GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
RAJYA SABHA
UNSTARRED QUESTION NO. 322
TO BE ANSWERED ON 13.12.2018

ACTIVITIES OF INSTITUTIONS RECEIVING FUNDS FROM DEPARTMENT

322. SHRI K. SOMAPRASAD:

Will the PRIME MINISTER be pleased to state:

(a) the details of institutions which received funds from the Department during 2014-15 to 2017-18;

(b) the details of achievements of such institutions during that period, institution-wise;

(c) the details of funds allocated for infrastructure developments, business done, profit earned and CSR fund spent by Indian Rare Earths Limited (IRE) Chavara, Kollam, Kerala, during those years; and

(d) the total uranium potential of our country and the quantity and percentage contribution of Kerala in it?

ANSWER

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES AND PENSIONS AND PRIME MINISTER'S OFFICE (DR.JITENDRA SINGH)

(a) Details are given in **Annex – I.**

(b) Details are given in **Annex – II**.

(c) Details of CSR fund spent by IREL at Chavara, Kollam, Kerala are as under:-

(Rs. in lakh)

Sr. No.	Particulars	2014-15	2015-16	2016-17	2017-18
1.	The details of fund allocated to business done	Nil *	Nil *	Nil *	Nil *
2.	Profit/(Loss) Before Tax-Chavara	(3407)	(6334)	(2900)	(865)
3.	Amount spent in Chavara, Kollam, Kerala towards CSR	99.42	108.77	32.08	44.11

* IREL is a Public Sector Unit, no funds are allocated to IREL for business purposes.

(d) The total Uranium potential of our country as established by Atomic Minerals Directorate for Exploration and Research, a Constituent Unit of this Department, is around three (3) lakh tonne(t). The State of Kerala has no known uranium deposit.

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Annex-I

The Aided Institutions under DAE are :

1. Tata Institute of Fundamental Research (TIFR), Mumbai
2. Tata Memorial Centre (TMC), Mumbai
3. Institute of Mathematical Sciences (IMSc), Chennai
4. National Institute of Science, Education and Research (NISER), Bhubaneswar
5. Institute for Plasma Research (IPR), Gandhinagar
6. Harish Chandra Research Institute (HRI), Allahabad
7. Institute of Physics (IoP), Bhubaneswar
8. Saha Institute of Nuclear Physics (SINP), Kolkata
9. Homi Bhabha National Institute (HBNI), Mumbai
10. Atomic Energy Education Society (AEES), Mumbai

Details of Funds allocated to the Institutions under DAE for the period from 2014-15 to 2017-18

(Rs. in Crores)

Institute	2014-15			2015-16			2016-17			2017-18		
	Plan	Non-plan	Total	Plan	Non-plan	Total	Capital	Revenue	Total	Capital	Revenue	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
TIFR	285.00	265.91	550.91	350.00	316.00	666.00	269.15	381.32	650.47	161.00	337.57	498.57
TMC	315.00	210.00	525.00	315.00	225.00	540.00	181.00	289.00	470.00	134.80	384.00	518.80
IMSc	18.00	35.33	53.33	15.00	34.00	49.00	11.05	46.41	57.46	15.99	44.50	60.49
NISER	50.00	45.45	95.45	50.00	41.00	91.00	100.00	85.64	185.64	50.00	87.64	137.64
IPR	550.00	69.23	619.23	550.00	80.00	630.00	406.72	105.46	512.18	456.94	139.02	595.96
HRI	15.00	21.86	36.86	15.00	24.00	39.00	3.56	30.15	33.71	7.70	32.80	40.50
IoP	10.00	24.68	34.68	10.00	26.00	36.00	10.30	26.81	37.11	9.00	28.96	37.96
SINP	35.00	70.28	105.28	35.00	84.00	119.00	30.00	88.51	118.51	16.57	109.11	125.68
HBNI	-	-	-	-	4.00	4.00	-	-	-	-	-	-
AEES	8.00	46.92	54.92	10.00	62.00	72.00	9.40	60.00	69.40	5.00	83.30	88.30
Total	1,286.00	789.66	2,075.66	1,350.00	896.00	2,246.00	1,021.18	1,113.30	2,134.48	857.00	1246.90	2103.10

Annex-II

The details of achievements made by each of such institutions during the last four years institution-wise details are appended below:-

Tata Institute of Fundamental Research (TIFR), Mumbai

The Tata Institute of Fundamental Research (TIFR), Mumbai, an autonomous institution under the administrative control of the Department of Atomic Energy (DAE) is engaged in fundamental research in the areas of astronomy, biology, chemical sciences, computer science, mathematics, physics and science education.

. The programmes of research were carried forward vigorously in the above fields / areas, both in the main campus in Mumbai and in the National Centre for Radio Astrophysics (NCRA), Pune; National Centre for Biological Sciences (NCBS), Bengaluru; Homi Bhabha Centre for Science Education (HBCSE), Mumbai; The Centre for Applicable Mathematics (CAM), Bengaluru; Centre for Interdisciplinary Sciences (TCIS) in Hyderabad; and the International Centre for Theoretical Sciences (ICTS), Bengaluru. TIFR is also the host institute for the multi-institutional mega science project, the India-based Neutrino Observatory (INO).

Some highlights of the work done during the following years in each of these areas of TIFR are short listed as below:

Year 2014-15

In the School of Mathematics, investigations in number theory showed substantial progress in the third degree of the Lindel of hypothesis.

(A) The School of Natural Sciences comprises of various departments:-

- In the Department of Astronomy and Astrophysics, three major payloads for the satellite based ASTROSAT experiment were developed at TIFR.
- In the Department of Biological Sciences, a breakthrough was made in understanding how a tug of war between opposing motor complexes regulates the transport of cellular cargo.
- In the Department of Chemical Sciences, a novel combination of spectroscopies was used to study amyloid-beta peptide oligomers throwing light on the origin of Alzheimer's disease.
- In the Department of Condensed Matter Physics and Materials Science, progress was made in the study of strongly correlated electron systems, nanophysics, optoelectronics and soft matter.
- In the Department of High Energy Physics, the Indian Neutrino Observatory (INO), a multi-institution project, was sanctioned by the Government of India. TIFR will play a key role in executing this mega science, project. The Large Hadron Collider, at CERN, resumed operation after a hiatus during which it was upgraded. TIFR has contributed to improving the Outer Hadron Calorimeter, a part of the CMS detector.
- In the Department of Nuclear and Atomic Physics, high spin states in nuclei close to closed shells were studied to understand the shell model better.

- In the Department of Theoretical Physics, a fast supercomputer was installed in the National Balloon Facility at Hyderabad. This machine will help on-going studies of Quantum Chromodynamics (QCD).

- Research in the School of Technology and Computer Science included contributions addressing important problems in the areas of Complexity of Approximation, Matching Theory, Information and Communication Theory and Formal Methods.

(B) National Centre for Biological Sciences -

At NCBS, advances were made in the chemical ecology and wildlife biology and conservation programmes, that show great potential given India's biodiversity. Research continued in other well established fields including neuroscience, where it was shown how a single gene, acting in a single stem cell, controls the functional wiring of neural circuits in the brain.

(C) Centre for Applicable Mathematics (CAM) -

At the CAM, important contributions were made to the study of partial differential equations in hyperbolic space.

(D) International Centre for Theoretical Sciences (ICTS), Bengaluru. -

At ICTS, an interesting result was a possible resolution to some deep puzzles tied to the black hole information question. Advances were also made in studying a) signals for the detection of gravity waves and b) dynamical systems.

(E) TIFR Centre for Interdisciplinary Sciences (TCIS), Hyderabad. –

At TCIS, work was carried out on the reversible formation and isolation of digermene with two remote functionalities. A phase transition in which flocking behavior appears dramatically was found by studying little pins placed on a vibrating surface, amidst a sea of tiny beads. This offers new possibilities for collective transport in industry or biology.

(F) Homi Bhabha Centre for Science Education (HBCSE) –

At HBCSE studies on socio-scientific and development issues in science education looked beyond factual and discipline based knowledge to identify ideological biases in textbooks and patterns of fallacious reasoning in students. A massive open online course (MOOC) platform was developed and used to deliver a course on digital literacy to over 7000 students, in collaboration with other organizations. HBCSE is also the nodal center in the country for training Indian participants in the science and mathematics Olympiads. Out of the total 30 student team members for the International Olympiads in Physics, Chemistry, Biology, Mathematics, Astronomy and Junior Science, 28 bagged medals, including 9 gold medals.

(G) National Centre for Radio Astrophysics (NCRA), Pune. –

A major upgrade of the Giant Metrewave Radio Telescope (GMRT) operated by NCRA is underway. This upgrade will keep the instrument at the forefront among radio telescopes for the next decade or so. A millisecond pulsar was discovered by GMRT this year throwing light on a transition from a Low-mass X-ray Binary to a Redback Millisecond Pulsar.

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(I) National Balloon Facility, Hyderabad. –

Balloon developed by the National Balloon Facility, Hyderabad was used to set a record for a manned balloon flight, along with a jump from an altitude of 41.4 km.

4. Total 40 officers of the Institute have received different awards and distinctions in different categories during the year 2014-15.

Year 2015-16

The year 2015-16 has been a fruitful one for TIFR. Important scientific findings have been made, several key results have been obtained, and some new areas of research have opened up.

- In Astronomy and Astrophysics a major achievement was the successful launch of ASTROSAT satellite in September 2015, carrying five science payloads on board. The TIFR Balloon Facility designed and fabricated a two-ton balloon for carrying a heavy payload up to an altitude of 11 km.

- In Condensed Matter Physics, detailed experimental evidence for a new class of materials, which can be termed as a “Composite Nanoglass” has been established.

- In High Energy Physics, TIFR has significantly contributed to the CMS experiment going on at the Large Hadron Collider (LHC) by analysing data to confirm the presence of the standard model Higgs boson which was discovered earlier. Under the Indian Neutrino Observatory (INO) project, the industrial production of 2m $\times$ 2m glass Resistive Plate Chamber (RPC) gaps for the 600 ton engineering prototype of the Iron Calorimeter (ICAL) detector has begun.

- In Chemistry, novel complexes involving hydrogen bonds were characterized by zero kinetic photoelectron spectroscopy. Identification and characterization of unconventional hydrogen bonded system was achieved, and novel hybrid materials were synthesized by methods involving efficient carbon dioxide capture.

- In Biology, the study on malaria parasite has led to important progress in the identification of an epitope with the potential to emerge as a broad spectrum multistage malaria vaccine candidate. Research has also resulted in new findings in the fields of Metabolism, Skin and Embryonic development, Spermatogenesis, Quantitative genetics and Lipid transport.

- In Mathematics, at the main campus in Colaba, research has been carried out in the fields of Algebra and Algebraic Geometry, Differential Geometry, Number Theory and Combinatorics, and some significant results have been obtained. At the Centre for Applicable Mathematics (CAM), Bengaluru, key findings have been made in the study of partial differential equations and stochastic differential equations. The School Of Technology and Computer Science (STCS) has pursued the study of important topics in the areas of computer science as well as systems science.

