

## BELUR MAIN CAMPUS – DEPARTMENT OF PHYSICS

### **(1) Total No. of class rooms available (seminar room, meeting room, etc. may be mentioned separately)**

4 classrooms, 1 seminar room, and 1 meeting room

### **(2) No. and details of Laboratories with brief description on the kind of work done therein, including computer laboratories**

Department has a modern teaching laboratory. The general physics laboratory courses have been designed to inculcate a hands-on approach towards experimental physics. Primary objectives of this Laboratory course are:

- to train to handle instruments
- to teach some basic experimental techniques
- to verify some fundamental laws of physics and to measure different physical quantities
- to perform some historically important experiments in the development of physics
- to design experiments and to learn to extract meaningful physics principles from the experimental observation

The department also has a Design and Fabrication laboratory. Fundamental objectives of this laboratory include:

- Challenging the creativity of students
- Making technology easily accessible to common people
- Developing an open-ecology through sharing of ideas and knowledge
- Creating an interdisciplinary/multidisciplinary platform for implementation of various ideas
- Training and empowering the students in designing, assembling, fabricating and computing digital and microprocessor controlled systems, using a hands on approach
- Designing cost effective real life devices/gadgets which can benefit human beings and society as a whole

The department also runs a Computation Physics Laboratory. Fundamental objectives of this laboratory include:

- Developing numerical, computational and logical skills relevant for solution of theoretical and experimental physics problems
- Acquiring a hands-on approach towards computer hardware, software, clustering and networking
- Synchronising computational skills acquired with requirements of theoretical physics courses

All these laboratories are currently being expanded even further with the FIST grant.

Further experiments are being planned for cosmology special paper students in the new telescope set up. The department has set up a Celestron 14 inch EdgeHD computerised telescope with WBDST-FIST grant. This year we are procuring solid state photometers to be integrated with the telescope so that meaningful measurements of relevant parameters of observable heavenly bodies can be done.

**(3) Details of Library: No. of books, no. of journals, web-based access to resources provided or not, total built up area, e-journals and e-databases available, other printed journals and magazines, total no. of users, total no. of books issued yearly, no. of yearly visitors approximately.**

The library houses approximately 1200 books in Physics. It has an e-subscription through INFLIBNET to American Physical Society Journals (Physical Review Letters, Physical Review D, Reviews of Modern Physics, Physics Today), Institute of Physics (IOP) Journals (Classical & Quantum Gravity, Journal of Physics A and G, Nature, Springer Journals).

**(4) No. of students admitted in various courses during the last 3 years (male and female to be separately shown)**

Name of the Programme	Applications received	Selected		Pass percentage	
		Male	Female	Male	Female
PhD (last 3 years)**	10	4	0		
MSc(2012)	295 (approx)	12*	3*	100	100
MSc(2013)	300 (approx)	11*	1*	100	100
MSc(2014)	325 (approx)	14*	3*	-	-
MSc(2015)	350(approx)	13*	2*		

\*The number shown here are the students who got selected, got admitted and continued till the end of the course.

\*\*Total number of Ph.D students in the department = 8

**(5) New educational and communication technologies used for teaching**

Class rooms with ICT facility :

All our class rooms have access to the internet through WiFi and LAN.

They are also equipped with lcd projection and videoconferencing facilities.

## **(6) Details of to what extent is the Faculty Centre computerized**

About 35 computers, all assembled by our M.Sc students, are running in the department. There is also a 64 core, each of 2.8GHz Xeon, 128GB RAM, server associated with a DST project. In addition to serving the departmental needs, this multicore machine is heavily deployed by faculty of computer science for carrying out combinatorially explosive calculations for their research work. All faculty and research scholars have been assigned a computer. There is a computer centre where classes and M.Sc projects are carried out.

## **(7) Research and Extension facility and actual work done during the last 3 years**

Details are given in the publication lists of individual faculties below in item (8)

## **(8) Publications of faculty during the last 3 years**

### **Debashis Gangopadhyay**

[Semi-classical treatment of k-essence effect on cosmic temperature](#) (with A. Bandyopadhyay, A. Moulik), arXiv:1406.2308

[The Hawking Temperature in the context of Dark Energy for Reissner-Nordstrom and Kerr background](#) (with G.Manna), arXiv:1303.2999 , Euro.Phys.Jour.C74, (2014) 2811.

[Probing the Leggett-Garg Inequality for Oscillating Neutral Kaons and Neutrinos](#) (with D. Home, A. Sinha Roy), arXiv:1304.2761, Phys.Rev. A88 (2013) 022115.

[The Hawking temperature in the context of dark energy](#) (with Goutam Manna) arXiv:1211.1268, Euro.Phys.Lett. 100 (2012) 49001 .

[A discussion on Lorentz preserving scalar fields in Lorentz violating theory](#) (with O.Ganguly, P.Majumdar) Jour.of Phys. Conference Series 405 (2012) 012015.

