clinical research, like proteomics, biomolecular recognition, chemical and structural biology *in silico* and synthetic biology.

SINP is also engaged in research encompassing different areas in chemical sciences. These include i) excited state dynamics using ultra-fast spectroscopy, ii) finding new functions for old drugs: Non Steroidal Anti-inflammatory Drugs (NSAIDs), iii) applications of conducting polymer based nanomaterials in biosensing and in developing energy storage devices, iv) single molecule and ensemble spectroscopic studies of protein folding, misfolding and aggregation, v) nuclear chemistry, radiochemistry and green chemistry and vi) neutron interaction, nanoparticle dosimetry and radiation safety. In addition, the division has recently expanded its activity in the areas of single molecular spectroscopic/microscopic



investigation of complex cellular processes as well as in the gas phase molecular beam spectroscopy/dynamics of the isolated molecules/their clusters to get good testing grounds in resolving many of the complexities found in larger complex molecular network.

Funding in all these areas of R&D activities is provided by the Department of Atomic Energy.

For more details, please see para 3.1 of the 'Criteria-wise Inputs'.

**17. Number of faculty with ongoing projects from a) national b) international funding agencies and c) Total grants received. Give the names of the funding agencies, project title and grants received project-wise.**

Full funding is received from the Department of Atomic Energy and all the faculties are involved in one or more projects. Details of ongoing projects and grants for SINP put together are given in Appendix 2.

**18. Inter-institutional collaborative projects and associated grants received**

Apart from collaborations with the other CIs of HBNI, SINP is associated with several national and international projects with a large number of research institutions/ universities.

National collaboration:

- Aligarh Muslim University
- Variable Energy Cyclotron Centre
- Inter University Accelerator Centre (INGA)
- Tata Institute of Fundamental Research
- Indian Institute of Science
- Jawaharlal Nehru Center for Advanced Scientific Research
- National Chemical Laboratory
- Indian Statistical Institute, Calcutta

International collaboration:

- CERN - ALICE at LHC
- CERN - CMS at LHC
- Universite Laval, Canada
- SNOLAB, Canada
- Universite du Maine, France
- Drecam, CEA, France



- European Synchrotron Radiation Facility, France
- Institut Laue-Langevin, France
- CBM at FAIR GSI
- Fakultat für Physik, Universität Bielefeld, Germany
- Ernst Moritz Arndt Universität Greifswald, Germany
- Hahn-Meitner Institut, Germany
- Institute of Physics, University of Potsdam, Germany
- Max Planck Institute for Metals Research, Germany
- Università di Padova, Italy
- Tokyo Institute of Technology, Japan
- Nagoya Institute of Technology, Japan
- University of Tokyo, Japan
- Rutherford Appleton Laboratory, UK
- Brookhaven National Laboratory, USA
- Argonne National Laboratory, USA
- North-western University, USA

**19. Projects funded by DST-FIST; UGC-SAP/CAS, DPE; DBT, ICSSR, AICTE, etc.; total grants received.**

Nil.

**20. Research facility / centre with**

- **state recognition**
- **national recognition**
- **international recognition**

While SINP, does not have a formal recognition as a centre of excellence, there are several state-of-the-art equipments / facilities in SINP required for carrying out frontline research in many areas of physics and biophysical sciences.

**21. Special research laboratories sponsored by / created by industry or corporate bodies**

HBNI is essentially a research university and research output of HBNI is deployed in industrial units and PSU of the DAE. Many technologies are transferred by SINP to outside entities through a well established technology transfer mechanism. One can thus say that all research laboratories in SINP are sponsored by the government for the purpose of deployment in the industry.

**22. Publications**



Please see para 3.3 of the 'Criteria-wise inputs'.

### **23. Details of patents**

A number of inventions have been patented. Please see Appendix 3 for a list.

### **24. Areas of consultancy and income generated**

Not Applicable. Please see para 3.4 of the 'Criteria-wise Inputs'.