- The Homi Bhabha Centre for Science Education (HBCSE), is the nodal Centre in the country for the International Olympiads. This year, of the 30 students who represented India in the International Olympiads, 27 bagged medals including 10 gold. The open house at HBCSE on National Science Day (NSD) witnessed over 2000 visitors.

- A major science discovery in the world this year was the first direct detection of gravitational waves, predicted by Albert Einstein's general theory of relativity, and the first observation of a binary black hole merger. This was achieved by the two detectors of the Laser Interferometer Gravitational-wave Observatory (LIGO). TIFR scientists, both at the main campus in Colaba and at the International Centre for Theoretical Sciences (ICTS) have played an important role in these discoveries. At the ICTS, the group working on Astrophysical Relativity made direct contributions to the recent discovery of Gravitational waves by LIGO to establish the consistency of the observed signal with a binary black hole merger predicted by general relativity.

- Total 47 officers of the Institute have received different awards and distinctions in different categories during the year 2015-16.

Year 2016-17

The year 2016-17 has progressed well in terms of research in crucial areas of science. Astronomy and Astrophysics achievements include setting up of ASTROSAT Payload Operation Centre (POC). The laboratory model of the IRSIS satellite experiment has been extensively tested in the lab. The TANSPEC spectrometer is expected to be commissioned by December 2017 on 3.6-meter Devasthal Optical Telescope. TIFR Balloon Facility at Hyderabad has upgraded the present S-Band tracking system with 70 MHz Tracking Receiver and Down Converter and tested this new system in three balloon flights (Lab Rats, BATAL and TIFR Engineering Test Flight) with improved payload tracking accuracy with better gain margin.

- In Biological Sciences an important study on Malarial parasites has shown that Circumsporozoite protein (CSP), a malaria antigen used in the only vaccine against the disease on trial (RTS, S), provides the cell flexibility and pliability, possibly by providing a lubrication capacity required for its long and penetrating journey through tissue layers during early infection.

- In Chemical Sciences crucial research is being done on $BiVO_4$ – n-type semiconductor having photo and electrochemical storage properties.

- In High Energy Physics members participating in CMS and Belle experiments are analysing the data collected over the past years and have published several important physics results which include various searches related to the Higgs boson, in particular, the Higgs decays to two tau leptons. The CMS collaboration has published a total of almost 600 scientific results based on the collision data since 2009. TIFR has built electronics in collaboration with Indian industry using radiation hard material. GRAPES-III has published new results on the earth's magnetic field. On 16 January 2017, India has become an Associate Member State of CERN. The initial signing ceremony was held on November 21, 2016 by the Atomic Energy Commission Chairman, Dr. Sekhar Basu and the Director-General of CERN, Dr. Fabiola Gianotti.

- In Nuclear and Atomic Physics innovative use of intense 5 fs duration laser pulses has enabled demonstration of ultrafast intramolecular proton migration and bond-selective dissociation of small molecules for the first time. An optical trapping method has been developed that enables assessment of the differentiation status of cancerous cells by determining the minimum time required for cell-cell adhesion to occur.

- In Condesed Matter Physics and Materials Sciences an important research has found evidence for bulk superconductivity in pure bismuth single crystals at ambient pressure. This discovery also makes Bi as the superconductor with the lowest carrier density thus, breaking the record held by doped $SrTiO_3$for nearly 50 years.

- In Theoretical Physics under Cosmology and Astroparticle Physics a novel analytic model was constructed of the X-ray AGN-halo occupation distribution and prospects of constraining the AGN-halo connection with upcoming eROSITA satellite was demonstrated. Under Condensed Matter and Statistical Physicsa novel superconductor driven by resonant tunnelling was predicted in the Ionic Hubbard model

- Homi Bhabha Centre for Science Education work with visually disabled students learning mathematics, from the perspective of Ableism indicated their mathematical capabilities and inventiveness. This was the first year since India's participation at the international science Olympiads that every student participant from India received either a Gold or a Silver medal.

- National Centre for Radio Astrophysics, Pune have succeeded in detecting emission from singly ionized carbon as well as dust-continuum emission at sub-mm wavelengths from two galaxies associated with two such absorbers at a red shift of z~4. Results obtained from GMRT observations (in conjunction with observations from other telescopes) were featured on the cover of the first issue of Nature Astronomy.

- At National Centre for Biological Sciences (NCBS), Bangalore, a study from Ecology and Evolution group revealed how deep valleys in the Western Ghats Mountains influence the species and biodiversity there, resulting in the new and unique species of birds. A new study showed how a single instance of severe stress can lead to delayed and long-term psychological trauma.

- International Centre of Theoretical Sciences, Bangalore made contributions to the detection of a second gravitational wave event by LIGO, from a binary black hole system, announced in June 2016. In Fluid Dynamics and Turbulence significant progress was made in understanding the role of triadic interactions in the intermittent fluctuations of velocity field in turbulent flows.

- TIFR-Centre for Interdisciplinary Sciences, Hyderabad under Biological Sciences a group working on cancer cell biology has devised a novel image-analysis based assay for the detection of cell cycle stage - this has led to unprecedented insight into DNA damage responses at the single cell level.

- In School of Technology and Computer Science, in the area of algorithms new voting mechanisms were analyzed. Algorithms for non-linear congestion functions were studied for the first time in congestion games.

- In Mathematics evidence was established of a Homotopy and Commutativity Principle for special linear, symplectic and orthogonal automorphisms. The techniques of Euler Class groups were used to prove that certain unimodular rows of length three over a class of rings are completable. A new proof of Suslins n-factorial theorem on unimodular rows was obtained.

- Under Interdisciplinary Mathematics study is being carried out on how dumbbells, placed inside a tilted hollow cylindrical drum that rotates slowly around its axis, climb uphill by forming dynamically stable pairs, seemingly against the pull of gravity. Another study introduced a hierarchy of phase spaces for static friction, which give a graphical way to systematically quantify the directional dependence in static friction via subregions of the phase spaces.

- Total 43 officers of the Institute have received different awards and distinctions in different categories during the year 2016-17.

Year 2017-18

- 2017-18 has been a good year for TIFR with respect to accomplishments made in many different scientific domains. The first joint detection of gravitational waves and electromagnetic radiation from a binary neutron star merger (GW170817) by the LIGO Collaboration, in which TIFR scientists are participating, provided unprecedented insights into many aspects of physics, astrophysics and cosmology.

- Researchers from the Department of Astronomy and Astrophysics were part of an effort that performed a generic -1PN test to probe the effects of dipole radiation in the data analysis of binary black hole events like GW170608, and GW170814 and the BNS event GW170817. Members are also working as part of the LIGO Scientific Collaboration. With the data collected by this collaboration, several gravitational wave events were observed, notably the merger of two neutron stars along with the electromagnetic signals and an independent measurement of the Hubble constant became possible. TIFR Balloon Facility at Hyderabad developed a portable antenna orientation system using 1.2m dish antenna to serve as a standby to the existing 3.7m dish antenna, to meet the future requirement of conducting balloon experiment at users' preferred site and to extend flight duration during balloon experiment.

- In Biological Sciences, using the murine malarial model, the long-term effect of a single episode of infection was studied. Studies related to molecular motors and role of intracellular transport indicated that motor protein kinesin plays a vital role in controlling lipid metabolism and neuronal activity in an organism. Separate research using rodents examined the epigenetic, molecular, cellular and cytoarchitectural basis of mood-related behavior generated in response to early adversity and pharmacological drugs used for the anxiety and depression therapy. Studies using zebrafish embryos suggested that application of controlled heat-shock at a certain stage of development could alter the ploidy without staling the development.

- In Chemical Sciences, a real-time Raman visualization of structural events on a donor-pi-acceptor backbone of a conjugated polymer subsequent to photoexcitation was recorded for the first time. Studies were performed on the synthesis of high surface area carbon nanospheres with wrinkled cages and their application in CO2 capture is being investigated. Techniques were devised to quantify messenger molecules in brain tissue without using any artificial labels. It was discovered that a concentration induced shift in the emission spectra can be used to internally calibrate the concentration of serotonin in living cells.

- In High Energy Physics, data for the CMS experiment at CERN, the Belle experiment, the GRPAES-III experiment and the HAGAR observatory are being analysed. GRAPES-III is undergoing hardware upgrade. The HAGAR group is developing a G-APD based camera for the future.

- In Nuclear and Atomic Physics, experiments also tracked a bunch of electrons traveling faster than light through a piece of glass to find out how long they actually live. In a significant breakthrough, scientists devised a high power radiation source in the terahertz (THz) region of the electromagnetic spectrum by irradiating common laboratory liquids like methanol, acetone, dicholorethane, carbon disulphide and water

with moderate energy femtosecond laser pulses, ionizing the liquid and forming long plasma channels called filaments. In another crucial study, a team of scientists from TIFR and Institute of Plasma Research, Gandhinagar recreated magnetic turbulence on a table top in the laboratory.

- In Condensed Matter Physics and Materials Science, the functioning of a fully programmable three-qubit quantum processor using superconducting circuits was successfully demonstrated in the area of quantum computation. In Nanomaterials Physics, it was shown that metallic Selenium, due to its unique, chiral crystal structure, is able to rotate Terhertz radiation and this is ascribed to a novel, phonon-mediated mechanism. In semiconductors and opto-electronics, evidence was found for local excitons in the core level spectra of Si/Ge inverted quantum hut embedded silicon. This discovery reveals a novel feature of electron spectroscopy and will help to begin activities in silicon based optoelectronic applications. In the area of magnetism and superconductivity, extremely large positive magnetoresistance (MR) was observed in a high quality single crystal of MoSi2.

- In Theoretical Physics, the first estimation of the hot circumgalactic medium from a cosmological sample of galaxies observed in both SZ and X-Ray was made, and shown to solve the galactic missing baryon problem. In Condensed Matter and Statistical Physics, a graduate level textbook on the theory of electrons in normal metals, *Landau Fermi Liquids and Beyond*, was completed. Under High Energy Physics, the ability of the proposed iron calorimeter (ICAL) detector at the India-based Neutrino Observatory (INO) to determine hadron shower direction was determined through simulations. In a study under String Theory and Mathematical Physics, the dynamics of near extremal black holes in four dimensional anti-de Sitter space was analyzed and was shown to be described by Jackiw-Teitelboim gravity in two dimensional anti-de Sitter space at low energies.

- At the Homi Bhabha Centre for Science Education, the National Olympiad programmes in Astronomy, Biology, Chemistry, Junior Science, Mathematics and Physics continued to flourish. Overall, in all subjects, out of 30 participants from India, 10 gold, 12 silver, 4 bronze medals, and 4 honourable mentions were won at the international Olympiads in the year 2017. An interactive web-portal has been developed for the Vigyan Pratibha project—a new science talent nurture programme for students of Class 8–10 in Kendriya Vidyalayas (KVs), Navodaya Vidyalayas (JNVs), and Atomic Energy Central Schools (AECSs).