[The k-essence scalar field in the context of Supernova Ia Observations](#) (with A. Bandyopadhyay, A. Moulik), arXiv:1102.3554, Euro.Phys.Jour. C72 (2012) 1943.

[Lorentz-preserving fields in Lorentz-violating theories](#) (with O.Ganguly, P.Majumdar) arXiv:1011.1206, Euro.Phys.Lett. 96 (2011) 61001.

[On a cosmological invariant as an observational probe in the early universe](#) (with S.Mukherjee), arXiv:1010.5355, Gravitation and Cosmology 17 (2011) 349.

[Estimating temperature fluctuations in the early universe](#)  
Debashis Gangopadhyay, arXiv:0903.3806, Gravitation and Cosmology 16 (2010) 231.

### **Abhijit Bandyopadhyay**

[Semi-classical treatment of k-essence effect on cosmic temperature](#)

(with D. Gangopadhyay, A. Moulik), arXiv:1406.2308

[Reconstructing the equation of state and density parameter for dark energy from combined analysis of recent SNe Ia, OHD and BAO data](#)

(with D. Adak, D. Majumdar), arXiv:1102.4726, Published in J.Phys.Conf.Ser. 375 (2012) 032008

[The k-essence scalar field in the context of Supernova Ia Observations](#)

(with D. Gangopadhyay, A. Moulik), arXiv:1102.3554, Eur.Phys.J.C (2012) 72:1943

[On Diurnal and Annual Variations of Directional Detection Rates of Dark Matter](#)

(with D. Majumdar), arXiv:1006.3231, The Astrophysical Journal, 746:107 (14pp), 2012

[Constraining Scalar Singlet Dark Matter with CDMS, XENON and DAMA and Prediction for Direct Detection Rates](#)

(with S. Chakraborty, A. Ghosal, D. Majumdar), arXiv:1003.0809, JHEP 1011:065,2010.

[Interpreting the bounds on Dark Matter induced muons at Super-Kamiokande in the light of CDMS data](#)

(with S. Chakraborty, A. Ghosal, D. Majumdar), arXiv:1002.0753, Int.J.Mod.Phys.A25:3741-3747, 2010.

## **Bobby Ezhuthachan**

[BPS solutions in ABJM theory and Maximal Super Yang-Mills on  \$R \times S^2\$](#)  (with Shinji Shimasaki, Shuichi Yokoyama), arXiv:1107.3545, JHEP 1112:048, 2011

## **Parthasarathi Majumdar**

Strong gravity Lense-Thirring Precession in Kerr and Kerr-Taub-NUT spacetimes

[Chandrachur Chakraborty, Parthasarathi Majumdar](#)

Journal-ref: Class. Quantum Grav. 31 (2014) 075006

Quantum Hairs and Entropy of Quantum Isolated Horizon from Chern-Simons Theory

[Abhishek Majhi, Parthasarathi Majumdar](#)

Journal-ref: Class. Quantum Grav. 31 (2014) 195003

Gravitational Coleman-Weinberg Potential and It's Finite Temperature Counterpart

[Srijit Bhattacharjee, Parthasarathi Majumdar](#)

Journal-ref: Nuclear Physics, Section B (2014), pp. 481-492

Charged Quantum Black Holes : Thermal Stability Criterion

[Abhishek Majhi, Parthasarathi Majumdar](#)

Journal-ref: Class. Quantum Grav. 29 (2012) 135013

Extremal Limits and Kerr Spacetime

[Parthapratim Pradhan, Parthasarathi Majumdar](#)

Journal-ref: Eur. Phys. J. C (2013) 73:2470

Schwarzschild horizon dynamics and SU(2) Chern-Simons theory

[Romesh K. Kaul, Parthasarathi Majumdar](#)

Journal-ref: Phys.Rev.D83:024038,2011

Circular Orbits in Extremal Reissner Nordstrom Spacetimes

[Parthapratim Pradhan, Parthasarathi Majumdar](#)

Journal-ref: Phys.Lett.A375:474-479,2011

## Somendra Mohan Bhattacharjee

Jaya Maji, S. M. Bhattacharjee, F. Seno and A. Trovato [Phys Rev E89, 012121 \(2014\)](#) Title: *Melting behavior and different bound states in three-stranded DNA models*

S. M. Bhattacharjee Achille Giacometti and Amos Maritan [J. Phys.: Condens. Matter 25 \(2013\) 503101](#)  
Title: *Flory theory for polymers*

Tanmoy Pal, Poulomi Sadhukhan, and S. M. Bhattacharjee [Phys. Rev. Lett. 110, 028105 \(2013\)](#)  
Title: *Renormalization Group Limit Cycle for Three-Stranded DNA*

Garima Mishra, Poulomi Sadhukhan, S. M. Bhattacharjee, and Sanjay Kumar [PRE 87, 022718 \(2013\)](#)  
Title: *Dynamical phase transition of a periodically driven DNA*

