

## Evaluative Report of the Department of Physics

1. Name of the Department : **Physics**  
Its year of establishment : **1960.**
2. Names of Programmes / Courses offered (UG, PG, M.Phil., Ph.D., Integrated Masters; Integrated Ph.D., etc.)
  - **UG (Honours, General )**
3. Interdisciplinary courses and departments involved: **NA**
4. Annual/ semester/choice based credit system:
  - **Before July 2010 Annual ,**
  - **From 2010 onwards semester system.**
5. Participation of the department in the courses offered by other departments **Nil**
6. Number of teaching posts sanctioned and filled (Professors/Associate Professors/Asst. Professors)

	<b>Sanctioned</b>	<b>Filled</b>
<b>Professor</b>	<b>NA</b>	<b>NA</b>
<b>Associate Professors</b>	<b>NA</b>	<b>2</b>
<b>Asst. Professors</b>	<b>7</b>	<b>1</b>

7. Faculty profile with name, qualification, designation, specialisation (D.Sc./D.Litt./ Ph.D./M.Phil., etc.)

<b>Name</b>	<b>Qualification</b>	<b>Designation</b>	<b>Specialization</b>	<b>No. of Years of Experience</b>	<b>No. of Ph.D. students guided in the last 4 years</b>
<b>Goutam Bhattacharya</b>	<b>Ph. D</b>	<b>Assoc Prof</b>	<b>Electronics</b>	<b>21</b>	
<b>Rajkumar Das</b>	<b>Ph. D</b>	<b>Assoc Prof</b>	<b>Nucl Phys.</b>	<b>21</b>	

<b>Name</b>	<b>Qualification</b>	<b>Designation</b>	<b>Specialization</b>	<b>No. of Years of Experience</b>	<b>No. of Ph.D. students guided in the last 4 years</b>
<b>Bhabesh Roy</b>	<b>Ph. D</b>	<b>Asst Prof</b>	<b>Electronics</b>	<b>12</b>	
<b>Dipak Ghose</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Solid S Phys.</b>	<b>41</b>	
<b>Chndra Madhab Pal</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Spectroscopy</b>	<b>38</b>	
<b>Siddhartha Roy</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Nucl, Particle Phys.</b>	<b>41</b>	<b>2</b>
<b>Sobhendu Ghatak</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Solid S Phys.</b>	<b>42</b>	
<b>Ajay Chowdhury</b>	<b>M. Sc.</b>	<b>Visiting Faculty</b>	<b>Nucl Phys.</b>	<b>37</b>	
<b>Arunagnshu Chowdhury</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Electronics</b>	<b>36</b>	
<b>Samaresh Chakraborty</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Nucl Phys.</b>	<b>40</b>	
<b>Sasanka Shekhar Mandal</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Solid S Phys.</b>	<b>33</b>	
<b>Swapan Saha</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Solid S Phys.</b>	<b>26</b>	
<b>Surajit Chakraborty</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Particle Phys.</b>	<b>37</b>	
<b>Tarasankar Nag</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Nucl. Phys.</b>	<b>32</b>	
<b>Bandhu Kishore Das</b>	<b>Ph. D</b>	<b>Visiting Faculty</b>	<b>Particle Phys.</b>	<b>32</b>	
<b>Asis Manna</b>	<b>M. Sc.</b>	<b>Visiting Faculty</b>	<b>Solid S Phys.</b>	<b>1</b>	

<b>Name</b>	<b>Qualification</b>	<b>Designation</b>	<b>Specialization</b>	<b>No. of Years of Experience</b>	<b>No. of Ph.D. students guided in the last 4 years</b>

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

<b>Courses of</b>	<b>Permanent Faculty</b>		<b>Temporary Faculty</b>	
	<b>Theory ( % )</b>	<b>Practical ( % )</b>	<b>Theory ( % )</b>	<b>Practical ( % )</b>
<b>1<sup>st</sup> Sem</b>	<b>Hons 25</b> <b>Gen 50</b>	<b>100</b> <b>50</b>	<b>75</b> <b>50</b>	<b>00</b> <b>50</b>
<b>2<sup>nd</sup> Sem</b>	<b>Hons 27</b> <b>Gen 40</b>	<b>100</b> <b>50</b>	<b>73</b> <b>60</b>	<b>00</b> <b>50</b>
<b>3<sup>rd</sup> Sem</b>	<b>Hons 40</b> <b>Gen 45</b>	<b>80</b> <b>50</b>	<b>60</b> <b>55</b>	<b>20</b> <b>50</b>
<b>4<sup>th</sup> Sem</b>	<b>Hons 54</b> <b>Gen 60</b>	<b>80</b> <b>50</b>	<b>46</b> <b>40</b>	<b>20</b> <b>50</b>
<b>5<sup>th</sup> Sem</b>	<b>Hons 34</b>	<b>90</b>	<b>66</b>	<b>10</b>
<b>6<sup>th</sup> Sem</b>	<b>Hons 25</b>	<b>90</b>	<b>75</b>	<b>10</b>