### **25. Faculty selected nationally / internationally to visit other laboratories/ institutions/ industries in India and abroad**

Visits within India are numerous and are not listed. For visits abroad, please see Appendix 4.

### **26. Faculty serving in**

- a) **National committees** b) **International committees** c) **Editorial Boards** d) **any other (please specify)**

Please see Appendix 3 of the 'Criteria-wise Inputs'.

### **27. Faculty recharging strategies (UGC, ASC, Refresher / orientation programs, workshops, training programs and similar programs).**

HBNI encourages faculty to participate in and organise national and international workshop and conferences, go to universities abroad for post doctoral fellowships and short term research assignments, participate in collaborative projects with universities in India funded by BRNS, participate in collaborative projects with laboratories abroad under various MOUs. All this helps to recharge the faculty.

### **28. Student projects :**

- **percentage of students who have done in-house projects: 100%**
- **percentage of students doing projects in collaboration with other universities/ industry/ institute: 0%.**

Situation in HBNI-SINP is reverse of what is prevalent in other universities. A large number of UG and PG students from other



universities carry out course / project work and summer project work at SINP.

**29. Awards / recognitions received at the national and international level by**

- Faculty
- Doctoral / post doctoral fellows
- Students

Please see Appendix 1 of the 'Criteria-wise Inputs'.

**30. Seminars/ Conferences/ Workshops organized and the source of funding (national/ international) with details of outstanding participants, if any.**

Please see Appendix 5.

**31. Code of ethics for research followed by SINP**

In addition to excellence in Science, a strict adherence to high ethical standards is a necessity. The core ethical policy of DAE is to establish a tradition with highest ethical standards, ensuring a harmonious future for the entire humankind, where every individual can live with dignity and self-respect. In accordance with the guidelines of the DAE, adhering to highest ethical standards is one of the guiding values of sinp. Every complaint of malpractice or plagiarism received is investigated and appropriate action is taken.

**32. Student profile programme-wise**

Please see para 15 and para 28 of the 'Profile.'

**33. Diversity of students**

Please see Para 2.1 of the 'Criteria-wise Inputs'.

**34. How many students have cleared Civil Services and Defense Services examinations, NET, SET, GATE and other competitive examinations? Give details category-wise.**

Please see para 1.1.3 of the 'Criteria-wise Inputs. This question is not



applicable to HBNI.

**35. Student progression**

Students joining SINP for doctoral work, usually go for post doctoral research after completing their doctoral work and take up research as career in an University or a Research Centre in India or abroad.

**36. Diversity of staff**

Please see para 2.4.3 of the 'Criteria-wise Inputs.'

**37. Number of faculty who were awarded M.Phil., Ph.D., D.Sc. and D.Litt. during the assessment period**

Nil

**38. Present details of infrastructural facilities with regard to**

a) Library: Please see para 4.2 of the 'Criteria-wise Inputs'. The library has adequate physical facilities such as reading-rooms, repography, internet and is stocked with number of books (34972) and other library resources (i.e. CDs/ cassettes, etc.). In addition the Department of Atomic Energy (DAE) has set up a consortium to subscribe 2405 journals through Science Direct and these are available to SINP.

b) Extensive internet facilities are available to staff and students

c) Six Lecture Halls and one Auditorium (having ICT facility) are also available. ICT available consists of the hardware, software, networks and media for the collection, storage, processing, transmission and presentation of information (voice, data, text, images) as well as related services

d) Students' laboratories Yes

e) Research laboratories Yes

**39. List of doctoral, post-doctoral students and Research Associates**

Please see Appendix 6.





**40. Number of post graduate students getting financial assistance from the university.**

All students perusing their Ph.D. programme get financial assistance from SINP.

**41. Was any need assessment exercise undertaken before the development of new programme(s)? If so, highlight the methodology.**

Please see para 1.1.2 of the 'Criteria-wise Inputs.