## Amitava Bhattacharyya

22. Unconventional superconductivity in Y5Rh6Sn18 probed by muon spin relaxation  
Bhattacharyya, D.T. Adroja, N. Kase, A. D. Hillier, J. Akimitsu and A.M. Strydom  
Scientific Reports 5, 12926 (2015)
21. Incommensurate spin-density-wave antiferromagnetism in CeRu2Al2B  
Bhattacharyya, D. Khalyavin, D. T. Adroja, A. M. Strydom, W. A. Kockelmann, A. D. Hillier, and B. D. Rainford  
Physical Review B: Rapid Communications 93, 060410(R) (2016)
20. Searching for triplet superconductivity in the Quasi-One-Dimensional Superconductor K2Cr3As3  
D.T. Adroja, A. Bhattacharyya, M. Telling, Yu. Feng, M. Smidman, B. Pan, J. Zhao, A. D. Hillier, F. L. Pratt, and A.M. Strydom  
Physical Review B 92, 134505 (2015)
19. Contrasting chemical pressure effect on the moment direction in the Kondo semiconductor CeT2Al10 (T = Ru,Os)  
D. T. Adroja, A. D. Hillier, C. Ritter, A. Bhattacharyya, D. D. Khalyavin, A. M. Strydom, P. Peratheepan, B. Fak, M. M. Koza, J. Kawabata, Y. Yamada, Y. Okada, Y. Muro, T. Takabatake, and J. W. Taylor  
Physical Review B 92, 094425 (2015)
18. SR and Neutron Diffraction Investigations on Reentrant Ferromagnetic Superconductor Eu(Fe0.86Ir0.14)2As2  
V. K. Anand, D. T. Adroja, A. Bhattacharyya, U. B. Paramanik, P. Manuel, A. D. Hillier, D. Khalyavin, and Z. Hossain  
Physical Review B 91, 094427 (2015)
17. Broken time-reversal symmetry probed by muon spin relaxation in the caged type Superconductor Lu5Rh6Sn18  
A. Bhattacharyya, D.T. Adroja, J. Quintanilla, A. D. Hillier, N. Kase, A.M. Strydom, and J. Akimitsu  
Physical Review B: Rapid Communications 91, 060503(R) (2015)

16. Contrasting carrier doping effect in the Kondo insulator CeOs<sub>2</sub>Al<sub>10</sub>: The influential role of c f hybridization in spin-gap formation  
A. Bhattacharyya, D.T. Adroja, A.M. Strydom, J. Kawabata, T. Takabatake, A.D. Hillier, V. Garcia Sakai, J.W. Taylor, R.I. Smith  
Physical Review B 90, 174422 (2014)
15. Anomalous change of the magnetic moment direction by hole doping in CeRu<sub>2</sub>Al<sub>10</sub>  
Bhattacharyya, D. Khalyavin, D. T. Adroja, A. M. Strydom, A. D . Hillier, P. Manuel, T. Takabatake, J.W. Taylor, and C. Ritter  
Physical Review B 90, 174412 (2014)
14. SR and inelastic neutron scattering investigations on noncentrosymmetric compound CeNiC<sub>2</sub>  
Bhattacharyya, D.T. Adroja, A.M. Strydom, A. D . Hillier, J.W. Taylor, A. Thamizhavel, S. K. Dhar, W. A. Kockelmann, B. D. Rainford  
Physical Review B 90, 054405 (2014)
13. Physical properties of noncentrosymmetric superconductor LaIrSi<sub>3</sub>: A SR study  
V. K. Anand, D. Britz, A. Bhattacharyya, D. T. Adroja, A. D. Hillier, A. M. Strydom, W. Kockelmann, B. D. Rainford, and K. A. McEwen  
Physical Review B 90, 014513 (2014)
12. Anisotropic magnetic properties of PrSi single crystal with giant magnetocaloric effect  
Pranab Kumar Das, Amitava Bhattacharyya, S. K. Dhar, and A. Thamizhavel  
Physical Review B 89, 134418 (2014)
11. Magnetic ordering with reduced cerium moments in hole-doped CeOs<sub>2</sub>Al<sub>10</sub>  
D. D. Khalyavin, D. T. Adroja, A. Bhattacharyya, A. D. Hillier, P. Manuel, A. M. Strydom, J. Kawabata, and T. Takabatake  
Physical Review B 89, 064422 (2014)
10. Two dimensional magnetic correlation in the unconventional corrugated layered oxides (Ba,Sr)<sub>4</sub>Mn<sub>3</sub>O<sub>10</sub>  
J. Sannigrahi, S. Chattopadhyay, A. Bhattacharyya, S. Giri, and S. Majumdar  
Journal of Physics: Condensed Matter 27, 056001 (2015)
9. Muon spin relaxation study on itinerant ferromagnet CeCrGe<sub>3</sub> and effect of Ti substitution on magnetism in CeCr<sub>1-x</sub>Ti<sub>x</sub>Ge<sub>3</sub>  
Debarchan Das, A. Bhattacharyya, V. K. Anand, A.D. Hillier, J. W. Taylor, T. Gruner, C. Geibel, D. T. Adroja, and Z. Hossain  
Journal of Physics: Condensed Matter 27, 016004 (2015)
8. Investigations of the singlet ground state system: PrIrSi<sub>3</sub>  
V. K. Anand, D. T. Adroja, A. Bhattacharyya, A. D. Hillier, J. W. Taylor, A. M. Strydom  
Journal of Physics: Condensed Matter 26, 306001 (2014)
7. Crystal structure and physical properties of CePt<sub>2.4</sub>Al<sub>0.6</sub>  
A. Provino, A. Bhattacharyya, L. Negretti, R. Kulkarni, A. Thamizhavel, S. K. Dhar  
Journal of Alloys and Compounds 622, 483 (2015)
6. Magnetocaloric effect near the second order ferromagnetic transition in superstructure