- At the National Centre for Radio Astrophysics, Pune Phase-2 of the GMRT High Resolution Southern Sky (GHRSS) survey with the upgraded GMRT has begun and led to the discovery of two pulsars in the pilot phase. Using the Giant Metrewave Radio Telescope and the Karl G. Jansky Very Large Array, a radio relic that traces peripheral shock in a low-mass galaxy cluster PLCK G200.9-28.2 has been discovered. This cluster is the lowest mass cluster known to have radio detected shock at its periphery. In another study, a non-parametric analysis of the new Arecibo data yielded the most stringent present constraint on fractional changes in the fine structure constant from astronomical spectroscopy.

- At the National Centre for Biological Sciences, Bangalore, a study from the Biochemistry, Biophysics and Bioinformatics group provided insight into the mutations that occur in the prolonged stationary phase of *Escherichia coli*. The first National Cryo EM Facility in the country was established at NCBS. The facility is equipped with a 300

kV Transmission Electron Microscope (TEM) that can do both high-resolution structure determination of macromolecules in solution as well as in situ in cells by tomography. Under Accelerator program for Discovery in Brain Disorders using Stem Cells (ADBS), a multicentre research program has been initiated with an objective to study severe mental illness using clinical, genetics and cell based techniques.

- At the International Centre for Theoretical Sciences, Bangalore, contribution was made to the tests of general relativity using the joint gravitational and gamma-ray observations of the binary neutron star merger GW170817/GRB170817A. In Physical Biology, embryonic development and the role of mechanical forces and deformations/flows in these morphogenetic processes was investigated. In a study related to Fluid Dynamics and Turbulence, the Markov Random Field approach to describing the monsoon yielded its first successful results. It was shown that ten spatial patterns over the Indian landmass were sufficient to describe the rainfall in 95 percent of all monsoon days in the past 110 years. Under Condensed Matter and Statistical Physics, signatures of multifractality in the universal conductance fluctuations in graphene were discovered. In String Theory and Quantum Gravity, it was demonstrated that locality breaks down in quantum gravity (in particular in superstring theory) when spacetime is probed with correlators or S matrices whose number scales inversely with Newton's constant.

- At the TIFR Centre for Interdisciplinary Sciences, Hyderabad, in Biological Sciences, a novel role of a gene named *DYRKA1* was identified in the regulation of gene expression*. DYRKA1* is essential for brain development and has been implicated in mental retardation. Under NMR Spectroscopy, solid-state Nuclear Magnetic Resonance (NMR) experiments were carried out for accurate measurements of distances in various molecules under a variety of experimental conditions. In a study related to Material Sciences, development of large area atomic layers and integration of them to electronic circuitries such as field effect transistors, photodetectors, and magneto-/magneto-dielectric devices were achieved. In Biological Chemistry and Molecular Biophysics group, research is underway to understand the molecular mechanisms of protein aggregation, which are involved in the pathology of Alzheimer's disease and Type-2 diabetes. In a study from the Theoretical Physics group, state-of-the-art numerical simulations were conducted to gain insight in multiphase fluid flow phenomena.

- In the School of Technology and Computer Science, research work was pursued in the areas of computer science as well as systems science. Under Complexity theory, a new simulation theorem that lifts parity decision tree complexity to asymmetric communication complexity was proved. For *popular matching problem*, it was shown that computing a max-weight popular matching in a bipartite graph is NP-hard and a fast exponential time algorithm was given for this problem. Under Information Theory, information theoretically secure computation over networks was studied and topologies which support secure computation were characterized. In Quantum Computation, an efficient quantum algorithm was developed to estimate average gate fidelity using far lesser randomness than the previous state of the art.

- At the School of Mathematics, a study found a new connection between stable random fields and Patterson-Sullivan measures. Many important contributions were made in the analysis of partial differential equations, scientific computation, control theory, inverse problems, stochastic analysis and in applications of mathematics at TIFR Centre for Applicable Mathematics, Bengaluru. Serrin's symmetry result was established for the highly degenerate normalized p laplacian for which strong comparison is not known. The work on forced Sine-Gordon equation found application in the study of ferronematic liquid crystals.

- As usual, TIFR's Outreach and Science Popularsisation programme, with its many features, was able to connect with the public at large and give a huge number of students and interested persons a flavour of science in general and the work being done at TIFR.

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Tata Memorial Centre (TMC), Mumbai

The Tata Memorial Centre (TMC) is an autonomous research institute under the administrative control of the Department of Atomic Energy

The achievements of TMC in the last four years are as follows:

Year 2014-15

- The research carried out in TMC over the last 15 years has been helpful in developing a Low cost screening modality by (VIA) visual inspection of cervix using ascetic acid, which has resulted in 31% reduction in deaths in women. The conventional method of screening is by carrying out pap smear test which is carried out in a hospital setting by a qualified medical practioner. Persons who have completed their HSC are trained to carry out this test by going to the different places. This technology and the procedure of training trainers has been shared with the Ministry of Health & Family Welfare for national implementation. This is also being implemented by countries across the globe.

- Research trials have shown that a low cost injection given prior to surgery of breast cancer could save 28% of patients who would have otherwise died of the disease.

- The Homi Bhabha Cancer Hospital in Sangrur District Punjab has become operational.

- A randomized clinical trials of “elective vs therapeutic neck lymph node dissection in newly diagnosed patients with non metastatic oral cancer” was presented at the plenary session of 2015 American Society of Clinical meeting in Chicago in May 2015. The study was to carry out a trial to establish the superiority of elective neck dissection with an overall survival benefit of 12.5% and disease-free survival benefit of 23.6%. This translated into prevention of 1 in 8 deaths and 1 in 4 recurrences by performing an elective neck dissection.

Year 2015-16

- The first study questioning the need for surgery in breast cancer was presented at the plenary session of ASCO in 2015 and published in Lancet Oncology (2016).

- The Tata Memorial Centre has excelled in providing outreach in cancer care by spreading its wings to far and remote areas of India. Sangrur a peripheral spoke in Punjab is fully functional with a state of art Surgery, Radiotherapy and Medical Oncology. It has treated more than 10000 patients by now. The Registry started in 2013 and 1st Yearly report released on 2016 and it available on website.

Year 2016-17

- The research carried out in TMC over the last 15 years has been helpful in developing a Low cost screening modality by (VIA) visual inspection of cervix using ascetic acid, which has resulted in 31% reduction in deaths in women. The conventional method of screening is by carrying out pap smear test which is carried out in a hospital setting by a qualified medical practioner. Persons who have completed their HSC are trained to carry out this test by going to the different places. This technology and the procedure of training trainers has been shared with the Ministry of Health & Family Welfare for national implementation. This is also being implemented by countries across the globe.

- Research trials have shown that a low cost injection given prior to surgery of breast cancer could save 28% of patients who would have otherwise died of the disease.

- The Centre for Cancer Epidemiology which is the first in the country has been set up with a dedicated facility in Advanced Centre for Treatment Research & Education in Cancer, Kharghar campus, resulting in major insights into breast, cervical, colorectal & gall bladder cancer.

- The Homi Bhabha Cancer Hospital in Sangrur District Punjab has become functional. More than 3000 patients are registered annually. This is the joint successful demonstration of a spoke in Dist. Gen. Hospital for delivery of healthcare in every state.

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- TMC has successfully conducted initial imaging studies in radioisotope tagged monoclonal antibodies for breast cancer and lymphoma. These radioisotope tagged monoclonal antibodies will be proven for therapeutic use in the next 3 years.

- There are a number of ongoing studies in breast (using yoga), cervix and thoracic cancers which will establish new treatments for these cancers.

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- The National Cancer Grid (NCG) is a large network of 82 major cancer centres, funded by the Govt. of India through the Department of Atomic Energy. The NCG has been thought of for uniform cancer care in India, seamless integration of documentation & registration of cancer and run research of national importance.

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- The Tata Memorial Centre has trained and graduated over 100 qualified professionals in various specialities of cancer including surgery, radiation and medical oncology,

pathology, radiology and anesthesiology in the past two years. This would initiate students into oncology to look after cancer patients for the next 30 years.

- Indigenous Bhabhatron Machine was given to 20 centres in the last two years and these machines by now have treated close 100000 patients.

- BHU Varanasi 250 beded Cancer Hosital the significant progress in the project :

  i. A comprehensive MOU is signed on September 21, 2017, between TMC, BHU Varanasi and Tata Trust with common focus towards improving cancer care in Varanasi and its catchment regions, assigning obligations and responsibilities on DAE(TMC), BHU and Tata Trust, is a major landmark in the future progress of the project.

  ii. The notable progress in the work on groud activities is taken up at BHU by the construction of Boundary Wall and Gate for Mahamana Pt. Madan Mohan Malviya Cancer Centre at BHU, Varanasi by CPWD, for which TMC has entered into MOU with CPWD to construct Compound Wall and Gate along with Residential Quarters, depictive pictures of progress of work are posted in the attachments.

- Indian Railway Cancer Research Institute, Varanasi 100 Beded Facility of North Eastern Railway transferred to DAE(TMC)

  Vacant possession of Railway Cancer Institute building has been taken over and the further processes for commissioning hospital activities from January, 2018, have been initiated on fast track with Tata Trust for commissioning the necessary Medical and Laboratory Equipments. The refurbishment of existing civil structure has begun and is expected to be completed in 3-4 months.

- The results of research trials in TMH have captured plenary slots in international meetings ESMO 2017 and ASTRO 2017. These research results will change the way cancer treatment is practiced globally.

  a) Dr. Sudeep Gupta presented NACT trial at the plenary session of ESMO 2017 Conference on 10th September, 2017.

  b) TMC was the leading contributor for IAEA HDR fractionation study that was presented at ASTRO Plenary in San Diego, September, 2017.

  c) Dr. Supriya Sastri [Chopra] won UICC – Young Leader Programme Award 2017, and appointed as Asia Pacific regional lead by UICC 2017.

Dr. B Borooah Cancer Institute became a grant-in-aid Institute of Department of Atomic Energy, Govt. of India, a unit under umbrella of Tata Memorial Centre, Mumbai on 27th November, 2017, inaugurating the following facilities.

Year 2017-18

- The Tata Memorial Centre (TMC) is an autonomous research institute under the administrative control of the Department of Atomic Energy. It comprises of eight centres – the Tata Memorial Hospital (TMH) in Mumbai, the Advanced Centre for

Treatment, Research and Education in Cancer (ACTREC) in Navi Mumbai, the Centre for Cancer Epidemiology (CCE) in Navi Mumbai, the Homi Bhabha Cancer Hospital (HBCH, Sangrur) in Punjab, the Homi Bhabha Cancer Hospital & Research Centre (HBCHRC) in Visakhapatnam, the Homi Bhabha Cancer Hospital & Research Centre (HBCHRC) at Mohali in Punjab; the recently acquired Dr. B. Borooah Cancer Institute in Guwahati; and the soon to be established two cancer centres in Varanasi, the Indian Railway Cancer Institute & Research Centre (renamed as Homi Bhabha Cancer Hospital) and the Mahamana Pandit Madan Mohan Malviya Cancer Centre (MPMMMCC) at Banaras Hindu University (BHU), Uttar Pradesh.