**42. Does SINP obtain feedback from**

- a. faculty on curriculum as well as teaching-learning-evaluation? If yes, how does SINP utilize the feedback?
- b. students on staff, curriculum and teaching-learning-evaluation and how does SINP utilize the feedback?
- c. alumni and employers on the programmes offered and how does SINP utilize the feedback?

Obtaining feedbacks from faculty, alumni and employees is a continuous process. Feedbacks from students is obtained once a year at the end of the academic session. All feedbacks received are analysed and fed to a committee for deliberation and decision. Introduction of new programmes and changes in syllabus are decided as needed.

**43. List the distinguished alumni of the CI (maximum 10)**

The list below includes those, who received a Ph.D. based on the work done at SINP, but prior to the setting up of HBNI.

Sl. No	Name
1.	Prof. Manoj Kumar Pal, Ex Director, SINP, FNA
2.	Prof. Ramendra Kumar Poddar, Ex Vice Chancellor, Univ of Calcutta
3.	Prof. Avinash Khare, Ex Prof, Inst of Phys, Bhubaneswar, FNA
4.	Prof. Chanchal K Dashupta, Ex Prof, Univ of Calcutta, FNA
5.	Prof. S N Chatterjee, Ex Prof, SINP, FNA
6.	Prof. A P Patro, First Director, Inter Univ Accel Centre
7.	Prof. Bikash K Chakrabarti, Director, SINP, FNA
8.	Prof. Subhrangshu Sekhar Manna, Prof. S N Bose Centre, Kolkata
9.	Prof. Subrata Pal, Prof. TIFR, Mumbai
10.	Prof. Jaydeep Basu, Prof. IISc, Bangalore



**44. Give details of student enrichment programmes (special lectures/ workshops/ seminars) involving external experts.**

SINP regularly invites eminent national and international experts to give seminars in their field of specializations.

**45. List the teaching methods adopted by the faculty for different programmes.**

Besides standard class room teaching, interaction through discussions in laboratories.

**46. How does SINP ensure that programme objectives are constantly met and learning outcomes are monitored?**

Quality of theses produced by doctoral students is demonstrated by comprehensive research abilities acquired by students. Invariably number of publications in peer reviewed journals coming out of a thesis varies from one to several as can be seen from previous annual reports. After their completion of PhD work students are generally selected for employment (including as INSPIRE faculty) in several national laboratories, universities or industry in India or abroad.

**47. Highlight the participation of students and faculty in extension activities.**

Please see para 3.5 of the 'Criteria-wise Inputs'. Further, faculty and students at SINP pursue various extension activities in the form of 'public outreach programme', 'project training programme' and 'young scientists' research programme'.

As a part of SINP public outreach programme, visits are arranged to SINP by students and faculty of colleges and schools. These visits are carefully planned keeping in mind the visiting group's level and interest. The aim is to induce students to take up a career in science within the country by giving an overview of the research going on at SINP and excitement in science research. SINP members teach regularly in neighbouring universities like the university of Calcutta, Jadavpur university, etc.

**48. Give details of "beyond syllabus scholarly activities".**



The faculty is continuously engaged in research necessary for meeting the mandate of the Department. A significant percentage of this engagement is scholarly and results in good publications in peer reviewed journals. The students and faculty give lectures very frequently in various fora like national and international symposia, workshops, awareness programmes and colloquia. They interact on a regular basis with scientists and technologists of repute from the country and from abroad. They organise high level knowledge dissemination activities like organization of advanced schools under the aegis of BRNS/ DST and other similar bodies. Specially designed courses are also conducted.

The details of the special courses conducted are given below.