- R15Si9C compounds (R = Gd, Tb and Dy)  
Amitava Bhattacharyya, A. Thamizhavel, S. K. Dhar and P. Manfrinetti  
Journal of Alloys and Compounds 588, 720 (2014)
5. Critical phenomena in Pr<sub>0.52</sub>Sr<sub>0.48</sub>MnO<sub>3</sub> single crystal.  
Sk. Sabyasachi, A. Bhattacharyya, S. Majumdar, S. Giri and T. Chatterji  
Journal of Alloys and Compounds 577, 165-169 (2013)
  4. Muon-spin-relaxation and inelastic neutron scattering investigations of the caged-type Kondo semimetals: CeT<sub>2</sub>Al<sub>10</sub> (T = Fe, Ru and Os)  
D. T. Adroja, A. D. Hillier, Y. Muro, T. Takabatake, A. M. Strydom, A. Bhattacharyya A. Daoud-Aladin and J. W. Taylor  
Physica Scripta 88, 068505 (2013)
  3. Neutron scattering and SR studies on a Kondo lattice heavy fermion CeRuSn<sub>3</sub>  
V. K. Anand, D. T. Adroja, A. Bhattacharya, A. D. Hillier, D. Britz, A. M. Strydom, A. Fraile, and W. Kockelmann  
J. Phys.: Conf. Ser. 592, 012008 (2015)
  2. ChemInform Abstract: Crystal structure and physical properties of CePt<sub>2.4</sub>Al<sub>0.6</sub>  
A. Provino, A. Bhattacharyya, L. Negretti, R. Kulkarni, A. Thamizhavel, S. K. Dhar  
ChemInform 46, 5 (2015)
  1. ChemInform Abstract: SR and inelastic neutron scattering investigations of the caged-type Kondo semimetals: CeT<sub>2</sub>Al<sub>10</sub> (T = Fe, Ru and Os)  
D. T. Adroja, A. D. Hillier, Y. Muro, T. Takabatake, A. M. Strydom, A. Bhattacharyya A. Daoud-Aladin and J. W. Taylor  
ChemInform 46, 4 (2015)

### Prasanta K Mukherjee (Retired Visiting faculty)

<sup>1,3</sup>D<sup>o</sup> and <sup>1,3</sup>P<sup>e</sup> states of two electron atoms under Debye plasma, Jayanta K. Saha, S. Bhattacharyya, T. K. Mukherjee and P. K. Mukherjee, JQSRT, 11, 675, 2010.

<sup>1</sup>S<sup>e</sup> resonance states of two electron atoms by stabilization method, Jayanta K. ha, S. Bhattacharyya, T. K. Mukherjee and P. K. Mukherjee, IJQC, 111, 1819, 2011

Positronium Formation in Debye plasma : Subhrangsu Sen, Puspajit Mandal and Prasanta Kumar Mukherjee, Eur. Phys. J. D, 62, 379, 2011

Hyperpolarizability of hydrogen atom under spherically confined Debye plasma, Jayanta K. Saha, T. K. Mukherjee, P. K. Mukherjee and B. Fricke, Eur. Phys. J. D, 62, 205, 2011.

Combining Monte Carlo Simulation and Density Functional Theory for Describing the Spectral Changes of Na Dimer in Liquid Helium, Lucas Modesto da Costa, Kaline Coutinho, Prasanta K. Mukherjee and Sylvio Canuto, Phys. Rev. A 83, 042515, 2011

Application of relativistic coupled cluster linear response theory to helium like ions embedded in plasma environment, Madhulita Das, Rajat K. Chaudhuri, Sudip Chattopadhyay, Uttam Sinha Mahapatra and P.