- The indigenous radiotherapy machine, the Bhabhatron was supplied to 20 centres across India and to some of the third world countries in the past 2 years. More than a lakh of cancer patients were treated using it.

- The International Peer Review provided a ready mechanism by which TMC was able to demonstrate that its cancer service, research, education and training were of world class in domains of clinical effectiveness, governance, patient focus, research infrastructure, breadth and depth of science, and teaching, training and development. The report of the Second International Peer Review held in 2016 was tabled by the Chairman of the committee, Professor AD Purushotham. The report benchmarked the Tata Memorial Cancer Centre's clinical services, research, education and training programmes as that of the highest standards, considering the complexities of its milieu. TMC has recently introduced 360^0 Development Programme (Train the Trainers) was a further commitment of TMC to develop both current and future leaders in its eco- system.

- The National Cancer Grid (NCG) funded through the DAE, continued to grow and now has more than 120 centres across India. As its offshoot, the NCG Virtual Tumor Board (VTB) grew as a web-based platform that included online, multiple clinical experts to address complicated patient management issues.

- The TMC-Navya online second opinion cancer services continued to be popular with the general public. More than 18000 patients from over 50 countries have utilized this service.

- For the first time in India, TMC in collaboration with the Tata Institute of Social Sciences (TISS) with support of Tata Trust announced a one-year Advanced Diploma in Patient Navigation called "Kevat". The aim of initiating this program was to create a trained taskforce to facilitate cancer patient's journey right from entry to the hospital to follow-up and getting back to normalcy; and taking into consideration, their emotional and socioeconomic needs in a holistic manner.

- TMC was accepted as a recognized training center in cancer education and research by several national and international organizations, including the World Health Organization (WHO), the International Atomic Energy Agency (IAEA) and the International Network for Cancer Treatment and Research (INCTR). TMC had initiated the training of African, Sub-Saharan country doctors and nurses under the Indo-African Forum Summit III.

- The annual fellowship and exchange programs for cancer research and education continued between King's College, London and TMC. TMC successfully conducted initial imaging studies in radioisotope tagged monoclonal antibodies for breast cancer and lymphoma. These radioisotope tagged monoclonal antibodies will be validated for therapeutic use in the next 3 years. Among the many International presentations, three (03) trial studies presented at the European Society for Medical Oncology (ESMO) and at the American Society for Radiation Oncology (ASTRO) proved to be of landmark significance in cancer treatment. TMC continued to provide the highest standard of patient care through its services and research, and capacity building by imparting knowledge through various educational activities.

- The Department of Surgical Oncology launched India's first Online Oncology Tutorial as an innovative way of conducting online Continuing Medical Education (CME) program. Tata Memorial Hospital concluded its Platinum Jubilee (1941-2016) celebrations with various educational and cultural events. The celebrations ended with the "Mumbai Declaration" pledge and the unveiling of the book titled, "Indelible Footprints on the Sand of Time" by Honourable Prime Minister, on 25th May 2017. The platinum jubilee oration was delivered by Nobel laureate, Professor Amaratya Sen on "Healthcare for All: Why and How?" in January, 2017.

- TMH continued to provide services to cancer patients from low income families through the Mahatma Jyotiba Phule Jan Arogya Yojana (MJPJAY) Scheme launched by Maharashtra State from 1st April 2017. This scheme replaced the earlier Rajiv Gandhi Jeevan Yojna Scheme (RGJYS).The tie up of the hospital with the State of Maharashtra continued and more districts were being added for the training programs for all medical and paramedical personnel in cancer screening and treatment.

- The TMH bed strength remained at 629, but the patient registrations increased. The year 2017 saw a total of 72001 new registrations, an increase of 3% over last year. The new patients numbered 44455, those for referred for second opinion numbered over 21853 and, those of Preventive services were 5693. Among the new patients, only 39 % were from Maharashtra (10789 from Maharashtra and 5545 from Mumbai); the majority of the others were from the northeast parts of India. There were almost a thousand foreign nationals who had registered.

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Institute of Mathematical Sciences (IMSc.), Chennai

The Institute of Mathematical Sciences (IMSc.), Chennai is an autonomous research institution under the administrative control of the Department of Atomic Energy (DAE), engaged in research work in Computational Biology, Mathematics, theoretical Physics and Theoretical Computer Science.

The qualified thesis work is submitted to the Homi Bhabha National Institute, which is a deemed to be University of which IMSc is a part, for award of PhD degrees.

Year 2014-15

- 6 students were awarded Ph.D degree and 5 students have submitted their Ph.D theses. One student was also awarded M.Phil Degree. In addition, 5 students were awarded M.Sc (by Research) and one submitted the thesis. A total of 51 courses / lecture series were taught at IMSc during this period, in addition 3 lecture courses were given at Chennai Mathematical Institute for their National Undergraduate Programme.

- There is a vibrant visitors' programme with the Institute hosting a large number of short and long term visitors from all over the world. About 253 scientists visited the Institute this year.

- Contribution of national and international publications in academic journals by the members of the Institute accounts to about 172 articles this year. Also 7 books were authored by the members, during this period.

- Institute members are also involved in joint projects with colleagues from other national and international institutes. At present there are 13 ongoing projects in progress in IMSc.

- Apart from this regular activity, IMSc also offers the opportunity of learning for a few students during the summer vacation period. About 56 students availed these opportunities this year.

- The Institute has conducted about 28 conferences / workshops and 263 seminars during the academic year 2014-2015.

Year 2015-16

- There are 130 visitors visited the institute during the reporting period. Institute members are also involved in joint projects with colleagues from other national and international institutes

- There are many ongoing projects in progress in IMSc. Institute members interact extensively with their colleges in the Universities and this interaction takes place via (i) Faculty Associateship Programme (ii) Refresher Courses for College Teachers (iii) Science Popularisation programmes.

- The Institute has conducted various conferences and workshops in addition to 288 seminars during this academic year.

Year 2016-17

- The Institute has conducted various Conferences and workshops in addition to 313 seminars during the academic year 2016-2017. The Institute has also conducted outreach activities and annual activities

- The peak performance of the Hybrid HPC System is over 85TeraFLOPS with 55TB Parallel file system for storage. It was developed in-house for the use of Parallel computing, Serial computing and GPU computing.

- The Institute is contributing significantly and extensively to the DAE mandate for supporting basic sciences in the area of Theoretical Physics, Theoretical Computer Science, Mathematics and Computational Biology.

- About 5 awards and honours were bestowed on the faculty of the Institute during this period.

Year 2017-18

- The Institute has conducted various Conferences and workshops in addition to regular seminars during the academic year 2017-18. The list of outreach activities are as under: -

- **Summer workshop for school students: April 2017:** Organized by the Ph.D students of IMSc, this featured 5 days of intense lectures, problem solving and hands-on activities.

- **Enriching Collegiate Education: June 2017:** This was a week-long teachers training workshop for mathematics teachers from arts & science colleges to bridge the gap between college and research level mathematics.

- **Facets: 3-4 July 2017:** The program was attended by about 200 students from various colleges in Chennai. It featured lectures, actitivities and a panel discussion.

- **Enriching Mathematics Education: 14-15 September 2017**. This workshop was attended by 75 high school mathematics teachers and included lectures and problem sessions.

- **Kanita Kaanakam: 23rd October 2017:** This was the first edition of IMSc's outreach program for school children in Tamil. The program included interactive mathematics activities and about 125 students from various government and corporation schools from the area attended the program.

- **Science Fun, Science Toys: 2nd November 2017:** Padma Shri awardee Arvind Gupta is a toy inventor and popularizer of science for kids. The talk was accompanied by demonstration of simple toys that he moulds out of trash and everyday goods to simplify the complex concepts of gravity, magnetic eld, friction, electricity, Newtonian laws among several other things.

- **Scientists and school education: 24th November, 2017:** A discussion was led by Professor Krishna Kumar, former Director, NCERT on what scientists can do to contribute to school curriculum and education.

- **Teachers' Enrichment Program: 27th November - 2nd December 2017:** This week-long workshop was aimed at mathematics teachers in Engineering colleges, to enable them to revisit and update content knowledge.

- **Science at the Sabha: 11th February 2018:** "Science at the Sabha" is the flagship outreach event of the Institute of Mathematical Sciences. It connects accomplished mid-career scientists who care deeply about science communication, with the public at large.

- The Institute is contributing significantly and extensively to the DAE mandate for supporting basic sciences in the area of Theoretical Physics, Theoretical Computer Science, Mathematics and Computational Biology. The total 132 research papers were published during this period. About 4 awards and honours were bestowed on the faculty of the Institute during this period.

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National Institute of Science Education and Research (NISER), Bhubaneswar

National Institute of Science Education and Research (NISER), Bhubaneswar is fully funded by the Department of Atomic Energy. NISER strives to be recognized as a Centre of Excellence in Education and Research in Basic Sciences (Biology, Chemistry, Mathematics and Physics) and in related areas. The aim of this Institute is to nurture world class scientists for the country who will take up challenging research and teaching assignments in universities, R&D laboratories and various industries. The important activity of NISER is high quality teaching for both undergraduate and post graduate students.

Year 2014-15

Among the major achievements of NISER during the period under review, the stand out one was the 3rd graduation ceremony held on 9.6.2014. Two Ph.D. Scholars and 37 M.Sc. integrated programme students graduated in the third convocation ceremony. Offers for doctoral programmes poured in from reputed universities in Paris Texas, Michigan, Wisconsin-Madison, Maryland, Stony Brook, Louisiana, Houston, Toulouse, Connecticut, Cologne and South Dakota, besides the IITs, the Tata Institute of Fundamental Research and the National Institute of Immunology in the home country.

The following programmes have been organized by the Institute during 2014-15:-

(i) Public Outreach Programme.
(ii) Public awareness on Plantation and go-green.
(iii) Vigilance Awareness Week
(iv) Sadbhavna Diwas
(v) Official Language Implementation.

The details of Publications, Conference/Seminar/Workshop and Invited Talks/Lectures made/conducted by the Schools of the NISER are as under:-

Sr. No.	Name of the School	No. of Publications	No. of Conference/ Seminar/workshop organized or attended	No. of Invited Talks/Lectures
1.	Biological Sciences	32	26	06
2.	Chemical Sciences	43	06	00
3.	Mathematical sciences	11	53	11
4.	Physical Sciences	105	19	26

The institute have received the following Awards and Honours during this period:

i. The following paper, "Observation of the rare B0s to mu+ mu- decay from the combined analysis of CMS and LHCb data' has been accepted for publication in **Nature**, arguably the most prestigious scientific journal. NISER was one of the primary authors (specifically NISER-CMS contributed to the paper for background, data-mc validation and other related study). The NISER-CMS team was led by Dr. Sanjay Swain.

ii. The first paper with NISER Jatni has been accepted for publication in Physical Review C (American Physical Society journal). “Selecting specific initial configurations using spectator neutrons in U + U collisions” by Vipul Bairathi, Md. Rihan Haque, and Bedangadas Mohanty.