**49. State whether the programme/ CI is accredited/ graded by other agencies? If yes, give details.**

Yes, by UGC

**50. Briefly highlight the contributions of SINP in generating new knowledge, basic or applied.**

Due to a very large volume of very high quality basic and applied research being carried out by the faculty and the students, the research output is excellent and this gets documented in the form of publications in international journals, patents and reports. On a yearly average about 15 theses are awarded for Ph.D. Degree and about 350 papers get published in peer reviewed Journals. About 30 students are enrolled yearly at SINP through a nation-wide test and interviews. A brief description of some important scientific and technological developments is provided below.

Life Sciences: Consists of about 25 faculty members and 60 Ph.D. students and research associates distributed over 4 Divisions – Biophysics & Structural Genomics, Computational Sciences, Crystallography & Molecular Biology and Chemical Sciences.

Physical Sciences: The activities in physical sciences can be divided into three groups:

Theoretical Physics group: Consists of about 21 academic members and



35 Ph.D. students & research associates, they are distributed over 2 Divisions – Theory and Astroparticle Physics & Cosmology, the latter division has two more academic members doing experiments in Astroparticle Physics.

Experimental Nuclear, Particle & Plasma Physics group: consisting of about 29 academic members and 42 Ph.D. students and research associates, distributed over 5 Divisions – Nuclear Physics, Applied Nuclear Physics, High Energy Nuclear & Particle Physics and Astroparticle Physics & Cosmology and Plasma physics.

Condensed Matter Physics group: consisting of about 32 faculty members and 70 Ph.D. students and research associates distributed over 2 Divisions – Condensed Matter Physics and Surface Physics & Material Science.

## **51. Detail five major Strengths, Weaknesses, Opportunities and Challenges (SWOC) of SINP**

### **Strengths**

1. The quality of students is very good because of very rigorous selection process adopted. Since a vast majority of the students are recruited through a tough selection process, a very high level of research output is ensured. This is contrary to the general trend seen elsewhere where students not finding employment are taking up research.
2. After a tough selection, the training imparted to the students is of very high standard.
3. The quality of research and infrastructural facilities available are very good.
4. The funding is generous.
5. Besides the students, the faculty profile is very strong, nationally and internationally known and there is a very strong peer pressure on students and faculties to do better.

### **Weaknesses:**

1. Ensuring very high quality sometimes leads to a low number of students in some of the disciplines.
2. The embargo on supply of some items has resulted in lack of some of the sophisticated analytical equipment. This results in delays in



research as alternate equipment has to be developed or innovative techniques have to be used for getting results.

3. Doctoral programme in engineering sciences has started expanding only in recent years. Faculty look at themselves as scientists first and give lower priority to mentoring students. This is expected to improve over the years as faculty takes more and more students.

### **Opportunities**

1. Opportunity to do high level research having immediate application in national programmes.
2. Opportunity to interact with scientist at national level and international level.
3. Opportunity to get various forms of national and international recognitions in the form of fellowships and awards.
4. Opportunity to develop various types of skills.
5. Opportunity to do interdisciplinary research.

### **Challenges**

1. To balance various types of responsibilities for the faculty.
2. To balance between various types of responsibilities for the employees enrolled as students.
3. To publish results of research on strategic topics without compromising classified nature of information.
4. To ensure superiority in quality of research while doing doctoral research on large scale set ups.

### **52. Future plans of the SINP.**

Expand the doctoral programme so as to utilise the full potential of the faculties and research infrastructure. Particular emphasis will be given to develop qualified human resources required for the rapidly developing fields of high energy particle accelerators and lasers in the country for energy, medical and industrial applications.



**List of appendices** (to be made available to the assessment team during their visit)

1. SINP: Appendix 1: Faculty profile referred to at para 11.
2. SINP: Appendix 2: Ongoing projects referred to at para 17.
3. SINP: Appendix 3: List of patents referred to at para 23.
4. SINP: Appendix 4: Visits of faculties to International, Laboratories/ Institutions referred to at para 25.
5. SINP: Appendix 5: Seminar/ Meetings/ Conferences/ Colloquia referred to at para 30.
6. SINP: Appendix 6: List of doctoral students referred to at para 39.