K. Mukherjee, J. Phys. B. At. Mol. Opt. Phys. 44, 165701, 2011

Evaluation of spectral line width of atoms in liquid helium, B. Fricke and P. K. Mukherjee, Phys. Lett. A 375, 2720, 2011

On the diagnosis of fluorescence active autoionising states of helium, J. K. Saha, S. Bhattacharyya, P. K. Mukherjee and T. K. Mukherjee, Chem. Phys. Lett, 517, 223, 2011

Effect of strongly coupled plasma on the doubly excited states of helium like ions Jayanta K.Saha, T. K. Mukherjee, P.K.Mukherjee and B. Fricke, EPJ D, 66, 43, 2012

Spectral Shifts and Line Profiles of Alkaline Earth Atoms in Liquid Helium Environment : a Monte Carlo Simulation and Time Dependent Density Functional Calculation, Lucas Modesto-Costa, Kaline Couthinho, Prasaanta K. Mukherjee and Sylvio Canuto, Chem. Phys. Lett. 533, 25, 2012.

Positronium formation in positron-helium collisions with screened Coulomb Interaction, Subhrangsu Sen, Puspajit Mandal and Prasanta Kumar Mukherjee Accepted for publication in Eur. Phys. J. D 66, 230, 2012

Hyperpolarizability of He atom under spherically confined Debye plasma, Subhrangsu Sen, Puspajit Mandal and Prasanta Kumar Mukherjee Phys. Plasmas, 19, 033501, 2012

Three body negative ions under Coulomb interaction, S. Bhattacharyya, J. K. Saha, P. K. Mukherjee and T. K. Mukherjee, Phys. Scr. 85, 065305, 2012

Hyperpolarizabilities of one and two electron atoms under strongly coupled plasma, Subhrangsu Sen, Puspajit Mandal, Prasanta Kumar Mukherjee and Burkhard Fricke Phys. Plasmas 20, 013505 (2013)

Effect of strongly coupled plasma on the magnetic dipolar and quadrupolar transitions of two electron ions: Jayanta K. Saha, T. K. Mukherjee, P. K. Mukherjee and B. Fricke, Phys. Plasmas 20, 042703 (2013)

Precise estimation of the energy levels of two-electron atoms under spherical Confinement, S. Bhattacharyya, J. K. Saha, P. K. Mukherjee and T. K. Mukherjee Phys. Scr. 87, 065305 (2013)

Observation of  $2p3d ({}^1P^o) \rightarrow 1s3d ({}^1D^e)$  radiative transition in He-like Si, S and Cl ions, by S. Kasthurirangan, J. K. Saha, A. N. Agnihotri, S. Bhattacharyya, D. Misra, A. Kumar, P. K. Mukherjee, J. P. Santos, A. M. Costa, P. Indelicato, T. K. Mukherjee and L. C. Tribedi, Phys. Rev. Lett. 111, 243201 (2013)

Doubly excited under spherical confinement: A case study: by Subhrangsu Sen, Puspajit Mandal, Prasanta Kumar Mukherjee and Burkhard Fricke, Int. Rev. At. Mol. Phys. 4, 29 (2013)

The variation of Borromean window with mass relation parameters of exotic systems under screened Coulomb interactions, by Sayantan Dutta, Jayanta K. Saha, Sukhamoy Bhattacharyya, Prasanta K. Mukherjee and Tapan K. Mukherjee, Phys. Scr., 89, 015401 (2014)

Borromean windows for muonic and electronic three-particle systems with screened Coulomb interactions, Mariusz Pawlak, Mirosław Bylicki and Prasanta K. Mukherjee, J. Phys. B, At. Mol. Opt. Phys. 47, 095401, 2014

## (9) Ongoing research project with source of funding

1. "Atomic Structure Calculations: Effect of External Plasma and Spatial Confinement." - sanctioned DST project, duration March 1, 2013 till 28 Feb., 2017 of ~ Rs. 30,00,000/- Principal



Investigator: Prof. Prasanta K Mukherjee, Co-Investigator: Prof. Abhijit Bandyopadhyay

Projects of Amitava Bhattacharyya

1. Title:

Geometrical frustration induced quantum phase transition in  $\text{CeRh}_{1-x}\text{Pd}_x\text{Sn}$ : Inelastic neutron scattering study

Funding:

Newton Bhabha Fund between India and UK

2. Title:

Investigation of complex magnetic structure and the role of frustration by means of high resolution neutron diffraction study in  $\text{CeRh}_{1-x}\text{Pd}_x\text{Sn}$

Funding:

Newton Bhabha Fund between India and UK

3. Title:

Investigation of superconducting energy gap in  $\text{TrIrSi}$  ( $\text{Tr} = \text{Ti}, \text{Zr}, \text{and Hf}$ ): A muon spin relaxation study

Funding:

Newton Bhabha Fund between India and UK

4. Title:

Superconductivity and itinerant ferromagnetism in d-band metal  $\text{Y}_9\text{Co}_7$ : A muon spin relaxation study