Year 2015-16

- Among the major achievements of NISER during the period under review, the stand out one was Hon'ble Prime Minister of India Shri Narendra Modi formally dedicated NISER permanent campus at Jatni, to the nation on 07.02.2016. On this occasion, Hon'ble Governor of Odisha, Hon'ble Chief Minister of Odisha, Minister of State for Atomic Energy in the Prime Minister's Office, Secretary DAE and many more dignitaries were present. Among other programs, the 4thgraduation ceremony held on 06 June, 2015. Chairman, AEC was the Chief Guest on this historic occasion. 59 (fifty nine) 5 Year Integrated M. Sc. students and 03 (three) Ph. D students graduated this year. Offers for doctoral programme poured in from reputed universities in Paris, Texas, Michigan, Wiscosin-Madison, Maryland, Stony Brook, Louisiana, Houston, Toulouse, Connecticut, Cologne and South Dakota, besides the IITs, the Tata Institute of Fundamental Research and IISC, Bangalore in the home country.

- The following programmes have been organized by the Institute during 2015-16:-
  a. Public Outreach Programme.
  b. Public awareness on Plantation and go-green.
  c. Vigilance Awareness Week
  d. Sadbhavna Diwas
  e. Official Language Implementation.

- The details of Publications, Conference/Seminar/Workshop organized or attended and Invited Talks/Lectures made/conducted by different Schools of the NISER are as under:-

Sr. No.	Name of the School	No. of Publications	No. of Conference/ Seminar/workshop organized or attended	No. of Invited Talks/Lectures
1.	Biological Sciences	59	04	00
2.	Chemical Sciences	77	15	00
3.	Mathematical Sciences	40	67	01
4.	Physical Sciences	163	10	43
5.	Humanities and Social Sciences	05	05	02

- The Institute has received the following Awards and Honours during this period:

  a) Prof. T. K. Chandrashekar, Senior Professor in the School of Chemical Sciences received SASTRA – CNR RAO Award for the Year 2016.

  b) Shanti Swarup Bhatnagar Prize for Physical Sciences, 2015 was awarded to Dr.Bedangadas Mohanty of the School of Physical Sciences.

  c) Mr. Ashutosh Kumar received "Oral Presentation Award" in YUVA ISAR Conference held by Indian Society for Assisted Reproduction from 8th-9th August 2015.

  d) Mr. Arijit Ghosh, MSc student in SBS received Second poster award in 1st International Conference on Translational Research: From Basic Science to Clinical Application, at KIIT University, Bhubaneswar, India. 5-7th February, 2015.

e) Dr. Colin Benjamin was awarded DAAD, Germany Research stay at RWTH Aachen University.

f) Dr. Praful Singru was selected as a Member, Executive Council; Society for Evolutionary and Integrative Biology (SEIB), India. 2014-15.

g) Dr. Debasmita Alone was elected as a member; Executive Council (2015-2017) of All India Society for Cell Biology, India.

h) Dr.Chandan Goswami has been selected as editorial member (2015) for PeerJ

i) Dr. Kishore C Panigrahi has been selected as editorial member for "Frontiers in Bioscience.

- From Social Welfare point of view, the social service club of NISER has been actively taking measure to address some major societal issues which include education of children residing in the slums opposite to NISER campus, donation of clothes to the needy and cleanliness drives. Students at NISER have given an expression of their compassionate minds by forming an organisation named "Zariya" to serve a medium for translating their concern and feeling for their fellow beings.

Year 2016-17

- The institute received the prestigious **Vishwakarma Award** for best construction/design by Construction Industry Development Council (CIDC), New Delhi.

- The following programmes have been organized by the Institute during 2016-17 :-

a) Public Outreach Programme.
b) Mimamsa Quiz
c) Training Program in Mathematics (TPM-2016)
d) Summer Outreach Program in Mathematics (SOPM-2016)
e) Discussion Meeting on Automorphic Forms-2016
f) School & Workshop on Modular Forms & Black Holes-2017

- The details of Publications, Conference/Seminar/Workshop organized or attended and Invited Talks/Lectures made/conducted by different Schools of the NISER are as under :-

Sr. No.	Name of the School	No. of Publications	No. of Conference/ Seminar/workshop organized or attended	No. of Invited Talks/Lectures
1.	Biological Sciences	46	33	07
2.	Chemical Sciences	105	31	01
3.	Mathematical Sciences	32	42	00
4.	Physical Sciences	162	02	54
5.	Humanities and Social Sciences	03	05	08
6.	Earth and Planetary Sciences	05	00	02

- The Institute has received the following Awards and Honours during this period:

  a) **Dr. Palok Aich** has become Member of DBT TASK Force for Biotechnology Ignition Grant (BIG) of the Department of Biotechnology (DBT)-Biotechnology Industry Research Assistance Council (BIRAC), Government of India (GoI), since June 2016.

  b) Dr. Chandan Goswami served as a jury member of "Monitoring meeting of PAC in Health Sciences, DST-SERB" on 7th-8th Feb, 2017.

  c) Dr. C. Gunanathan received "ECRP Award-2016.

  d) Dr. Deepak Dalai has received the Best paper Award at the 6th International Conference on Sensor Networks, SENSORNETS 2017 held in Porto-Portugal February 19--21, 2017.

  e) Prof.Bedangadas Mohanty – Got elected as a Fellow of Indian National Science Academy, New Delhi

  f) Prof. Bedangadas Mohanty- Got elected as Fellow of Indian Academy of Sciences, Bangalore.

  g) "Special Jury presentation award" to Mr. Manoj Yadav. 2nd International Conference on Translational Research: Applications in Human Health and Agriculture. 14-16th Oct 2016, Bhubaneswar.

  h) "Best Poster award" to Md. Khurshidul Hassan. 10th year celebration of excellence in science at IISER Kolkata "Advances in Life Sciences" during January 13-15, 2017.

- From Social Welfare point of view, the social service club of NISER has been actively taking measure to address some major societal issues which include education of children residing in the slums opposite to NISER campus, donation of clothes to the needy and cleanliness drives. Students at NISER have given an expression of their compassionate minds by forming an organisation named "**Zariya**" to serve a medium for translating their concern and feeling for their fellow beings.

Year 2017-18

- The NISER conducts the nation-wide test viz. National Entrance Screening Test (NEST)] to select the most deserving candidates for admission into its flagship 5 years integrated M.Sc program, which has been extremely popular and effective. A new batch of 170 students was subsequently admitted and the classes for the academic session 2017-18 started from 2 August, 2017.

- The admissions to the **Ph.D programs** were completed in the month of June 2017. A total of 60 students in the Ph.D and 6 in Integrated Ph.D program were admitted.

- The 6th graduation ceremony was held on 6th June, 2017. Honourable Chief Guest Prof. D. Balasubramanian, Director (Research), Prof. Brien Holden Eye Research Centre of L.V.Prasad Eye Institute, Hyderabad former President, Indian Academy of Sciences, graced the occasion and awarded the degrees to the Graduated students. One Ph.D scholar and 57 Integrated M.Sc students graduated in the 6th Graduation Ceremony.

- The 6th batch of Integrated M. Sc graduating students graduated in June 2017, have bagged offers for Ph.D. positions from various universities in India and abroad. In India, they have secured positions at TIFR, NCBS and IITs. From abroad, students have received offers from various universities including 13 universities under top 50 global rankings in respective subjects, some of them are University of Oxford, ETH Zürich, University of Illinois at Urbana-Champaign, University of Wisconsin-Madison, Texas A&M University, University of Michigan, RWTH Aachen University, University of British Columbia, Rice University.

- An important measure of NISER's standing is reflected in the awards bagged by its faculty members. Some of the important awards/achievements received in 2017 are listed below:-

Sl.	Name	Name of Award	Year
1.	Prof. Bedangadas Mohanty	J C Bose Fellowship by the Department of Science & Technology	2017
2.	Prof. Bedangadas Mohanty	Fellow of the Indian Academy of Sciences Bangalore.	2017
3.	Dr Ajaya Kumar Nayak	Ramanujan Fellowship	2017

- NISER has already made a mark, among its peers through its scientific publications. During the year 2017, so far faculty members and students of different schools have published over 100 academic papers in high impact journals underlining their commitment to creating a niche in the global scientific community.

- NISER has conducted a lot of conferences/seminars/meets/talks. Some of the major events are enumerated below:-

(i) International Conference on Plant Developmental Biology (ICPDB) 2017
(ii) XIth SERC School of Experimental High Energy Physics
(iii) Summer Outreach Program in Mathematics,
(iv) National conference on Science, Technology and Society
(v) Symposium on Recent Advancement in Neuroscience,
(vi) One day symposium on "Recent Advancement in Neuroscience"
(vii) National String Meeting 2017: IISER NISER Meet and All India People's Science Congress.

- Besides these, NISER has conducted various outreach programs as its responsibility to reach out to society in which NISER imparts lectures and practical demonstrations to school children and teachers from Odisha and other parts of the country.

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Institute for Plasma Research (IPR), Gandhinagar

Institute for Plasma Research (IPR), Gandhinagar, a grant-in-aid institution under the administrative control of the Department of Atomic Energy (DAE), Mumbai is carrying out experimental and theoretical research in plasma physics with emphasis on the physics of magnetically confined hot plasmas and non-linear plasma phenomena. The scientific and technological programmes of the Institute can broadly be categorised into four main areas viz., (1) Fusion Plasma Experiments, (2) Fusion Technology Developments, (3) Basic Plasma Experiments; and (4) Theoretical, Modelling & Computational Plasma Physics.

Some of the highlights of the work done/achievements during the following years are appended below:-

Year 2014-15

- Year 2014-15 has been a year of 'up-gradation' in the Institute. After giving consistent operating performance, in its silver jubilee year, it was decided that ADITYA (the first indigenously designed and built tokamak of India) will be up graded to have a shaped plasma cross section. An additional set of coils and the vacuum vessel are being changed to achieve this.

- In the Superconducting Steady-state Tokamak-1 (SST-1) maximum plasma current of 75000 A at a Toroidal magnetic field of 1.5 T at the plasma centre assisted with Electron Cyclotron (EC) pre-ionization at the fundamental mode was achieved. These Mega Joule classtoroidal magnetic fields were also operated upto 2.0T. All the diagnostics have also been upgraded with some new diagnostics in place. First successful launching of Lower Hybrid Current Drive waves has been conducted.
- To fulfill the commitment of delivering the Test Blanket Module (TBM) to ITER project, various small experimental set ups like liquid metal heat transfer loop, experimental Helium Cooling Loopetc are being done to understand and develop the required technologies. For the remote handling and robotics technology, various prototypes are being made and tested. A laboratory scale hydrogen isotope removal system (HIRS) for Helium purge gas to validate design concepts for tritium extraction is being developed.