Funding:

Newton Bhabha Fund between India and UK

5. Title:

Investigation of the reduced dimensionality and magnetic frustration in  $\text{ACr}_3\text{As}_3$  ( $\text{A} = \text{K}, \text{Rb}$  and  $\text{Cs}$ )

Funding:

Newton Bhabha Fund between India and UK

6. Title:

Neutron diffraction study to understand the complex magnetic ordering of  $\text{PrRu}_2\text{M}_2\text{B}$  ( $\text{M} = \text{Al}$  and  $\text{Ga}$ )

Funding:

Newton Bhabha Fund between India and UK

## **(10) National and international linkages**

### **a) National collaborations set up**

#### **Bobby Ezhuthachan**

Scientific collaborations started with Chetan Gowdigere (NISER, Bhubaneswar) Alok Laddha

(CMI, Chennai), and Kaushik Roy (IACS, Kolkata) in 2014 and is in progress.

### **Somendra Mohan Bhattacharjee**

Scientific collaborations with Prof. Sanjay Kumar, BHU, Varanasi Prof. Debaprasad Giri, IIT-BHU, Varanasi

### **Abhijit Bandyopadhyay**

Scientific collaboration on dark matter research started with Debasish Majumdar and Ambar Ghoshal (SINP, Kolkata) in 2010 . Outcome of the collaboration are the following publications  
[Reconstructing the equation of state and density parameter for dark energy from combined analysis of recent SNe Ia, OHD and BAO data](#)

(A Bandyopadhyay, D. Adak, D. Majumdar), arXiv:1102.4726, Published in J.Phys.Conf.Ser. 375 (2012) 032008

#### [On Diurnal and Annual Variations of Directional Detection Rates of Dark Matter](#)

(A Bandyopadhyay, D. Majumdar), arXiv:1006.3231, The Astrophysical Journal, 746:107 (14pp), 2012

#### [Constraining Scalar Singlet Dark Matter with CDMS, XENON and DAMA and Prediction for Direct Detection Rates](#)

(A Bandyopadhyay, S. Chakraborty, A. Ghosal, D. Majumdar), arXiv:1003.0809, JHEP 1011:065,2010.

#### [Interpreting the bounds on Dark Matter induced muons at Super-Kamiokande in the light of CDMS data](#)

(A Bandyopadhyay, S. Chakraborty, A. Ghosal, D. Majumdar), arXiv:1002.0753, Int.J.Mod.Phys.A25:3741-3747,2010.

### **Prasanta Kumar Mukherjee (Retired Visiting Faculty)**

Scientific collaboration with Tapan K Mukherjee at Narula Inst., Kolkata, and with Puspajit Mandal at Visva Bharati, Shantiniketan from 2009 - till date. Outcome of the collaboration are the following publications:

[\$^{1,3}D^o\$  and  \$^{1,3}P^e\$  states of two electron atoms under Debye plasma](#), Jayanta K. Saha, S. Bhattacharyya, T. K. Mukherjee and P. K. Mukherjee, JQSRT, 11, 675, 2010.

[\$^1S^e\$  resonance states of two electron atoms by stabilization method](#), Jayanta K. ha, S. Bhattacharyya, T. K. Mukherjee and P. K. Mukherjee, IJQC , 111, 1819, 2011

[Positronium Formation in Debye plasma](#) : Subhrangsu Sen, Puspajit Mandal and Prasanta Kumar Mukherjee, Eur. Phys. J. D, 62, 379,2011

### **Debashis Gangopadhyay**

Started scientific collaboration on Quantum Computation theory and Information with Dipankar Home (Bose Institute, Kolkata) in 2012. Outcome of the collaboration is the following publication:

[Probing the Leggett-Garg Inequality for Oscillating Neutral Kaons and Neutrinos](#)

(D Gangopadhyay, D. Home, A. Sinha Roy), arXiv:1304.2761, Phys.Rev. A88 (2013) 022115.

### **Parthasarathi Majumdar**

Scientific collaboration on Quantum Gravity with Abhishek Majhi, Chandrachur Chakraborty at Saha Institute of Nuclear Physics, Kolkata from 2013- till date. Outcome of the collaboration are the following publications:

Strong gravity Lense-Thirring Precession in Kerr and Kerr-Taub-NUT spacetimes

[Chandrachur Chakraborty, Parthasarathi Majumdar](#)

Journal-ref: Class. Quantum Grav. 31 (2014) 075006

Quantum Hairs and Entropy of Quantum Isolated Horizon from Chern-Simons Theory

[Abhishek Majhi, Parthasarathi Majumdar](#)

Journal-ref: Class. Quantum Grav. 31 (2014) 195003

### **b) International collaboration**

#### **Bobby Ezhuthachan**

Shinji Shimasaki in Kyoto University, Japan in 2013 and is in progress.

#### **Somendra Mohan Bhattacharjee**

Scientific collaboration with Prof Flavio Seno, Prof Antonio Trovato, Prof Amos Maritan, University of Padova, Italy, Prof Achille Giacometti, Universita' Ca' Foscari Venezia, Venice, Italy, Dr P. Sadhukhan, University of Goettingen, Germany

#### **Prasanta Kumar Mukherjee (Retired Visiting Faculty)**

Scientific collaboraton on Molecular spectroscopy with Burkard Fricke (Univ of Kassel, Gemany) and with Sylvio Canuto (Univ of Sao Paulo, Brazil) from 2009 - till date.

Outcome of the collaboration are the following publications :

Hyperpolarizability of hydrogen atom under spherically confined Debye plasma, Jayanta K. Saha, T. K. Mukherjee, P. K. Mukherjee and B. Fricke, Eur. Phys. J. D, 62, 205,2011.

Combining Monte Carlo Simulation and Density Functional Theory for Describing the Spectral Changes of Na Dimer in Liquid Helium, Lucas Modesto da Costa, Kaline Coutinho, Prasanta K. Mukherjee and Sylvio Canuto , Phys. Rev. A 83, 042515, 2011

Evaluation of spectral line width of atoms in liquid helium, B. Fricke and P. K. Mukherjee, Phys. Lett. A 375, 2720 , 2011

Effect of strongly coupled plasma on the doubly excited states of helium like ions Jayanta K.Saha,T. K. Mukherjee, P.K.Mukherjee and B. Fricke, EPJ D,66, 43, 2012

Spectral Shifts and Line Profiles of Alkaline Earth Atoms in Liquid Helium Environment : a Monte Carlo Simulation and Time Dependent Density Functional Calculation, Lucas Modesto-Costa, Kaline Couthinho, Prasaanta K. Mukherjee and Sylvio Canuto , Chem. Phys. Lett. 533, 25, 2012.

## **(11) Conferences and Workshops organized/attended by the faculty during the last 3 years.**

### **Annual one-day workshop series:**

Since 2009, the physics department has been organizing a one-day workshop every year on various topics. The details of the programmes are as follows:

### **One day meeting on non-equilibrium transport, 8 November 2014 (Saturday)**

Speakers:

Goutam Tripathy (IOP, Bhubaneswar): An Overview of ASEP

Sutapa Mukherji (IIT Kanpur): Asymmetric simple exclusion process: A boundary layer analysis

Abhik Basu (SINP, Kolkata): Generic nonequilibrium steady states in exclusion process on inhomogeneous rings

Arvind Kumar Gupta (IIT Ropar): Modeling Of Stochastic Transport Processes: Vertical Cluster Mean Field Approach for Two-Channel Tasep

Sudipto Muhuri (University of Pune): Jamming transition in a driven lattice gas

Subhadip Ghosh (IOP, Bhubaneswar): Intracellular transport on multifilament tracks

Bappa Saha (IIT Kanpur): Boundary layers and phase transitions in multi-lane driven diffusive systems

### **RKMVU - IUCAA Introductory Workshop on Solar Physics 5-7 February, 2013**

Speakers:

Ashok Ambastha, (PRL, Udaipur Solar Observatory), "The Sun"

Ashok Ambastha, (PRL, Udaipur Solar Observatory), "Helioseismology"

Ashok Ambastha, (PRL, Udaipur Solar Observatory), "Solar Magnetic Fields"

Dibyendu Nandi, (IISER, Kolkata), "Solar Magnetic Fields and Dynamo Theory"

Bhuwan Joshi, (PRL, Ahmedabad), "Solar Eruptive Phenomena"

Dipankar Banerjee (IAA, Bangalore) "Waves in Water Atmosphere"

**One-day Workshop on Recent Trends in Statistical Mechanics and Condensed Matter Physics, 15 September, 2012**

Speakers:

Mustansir Barma (TIFR, Mumbai)

Title of talk: Entropy and Order

Somendra Mohan Bhattacharjee (IOP, Bhubaneswar)

Title of talk: Entanglement Entropy in Quantum Mechanic

Indrani Bose (Bose Institute, Kolkata)

Title of talk: Spin Ladders: Theory meets Experiments

Ranjan Chaudhury (SNBNCBS, Kolkata)

Title of talk: Correlations, Ordering and Anomalies in Condensed Matter Systems

**One-day Workshop on General Relativity, Gravitation and Cosmology, 5 March, 2011**

Speakers:

Narayan Banerjee (IISER, Kolkata)

Title of talk: On the Darkness of the Universe

Debashis Gangopadhyay (SNBNCBS, Kolkata)

Title of talk: Dark Energy and Emergent Gravity

Soumitra SenGupta (IACS, Kolkata)

Title of talk: Aspects of Braneworld Models

Rajesh Gopakumar (HRI, Allahabad)

Title of talk: String Theory and the Quest for Quantum Spacetime

**One day workshop on Recent Trends in Atomic and Molecular Physics Research, 13 February, 2010**

Speakers:

Markus Pernpointner (Heidelberg University, Germany)

Title of talk: Relativistic Effects in Chemistry and Chemical Physics

S. P. Bhattacharyya (IACS, Kolkata)

Title of talk: Computational Intelligence in Electronic Structure Calculation of Atoms Molecules and Clusters -A Paradigm shift?