- Exploration of societal benefits from plasma technologies is continued vigorously at Facilitation Centre for Industrial Plasma Technology (FCIPT). The projects cover various areas such as bio-medics, conventional and green power, textiles, waste management, nano-technology. FCIPT is working on developing Plasma Pyrolysis system (on proof of concept basis) for plastic and paper waste disposal at GIFT (Gujarat International Finance Tech) City - a smart city that is being developed near Gandhinagar, Gujarat.

Year 2015-16

- For ITER-India, most of the procurement packages entered into the factory testing phase. Manufacturing and factory testing are being done following international quality assurance and control standards, as is necessary for the ITER project.

- At the Centre of Plasma Physics, Guwahati the commission of the CPP-IPR Magnetized plasma Experiment for Plasma Surface interaction (CIMPLE-PSI) has been successfully completed. The objective is tore-crease ITER Diverter like plasma with extreme hot ion flux to be used for plasma material interaction experiments. Theory and simulation works in the centre are catering to other experimental activities as CPP-IPR.

- For the development of superconducting magnet technology, a dedicated facility has been established. Efforts are being continued in developing materials & fabrication technologies for Plasma Facing Components (PFCs). After successful demonstration of a prototype pellet injector in the laboratory, a single barrel pellet (LLCB) blanket and its associated ancillary systems to ITER projects, many small experiments have been set up. A Virtual and Augmented Reality Integrated Development Lab (VVARID –Lab) is being set up.

Year 2016-17

- During the year 2016-17, Institute continued its activities in fusion research, Technology development, Industrial and Societal applications and experimental & theoretical investigations of fundamental plasma physics, apart from deliveries to the International Thermonuclear Experimental Reactor (ITER) project.

- Academic programs like Summer School (46 students), Technical Training and Doctoral programs (42 students) of the institute were continued as usual. The institute had 217 publications in peer reviewed journals apart from 88 Research Reports and 48 Technical Reports published during the year.

Year 2017-18

- Institute for Plasma Research (IPR), Gandhinagar, a grant-in-aid institution under the administrative control of the Department of Atomic Energy (DAE), Mumbai is carrying out experimental and theoretical research in plasma physics with emphasis on the physics of magnetically confined hot plasmas and non-linear plasma phenomena. The scientific and technological programmes of the Institute can broadly be categorised into four main areas viz., (1) Fusion Plasma Experiments, (2) Fusion Technology Developments, (3) Basic Plasma Experiments; and (4) Theoretical, Modelling & Computational Plasma Physics.

- Results from several experiments from basic research setups in diverse areas, e.g., plasma transport and turbulence, microwave, non-neutral plasma, surface interactions, negative ion generation, dusty plasma, electrostatic confinement fusion, etc., reported good outcome and resulted in good number of publications in peer reviewed journals.

- Aditya tokamak was routinely operated at about 80mS/ 90kA plasma current operation after upgrading with installation of graphite limiters. Experiments with several new equipments, e.g., molecular beam injection, fast feedback system, etc., are initiated towards better plasma performance in the machine. In SST-1, several changes were made and success was achieved in simultaneous cooling of both TF coils and a set of PF coils to superconducting temperature. Further changes are being implemented in preparation for enhanced plasma operation.

- On technology development front; new magnets using High Temperature Superconducting materials have been developed and full characterization of indigenously built liquid nitrogen based Cryopumping panels were completed. In several other development areas, viz., diverter, large cryo-plant, fusion blanket technologies, remote handling and negative neutral beam systems, expansion of facilities by addition of new equipments or better diagnostics have been done.

    - Emphasis was put on projects bearing direct societal benefits in short time frame. Several new areas of interdisciplinary research have been initiated in collaboration with organizations relevant to the intended applications. Few among them are; use of plasma torch in treatment of brain tumours, Surface Enhanced Raman Scattering (SERS) studies of blood glucose and cancerous cells, hydrophobic coating on glass surface, nanoparticles manufacturing, nitriding of equipments for space applications, seed sterilization, etc. Several new projects in food preservation, textiles, etc. were also initiated.

    - Studies in theoretical and computational fields continued in diverse topics like design of future tokamaks and concepts of plasma-thrusters, etc.

    - ITER-India reported considerable progress during the year. Manufacture of Cryostat base and lower cylinder made visible progress at site. The In-Wall Shields for sectors were completed. Major deliveries including 2000 pipe spools and several heavy equipments for cooling water system were dispatched to ITER site. So is the case of delivery of Cryo-lines by Indian and European manufacturers. Cryo-distribution system was manufactured and reached test phase in factory. One 100kV power supply was supplied and installed at Padova, Italy as a part of ITER deliverable. In house R&D activities in 35-65MHz, high power range Radio Frequency system, Diagnostic Neutral Beams, Diagnostics and Power Supplies too have reported several experimental results as well as progress in deliveries.

    - The institute had 16 Doctoral Theses submissions and 187 Journal publications during the report period apart from a large number of conference presentations. Other details of importance like facility additions, building construction, administrative reports, etc. are covered at appropriate places in the Annual Report.

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Harish Chandra Research Institute

The focus of HRI is on theoretical physics and Mathematics. The contribution can be assessed in terms of four indicators:

1. Research Output: The academic members of HRI publish about 120 papers in a year in peer reviewed international publications. Major contributions are in string theory, high energy physics and quantum information, condensed matter and mathematics.

2. Peer Recognition: HRI faculty and students have received awards and fellowships of academies based on their research achievement.

3. HRI contributes to the high quality manpower to meet academic need of the country. The students who complete Ph.D finally join the science establishments in the country as teachers and researchers.

4. M.Sc programme significantly widen institutions reach and provide research exposure to students in our country.

Year-wise details of publications, graduated students etc. is as under:

Particulars	2014-15	2015-16	2016-17	**2017-18**
Publications	128	154	125	
Awards	5	8	5	
No. of students graduated	8	6	8	
No. of students completed Ph.D	6	14	11	

- The major research activities carried out by HRI in the areas of Mathematics and Physics during 2017-18 are as under:-

- Mathematics: The mathematics group at HRI carries out research in several areas. In algebra, work is done on algebraic groups and related structures, the theory of groups and group rings, representation theory, and infinite-dimensional Lie algebras. Work in analysis is in the field of harmonic analysis of Lie groups. Activity in geometry includes discontinuous groups and Riemann surfaces, algebraic topology, vibrational problems on manifolds, Chow groups of rational surfaces, and moduli of vector bundles. The number theory group works on algebraic, analytic and combinatorial number theory, automorphic forms and cryptography.

- Physics: HRI carries out research in the fields on astrophysics, condensed matter physics, quantum information and computing, high energy phenomenology and string theory. In astrophysics, work is done on the cosmic microwave background, large scale structure formation and galaxy evolution. Main areas of activity in condensed matter physics are strongly correlated electron systems, mesoscopic systems, quantum Hall effect and superconductivity. In string theory, perturbative and non-perturbative aspects of string theory and quantum field theory are being actively investigated. Research in neutrino physics, strong interactions, lattice gauge theory, super symmetry and various aspects of physics beyond the standard model is done in high-energy phenomenology. The Institute is a member of the India-based Neutrino Observatory (INO) collaboration.

- The following meetings, workshops, lectures, conferences, schools and programmes were organized / hosted by the HRI in 2017-18:-

Sl. No.	Title of the meetings/conference/lecture/workshop/ school/programmes
1.	HRI has started a Masters program in Physics, with a laboratory on campus.
2.	HRI hosted several visitors, over the year, on the basis of an Infosys grant.
3.	“Focused meeting on Stack in Algebraic Geometry” in July 2017
4.	International conference on “Class Groups of Number Fields and Related Topics” in September 2017
5.	Quantum Science and Technology (QuST)” in October 2017
6.	Nu HoRIzons VII and School on String Field Theory and String Phenomenology, in February 2018
7.	the Sangam@HRI-2018 – Instructional Workshop in Particle Physics, in March 2018

- Fifteen Ph.D students graduated from HRI during 2017-18. HRI maintained their research productivity, maintaining a position within the top 10 in the Nature India list. About twenty five students joined the Ph.D program this summer, they will enliven what was beginning to look like an ageing campus.

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Institute of Physics (IoP), Bhubaneswar

The Institute of Physics (IoP) is an autonomous research institution under the administrative control of the Department of Atomic Energy (DAE), Mumbai engaged in research and development activities in the frontier areas of physics and allied sciences.

Some highlights of the work done/achievements during the following years are appended below:-

Year 2014-15

- 120 papers were published in various national, international refereed journals, while 40 more papers are under review for publication. Institute members have delivered large number of lectures, colloquia, seminars, etc to promote science and there research work within & outside the country. More than 120 lectures were delivered by various eminent scientists & young researchers at IoP.

- Institute of Physics is a major hub for scientific activities & discussions in the Eastern part of the country.

- The laboratory houses equipment for conducting research in several frontier areas on thin films and nano-materials. Using the facilities existing here, samples can be prepared under sensitive and controlled conditions and can be investigated for their morphological, magnetic, optical vibrational properties.

- The Institute is also actively involved in popularizing science. A Science outreach program has been organized in different schools of Odisha with collaboration of SCAA. Night sky viewing session was organised using telescope and binoculars at Machhuati, Salipur, Odisha *(Coastal Odisha)* on 21st February, 2015.

Year 2015-16

- 140 papers were published in the International Peer Reviewed Journals. Besides, the faculty members and research scholars of the Institute have received many academic accolades like distinguished faculty award from Homi Bhabha National Institute(HBNI), Ramanujan Fellow, best thesis award from HBNI and best poster award at different conferences.

- A Max-Planck Partner Group in the field of high energy physics is also set up at Institute of Physics. Institute members have delivered large number of lectures, colloquia, seminars, etc to promote science and there research work within & outside the country.

- Institute of Physics is a major hub for scientific activities & discussions in the Eastern part of the country.

- More than 20 colloquia, 86 seminars lectures were delivered by various eminent scientists and young researchers at our Institute.

Year 2016-17

- The faculty members and research scholars of Institute have received many academic accolades like distinguished faculty award from Indian Academy of Sciences, Indian National Science Academy Award, MRSI Medal in Materials, NASI Scopus Young Scientist Award, best ORAL presentation Award etc. Institute members have delivered a large number of lectures, colloquia, seminars, etc to promote science and research work within and outside the country.

- 117 papers were published in the International Peer Reviewed Journals.

- Around 9 colloquia, 116 seminars and lectures were delivered by various eminent scientists and young researchers at the Institute.

- Year-long academic programmes and scientific events like social outreach, popular talks, telescope making workshop for high schools children, conferences, meetings, workshops, and activities related to recharging of school teachers were organized during the year.

- Eminent national/international scientists were invited to visit Institute on short term basis, to initiate collaboration with the faculty members of the institute.

- During the year Institute organized programmes like Awareness-cum-Seminar on "Role of Atomic Energy & Nuclear Power in the Service of Mankind" conducted at Soro, Balasore, Public Awareness conducted at Gopabandhu Vidyamandir, Po-Sailo Badabil, Distt.- Cuttack and Public Awareness Programme conducted at Ekalavya Model Residential School, Mahasingi, Kandhamal, Odisha for early college students.

Year 2017-18

- During the academic year 2017-18, excellent research work on both fundamental and applied physics has been carried out by the members of IOP that has resulted in about 150 publications in the international peer-reviewed journals. The IOP members are making leading contributions in the following research areas –

- **Theoretical high energy physics:** The research in theoretical high energy physics includes string theory, HEP phenomenology, quark gluon plasma, cosmology, and astroparticle physics. The major areas of interest are quantum correlations, quantum nonlocality, and quantum communication protocols.

- **Theoretical nuclear physics:** The theoretical nuclear physics group has current interest in studies of nuclear structure that is essential to understand various nuclear phenomena.

- **Experimental high energy physics:** The experimental high energy physics groups at IOP are participating in the collider based experiments at various international laboratories, such as the CMS and ALICE experiments at CERN-LHC, the STAR experiment at RIHC (BNL), USA, and the proposed CBM experiment at FAIR (GSI), Germany. Apart from the physics studies the groups also contribute to the R&D of the state-of-the-art detectors for the present and future experiments.

- **Quantum information/ Experimental condensed matter physics/ Theoretical condensed matter physics:** The interests of the theoretical condensed mater physics group include quantum condensed matter physics, soft condensed matter and biological physics, and statistical physics. The members of the group have given about 25 presentations within this academic year at various national and international conferences and workshop.

- Furthermore, the members have delivered about 75 seminars and popular talks at various national and international universities, institutions, and colleges. Moreover, the faculty members of IOP have received academic recognitions in the form of J. C. Bose national fellowship, young scientist research grant, presidentship of the electron microscope society of India and members of editorial board of national and international journals.

- The institute has vibrant academic activities, which consist of pre-doctoral, doctoral, and summer student's visiting programs. During the academic year 2017-18, nine students, who had completed their MSc from various universities and institutions, were admitted to the pre-doctoral program through an intense selection process.

- During this academic year there are about 10 students who have completed PhD and obtained their PhD degrees from Homi Bhabha National Institute. The institute also conducted the summer student's visiting program (SSVP) during the months of May to July. The motivation of the SSVP program is to expose young students to frontline research areas that are being pursued at the institute. Twelve students from various leading universities and institutions, who had completed one year of their MSc, participated in this program and carried out research projects with faculty members in the institute.

- In this academic year, about 25 eminent scientists of national and international repute have been invited to deliver colloquium and popular talks. In addition, many students and post-docs from other institutes also visited IOP and delivered seminars. To strengthen the collaborative research work, different workshops like Indo-Japan collaboration meeting on neutrino and particle physics, a joint venture of Max Plank Institute of Solid State research and IOP through MPI partner group program, and the India-CMS collaboration meeting were organized.

- IOP has been playing pivotal role in spreading the awareness of science and promote scientific temper among young school and college students. Towards this effort various programs such as the National Science Day celebration, student visit program, sky watching program etc have been organized, where school and college students from different parts of Odisha have participated and listened to popular talks by eminent scientists.

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Saha Institute of Nuclear Physics (SINP), Kolkata

The Saha Institute of Nuclear Physics (SINP) is an autonomous institute for basic research under the administrative control of the Department of Atomic Energy (DAE). The Institute is engaged in research classified in the five major areas viz. (a) Biophysical Science Including Chemistry (b) Condensed Matter Physics including Surface Physics and Nano Science, (c) Experimental Nuclear and Particle Physics, (d) Plasma Physics; and (e) Theoretical and Mathematical Physics.

Some highlights of the work done/achievements during the following years are appended below:-

Year 2014-15

- Altogether 446 research publications have been credited during the period with about 30 theses awarded for Ph.D degree. About 70 publications in high impact journals with impact factor more than 6 in Journals like Physical Review Letters, Reviews in Modern Physics, Journal of High Energy Physics, Journal of Cosmology & Astroparticles Physics, kCell eath & Disease and RNA biology to name a few.

- International Collaboration with CERN in ALLICE and CMS experiments and with SNO Lab in PICASSO experiment for Dark Matter Search. Outreach programs conducted from the Centre for Advanced Research & Education (CARE) both in and outside SINP, going to remote places of Sundarban to district school in Hoogly and Birbhum, have been successful with overwhelming response from students of high school on science and related area of contemporary interest.

During the year 4 faculty members of SINP have received the awards/fellowships and distinctions.

Year 2015-16

- Altogether 415 research publications have been credited during the period and about 55 theses awarded for PhD degree. About 90 publications in high impact (IF>6.0) journals like Physics Letters B, journal of High Energy physics, Astrophysical Journal & Carcinogenesis.

- The successful operation of the Indian Beam Line at Photon Factory (KEK) at Tsukuba has been recognized as a flagship cooperative activity by the honourable Prime Minister of India.

During the year 2 faculty members of the SINP have received the awards/fellowships and distinctions of International Importance.

Year 2016-17

- Altogether 438 research publications have been credited during the period and about 56 theses awarded for PhD degree. And 62 scientific articles published in high impact(I.F.≥ 6) journals like Nature, Science, ACS Catalysis, Nucleic Acids Research, Proceedings of the National Academy of Sciences of the United States of America, Chemistry of Materials, Physical Review Letters, ACS Applied Materials & Interfaces, Chemsuschem, Cancer Letters, Acta Biomaterialia, Chemical Engineering Journal and Journal of High Energy Physics, etc.
- ALICE and CMS experiments at CERN, PICASSO experiment at SNOLab

- Experiments at Deutsches Elektronen-Synchrotron (DESY), Hamburg through the Indo-German Collaboration in synchrotron research.

- Successful operation of the Indian Beam Line at Photon Factory (KEK) at Tsukuba, Japan has been recognized as a flagship cooperative activity by the honorable Prime Minister of India. Publications through international collaborations are represented in the following graphical presentation.

- The institute has organised several **outreach programs** through the CARE unit (Centre for Advanced Research & Education) both inside and outside SINP and received overwhelming response from the participants.

During the year 1 faculty member received a prestigious fellowship.

Year 2017-18

- During the year 2017-18 - Thirty Five (35) Post M. Sc students have been inducted into research and teaching program, Ten (10) undergraduate associates, Twenty Four (24) summer students coming from different parts of the country have been trained in the Institute and Twenty Eight (28) Research Fellows have been awarded Ph.D. degree.

- Important achievements of the SINP during 2017-18 are as follows:-

- About 450 scientific articles (without collaboration 283 & with collaboration 167) have been published in 128 different journals. Among these, 81 scientific articles (without collaboration 20 & with collaboration 61) have appeared in 12 high impact journals (I.F.≥ 6).

- The institute has also participated in several International Collaboration programmes like; ALICE, CMS, CMS Tracker, CMS HCAL, ECHo, Fermi-LAT, INO, MAGIC, LCTPC, PICASSO, PICO, R3B.

- SINP has established an underground laboratory, named Jaduguda Underground Science Laboratory at the existing mine of Uranium Corporation of India Limited in Jharkhand. This laboratory is at present, the only underground science laboratory in India to carry out rare event search experiments, which are otherwise impossible to do at the Earth surface because of very large cosmic radiation background.

- SINP has also set up a small underground science laboratory at 555 m depth of the existing Uranium mine. To begin with, the laboratory is used to study the performance

of detectors under development for a future Dark Matter Search and neutrino experiments in which scientists from SINP, Kolkata, Uranium Corporation of India Limited, Jharkhand, National Institute of Science Education & Research (NISER), Bhubaneswar, Bhabha Atomic Research Centre (BARC), Variable Energy Cyclotron Centre (VECC), Kolkata, Institute of Physics, Bhubaneswar, Tata Institute of Fundamental Research (TIFR), Mumbai and other institutions are participating.

- The installation, commissioning and training of the LEEM-PEEM system has been successfully completed at the SPMS division of SINP. It is to be highlighted that this is the first such LEEM-PEEM facility available in India. The Low Energy Electron Microscopy (LEEM) and Photo-Emission Electron Microscopy (PEEM) are complementary imaging methods which are not only powerful for imaging the surfaces at very high spatial resolutions (~ 4 nm) but also for the study of different dynamical processes at surfaces in real-time.

- The pilot phase project of Vigyan Pratibha (VP) program was launched on 31stJuly 2017 with a joint session by Homi Bhabha Centre for Science Education (HBCSE), Tata Institute of Fundamental Research (TIFR), Mumbai and Saha Institute of Nuclear Physics (SINP), Kolkata through Video Conferencing. Principals, teachers and students of several KV schools participated in the inaugural programme.

- The following special events have been celebrated in SINP during 2017-18:-

- Foundation day celebration on 11thJanuary, 2018

- On the occasion of 125thBirth Anniversary of Prof. Meghnad Saha, a series of memorial talks were held.

- Conferences and School viz. CMNSER 2018, Saha Theory Workshop, AAPCOS-2018.

- Outreach Programme.

- Dr. H. Raghuraman has been awarded “Welcome Trust/DBT India Alliance Intermediate Fellowship” in December 2017.

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Homi Bhabha National Institute (HBNI), Mumbai

The Homi Bhabha National Institute (HBNI), Department of Atomic Energy (DAE) is a Deemed to be University under Section-3 of the UGC act 1956 as notified by the Ministry of Human Resources Development in 2005. HBNI has been set up to provide higher education in science, to promote development of science and technology with the help of Research & Development Centres and Grant-in-Aid Institutions under DAE. HBNI is a registered society under the Societies Registration Act 1870 and has its own Memorandum of Association and Rules.

The HBNI offers a range of academic programmes. Various programmes offered are Ph.D., M.Tech. in engineering sciences and M.Phil. in physical sciences, chemical sciences and life sciences, M.Sc. (Engg), Integrated M.Sc. of five-year duration at National Institute for Science Education and Research (NISER), Bhubaneswar, Super Specialty Courses at Tata Memorial Centre (TMC), Mumbai, Post Graduate Courses at TMC, DRM (Diploma in Radiation Medicine) at BARC, M.Sc. (Nursing) at TMC, M.Sc. (Clinical Research) at TMC, Dip.R.P. (Diploma in Radiological Physics) at BARC, DMRIT (Diploma in Medical Radio Isotope Techniques) at BARC, DFIT (Diploma in Fusion Imaging Technology) at TMC. Around 1590 students are currently pursuing Ph.D. in various disciplines.

HBNI has the following as its constituents Institutions (CIs).