Indrani Bose (Bose Institute, Kolkata)

Title of talk: Stochastic Gene Expression: A Single Molecule View

Lokesh Tribedi (TIFR, Mumbai)

Title of talk: New facets in molecular ionization by swift ions: An experimental study

S Chakravarti (IACS, Kolkata)

Title of talk: Spectroscopy in Nano Vessels

## **Conferences / Talks by faculty :**

### **Debashis Gangopadhyay**

- (1) "An Ermakov Invariant and Temperature Fluctuations in the Early Universe"- ICGAC10, Xth International Conference on Gravitation Astrophysics and Cosmology, Quy Nhonh, Vietnam, 17-22 Dec.2011.
- (2) "Our Universe and the Higgs Boson" : Evening Lecture of The Institution of Engineers India), 12th September, 2012.
- (3) "On k-essence Scalar Fields": International Conference on New Trends in Field theories, Benaras Hindu University , Nov. 23-26, 2012.
- (4) "Our Universe": Prabhat Kumar College, Contai, Purba Medinipur, November 14 , 2013.
- (5) " Our Universe : Particles, Fields , Galaxies and the Higgs Boson" (Invited Speaker): St. Paul's College, Kolkata , February 28, 2014.
- (6) "Cosmology at RKMVU", India-JINR Forum, Joint Institute of Nuclear Research, Dubna, Moscow, Russia, 19th June, 2014.

### **Abhijit Bandyopadhyay:**

"Missing Mass and Energy of the Universe" - talk given at Ramakrishna Mission Vivekananda Centenary College, Rahara in January 2013.

### **Bobby Ezhuthachan :**

Guest lecturer (Group Theory for Particle Physics) at the preparatory SERC School held at North Bengal University held during September- October 2012

### **Parthasarathi Majumdar:**

- (1) Black Hole Mysteries, Acharya J C Bose Birth Anniversary Lecture, BESU Shibpur, Howrah, 30 November 2012.

- (2) Rahasye bhara Andhakuup (in Bangla), Prof. Bidhubhushan Roy Memorial Lecture, WB National Council of Education, Jadavpur, 27 January 2013.
- (3) Black Hole Mysteries, Prof. K. C. Kar Memorial Lecture, Inst of Theoretical Physics, Kolkata, 9 February 2013.
- (4) kano bigyan porhbo ? (in Bangla) talk given at Bigyan Karmashala, Bali Shikshayatan, Bali, 11 September 2012.
- (5) Higgs Boson: kathay kathay (in Bangla) Radio Talk at Akashvani Kolkata (A) on 25 November 2012.

**Amitava Bhattacharyya:**

- (1) Electronic Properties of Modern Materials, November 17-19, 2015  
Diamond Light Source, Oxfordshire, United Kingdom  
*Broken time-reversal symmetry probed by muon spin relaxation in the caged type superconductor Sc<sub>5</sub>Rh<sub>6</sub>Sn<sub>18</sub>*
  - (2) Oxford Symposium on Quantum Materials, May 1, 2015  
Somerville College, Oxford University, United Kingdom, April 12-15, 2015  
*Unconventional superconductivity in Y<sub>5</sub>Rh<sub>6</sub>Sn<sub>18</sub> probed by muon spin relaxation*
  - (3) UK - Japan Workshop on Physics and Applications of Superconductivity, July 7-11, 2014  
King's College, Cambridge University, United Kingdom  
*Broken time-reversal symmetry probed by muon spin relaxation in the caged type superconductor Lu<sub>5</sub>Rh<sub>6</sub>Sn<sub>18</sub>*
  - (4) International Conference on Strongly Correlated Electron Systems, July 7-11, 2014  
Grenoble, France  
*Electron and hole doping effects on the spin gap of the caged type Kondo semimetal CeOs<sub>2</sub>Al<sub>10</sub>*
  - (5) International Conference on Strongly Correlated Electron Systems, July 7-11, 2014  
Grenoble, France  
*Neutron scattering and SR studies on a Kondo lattice heavy fermion CeRuSn<sub>3</sub>*
  - (6) Theoretical and Experimental Magnetism Meeting, July 2-3, 2014  
Cosener's House, Abingdon, Oxfordshire, United Kingdom  
*Contrasting electron and hole doping effects on the spin gap of the caged type Kondo semimetal CeOs<sub>2</sub>Al<sub>10</sub>: A muon spin relaxation and inelastic neutron scattering investigation*
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