(i) Bhabha Atomic Research Centre (BARC), Mumbai
(ii) Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam
(iii) Raja Ramanna Centre for Advanced Technology (RRCAT), Indore
(iv) Variable Energy Cyclotron Centre (VECC), Kolkata
(v) Saha Institute of Nuclear Physics (SINP), Kolkata
(vi) Institute for Plasma Research (IPR), Gandhinagar
(vii) Institute of Physics (IOP), Bhubaneswar
(viii) Harish-Chandra Research Institute (HRI), Allahabad
(ix) Institute of Mathematical Sciences (IMSc), Chennai, and
(x) Tata Memorial Centre (TMC), Mumbai.

Year 2014-15

- Two new courses namely Diploma in Fusion Imaging Technology (DFIT) and M.Sc. in Clinical Research were started during the year 2014-15 by TMC.

- In this academic year, 762 students were admitted to various programmes being conducted under HBNI by various CIs and 566 Degrees/Diplomas were awarded.

Year 2015-16

- During 2015-16, 888 students were admitted in different programs. HBNI has also awarded 200 Ph.D., 165 M.Tech., 6 M.Sc. (Engg), 79 M.Sc., 70 post graduate medical degrees MD, DM and MCh, 5 M.Sc.(Nursing) and 40 PG diplomas in radiation protection (DipRP), medical radioisotope technology (DMRIT), radiation medicine (DRM) and fusion imaging technology (DFIT). Around 1590 students are currently pursuing Ph.D. in various disciplines.

- The Government of India launched National Institutional Ranking Framework (NIRF) for educational institutions from the year 2015-16 for various disciplines, viz. Engineering (Teaching & Research), Engineering (Teaching), Management, Pharmacy, Architecture and Colleges (UGC). HBNI participated in the ranking framework and provided information as per desired format. India Rankings 2016 were released on April 4, 2016 by then MHRD minister. HBNI was ranked 17th out of the 233 universities participated in this category.

Year 2016-17

- A Strategic Studies program has also been identified to ensure availability of adequate qualified human resources to address issues pertaining to nuclear law, economics of nuclear power, nuclear security, nuclear proliferation, intellectual property rights etc.

- During 2016-17, 914 students were admitted in different programs, out of which 353 students re for Ph.D. Program. HBNI has awarded 218 Ph.D., 106 M.Tech., 10 M.Sc. (Engg), 73 M.Sc., 107 post graduate medical degrees, 6 M.Sc.(Nursing) and 42PG diplomas in radiation protection (DipRP), medical radioisotope technology (DMRIT), radiation medicine (DRM) and fusion imaging technology (DFIT).

- The following major development has taken place during this year:-

  (a) Memorandum of Association (MoA) of the HBNI are amended in compliance with UGC (Institutions Deemed to be Universities) regulations 2016;

  (b) HBNI has received 21st Rank in University category and 35th rank in overall category (among a total 3319 participants);

  (c) HBNI has signed eleven Memorandum of Understandings (MoU) with reputed Universities / Institutes at National and International level for Academic collaborations; and

  (d) In order to have better employment opportunities to the students pursuing PhD programmes under 'Board of Strategic Studies' and also to enhance its mandate, the 'Board of Strategic Studies' has been renamed to 'Board of Study for Applied System Analysis'.

Year 2017-18

- During 2017-18, 785 students were admitted in different programs, out of which 336 students are for Ph.D. Program. HBNI has awarded 225 Ph.D., 94 M. Tech., 22 M.Sc. (Engg), 89 M.Sc., 108 post graduate medical degrees, 5 M.Sc.(Nursing) and 38 PG diplomas in radiation protection (DipRP), medical radioisotope technology (DMRIT), radiation medicine (DRM) and fusion imaging technology (DFIT).

- The following major development has taken place during this year:-

- Review of functioning of HBNI by UGC-AICTE

- HBNI has crossed a milestone of award of 1000 PhD degrees (cumulative) during the current academic year.

- HBNI participated in Institutional ranking Framework (NIRF) with Dean as HBNI coordinator. India rankings 2018 were released in April, 2018. HBNI was ranked 26th in University category.

- The draft bill on declaring HBNI as Institution of National Importance (INI) is in advanced stage of submission to competent authority.

- The HBNI-IGCAR faculty members through “Society for Advancement of Chemical Sciences and Education and Research (SACSE), Kalpakkam” carried out 6 outreach programs in and around Chennai, covering about 1200 students of intermediate, Graduation and Postgraduate students. Demonstration experiments in chemistry, Science Quiz and lectures on fundamental aspects of chemistry were arranged as part of outreach program. HBNI faculty have also been involved in conducting more than 10 school workshops in both English and the Tamil medium in the Southern region, to spread awareness about radioactivity and its applications.

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Atomic Energy Education Society (AEES)

The Atomic Energy Education Society (AEES), Mumbai an autonomous institution under the administrative control of the Department of Atomic Energy (DAE), is established to provide education to the children of the employees of the Department of Atomic Energy and its constituent units. At present, AEES administers 30 Schools/Junior colleges at 16 centres located all over the country and provides education to over 27,000 students.

Year 2014-15

- AEES has launched several long-term key projects such as Application of Science and Technology for Educational Reforms (ASTER) for the development of the complete personality of its students through modern and technical education infrastructure.

- AEES has established the Satellite Interactive Terminals at all centers under which a hub and video recording studio have been set up at Anushaktinagar in Mumbai.

- During the year 2014-15, AEES has undertaken the following academic activities for further improvement / development of the students of the AEES:-

  a) AEES Junior Science and Mathematics Olympiad (in collaboration with HBCSE).
  b) All India Inter AECS/AEJC Science, Social Science, Mathematics & Teaching Aids Exhibition – 2014.
  c) Inter AECS Hindi Vigyan Prashna Manch.
  d) Talent Nurture Programme [The Societal Enrichment & Education Programme (SEEP)]
  e) Non-scholastic Activities – Sports, N.C.C. and Art.
  f) Application of Science and Technology in Educational Reforms (ASTER) Programme.

- More than 156 students of AEES have secured admission in reputed professional colleges of Engineering (including IITs and NITs) and Medicine.

- In the All India Secondary School Examination [AISSE] (CBSE) held in March 2015, the pass percentage was 98.17. In the Higher Secondary Examination, the pass percentage was 93.51.

- AEES institutes a healthy competition amongst all AEC schools to bring out the best of every child as well as teacher and administrator to achieve brilliance in over all development. The following trophies are awarded to AEC Schools and Junior College for remarkable achievements in different areas:-

  (i) Dr. Homi Bhabha Rolling Trophy for the best overall performance for Schools and Junior College.
  (ii) Dr. Vikram Sarabhai Rolling Trophy for the best academic performance among Schools and Junior Colleges.
  (iii) Dr. Raja Ramanna Trophy for the best Co-scholastic Activities among Schools and Junior Colleges.

(iv) Dr. Homi Sethna Trophy for the Sports achievements among Schools and Junior colleges.

Year 2015-16

- The Constitution of India gives the right to free and compulsory education to all children in the age group of six to fourteen years, as a Fundamental Right. The same was implemented in AEES, in the year 2015-16 and 433 students from various centres were inducted in AEES under RTE.

- In the All India Secondary School Examination held in March 2016, the average pass percentage was 98.49. In the Higher Secondary Examination, the average pass percentage was 92.29%. More than 200 students of AEES have secured admission to reputed professional colleges for Engineering, Medicine, etc.

- It is important that the children of the country understand the necessity of cleanliness. All AEC schools and Junior colleges took part in the **Swachh Bharat Abhiyaan** this year also with great enthusiasm and the message was conveyed to the students about keeping the surroundings clean and tidy for a healthy atmosphere.

- Shri Madan Rao, Principal, AECS-1, Tarapur and Smt. Usha Chaturvedi, Headmistress, AECS-5, Mumbai were bestowed upon with the National Award for Teachers for the year 2015, conferred by Ministry of Human Resource Development

Year 2016-17

- The All India Junior Science and Mathematics Olympiad as well as the AEES Science, Mathematics, social Science and Teaching Aides Exhibitions are organized every year to motivate and nurture the students as well as teachers. Selected exhibits are sent to the Jawaharlal Nehru National Science, Mathematics and Environmental Exhibition conducted by NCERT.

- AEES believes in the all round development of the children. Keeping this in mind, AEES in collaboration with the Department of Atomic Energy Sports and cultural Sports and Cultural Council organizes Summer Sports coaching Camp for school children in various sports.

- AEES institutes a healthy competition amongst all AEC schools to bring out the best of every child as well as teacher and administrator to achieve brilliance in overall development.

- Shri B.S.K. Raju, Principal of AECS-3, Rawatbhata and Shri S.R. Mohanta, Head Master of AECS-2, Tarapur were bestowed upon with the prestigious National Award for Teachers for the year 2016, conferred by Ministry of Human Resource Development.

Year 2017-18

- AEES has achieved significant results in its pursuit of excellence in academic as well as non-academic fields. The enrichment of the school libraries, computer aided

education, improved sports facilities, play equipment, in-service training programmes for teachers, multimedia programmes and enrichment programmes for students have helped the institutions to set new benchmarks in excellence. Constructions of auditoria, additional classrooms, volleyball and basketball courts etc. have greatly contributed to the strengthening of infrastructural facilities in AEES.

- AEES provides special incentives to the economically and socially deprived children living around its establishments through its Societal Enrichment and Education Programme (SEEP). This faculty, meant for the bright children from the rural/tribal areas, is running at 9 centers and is extended to some of those who are admitted to various schools under RTI programme. At present over 1200 children are receiving free education other facilities under this programme.

- In the All India Secondary School Examination (Class X) conducted by CBSE held in March 2018, the average pass percentage was 97.11%. In the Higher Secondary Examination (Class XII), the average pass percentage was 90.79%. More than 55 students of AEES have secured admission to reputed professional colleges for Engineering, Medicine, etc.

- The All India Junior Science and Mathematics Olympiad as well as the AEES Science, Mathematics, social Science and Teaching Aides Exhibitions are organized every year to motivate and nurture the students as well as teachers. Selected exhibits are sent to the Jawaharlal Nehru National Science, Mathematics and Environmental Exhibition conducted by NCERT.

- AEES believes in the all round development of the children. Keeping this in mind, AEES in collaboration with the Department of Atomic Energy Sports and cultural Sports and Cultural Council organizes Summer Sports coaching Camp for school children in various sports.

- AEES aims at broader development of the complete personality of its students through modern and technical educational infrastructure. AEES runs a project called Application of Science and Technology for Educational Reforms (ASTER). AEES has established Satellite Interactive Terminals at all centres and a recording studio has been set at Anushaktinagar, Mumbai. 16 programmes on various subjects and interviews were recorded this year.

- AEES institutes a healthy competition amongst all AEC schools to bring out the best of every child as well as teacher and administrator to achieve brilliance in overall development.

- Smt. Kankana Chandra, PRT of AECS-2, Mumbai was conferred with the prestigious National Award for Teachers for the year 2017 by Ministry of Human Resource Development.

- “Say no to plastic” campaign also formed a part of the students’ learning, this year.

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