**9. Programme-wise Student Teacher Ratio : 16:47**

**10. Number of academic support staff (technical) and administrative staff: sanctioned and filled**

	<b>sanctioned</b>	<b>filled</b>
<b>Academic support staff (technical)</b>	<b>3</b>	<b>0</b>
<b>Administrative staff</b>	<b>NA</b>	<b>NA</b>

**11. Number of faculty with ongoing projects from**

- |  |                  |
|--|------------------|
| <b>a) national</b>                       | <b>Two</b>       |
| <b>b) international funding agencies</b> | <b>NA</b>        |
| <b>c) Total grants received.</b>         | <b>Rs 41 lac</b> |

Mention names of funding agencies and grants received project-wise.

**Bhabesh Roy :**

- a) Study of the Magnetocaloric Effect in Some Manganites, UGC, Rs. 1 Lac.

**Gautam Bhattacharya :**

(The following two projects are running in the BESU)

- a) Lab Scale Precision I-V real time analyzer for design and development of a Selective gas sensor. DST, Rs. 20 Lac
- b) Healthy and Safe Home based on wireless sensor system for Elderly People.  
DST, Rs. 20 Lac

**12. Departmental projects funded by DST-FIST; DBT, ICSSR, etc.; total grants received:  
UGC, Rs. 1 Lac.**

**13. Research facility / centre with**

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

**14. Publications:**

- \* **number of papers published in peer reviewed journals (national / international)**

<b>National</b>	<b>1</b>
<b>International</b>	<b>7, Documents attached page 13-14</b>
- \* **Monographs** NA
- \* **Chapter(s) in Books** NA
- \* **Editing Books** NA
- \* **Books with ISBN numbers with details of publishers** NA
- \* **number listed in International Database (For e.g. Web of Science, Scopus, Humanities International Complete, Dare Database - International Social Sciences Directory, EBSCO host, etc.)** NA

* <b>Citation Index – range / average</b>	NA
* <b>SNIP</b>	NA
* <b>SJR</b>	NA
* <b>Impact factor – range / average</b>	( 1 – 3 ) / 2
* <b>h-index</b>	NA

**15. Details of patents and income generated** NA

**16. Areas of consultancy and income generated** NA

**17. Faculty recharging strategies**

**Goutam Bhattacharya.**

- 1) Two-week ISTE Workshop on Solar Photovoltaic: Fundamentals, Technologies and Applications. IIT Bombay. 12th to 22nd December, 2011.
- 2) Chemistry in our lives. RKMV 25th March 2011.
- 3) Workshop on Theoretical High Energy Physics & Theoretical Condensed Matter Physics. RKMVU. 26th February 2009.
- 4) National Seminar on Global Warming-A Challenge in 21st Century Uluberia College. 15th and 16th February 2008.
- 5) National Workshop on Undergraduate Physics Teaching: Search for Effective Methodology. Behala College 8 to 10th February 2008.
- 6) Physics Experiment: Objective, Approaches and Learning. IAPT Scottish Church College. 8th December 2007
- 7) Role of Experiments in the Development of Physics. 18th & 19th September 2007
- 8) Critical Issues in Sensor Development- Material to Packaging & Instrumentation. Dept. of E&TE BESU, CGCRI, JU, CECT. 3rd to 10th January 2007.
- 9) Workshop on The use of Data Acquisition System. IAPT and IUAC IISER. 21 to 24th September 2006.
- 10) Seminar on Einstein in Annus Mirabilis The World Year of Physics. 14th November 2005
- 11) Chemistry National Week 6th August 2005
- 12) Seminar on Continuous Quality Sustain and Monitoring in a Higher Education System. 14th May 2005

**13) Demonstration and Interactive Workshop on “Innovative Experiment” 16th July 2005**

**Raj Kumar Das.**

<b>Name</b>	<b>Sponsoring Agency</b>	<b>Place &amp; Date</b>
1. “Celebration of National Chemistry Week”	R.K.M Vidyamandira Chemical Research Society of India	R.K.M Vidyamandira Belurmath, Howrah. Aug. 6, 2005
2. National Seminar on “ Perspectives in Nuclear physics”	U.G.C.	Dept. of physics, R.K.M.Vidyamandira, Belurmath, Howrah. February 22, 2008.
3. National seminar on “ Microbiology : An Environmental perspective “	U.G.C.	Dept. of microbiology. R.K.M.Vidyamandira, Belurmath, Howrah. March 4, 2008
4. Seminal on “Einstein –In-Annus Mirabilis: The World Year of Physics”	Science and Technology Council &Department (Govt. of W.B)	R.K.M Vidyamandira Belurmath, Howrah. Nov. 14, 2005
5. Workshop on “Theoretical High Energy Physics & Theoretical Condensed Matter Physics”	Ramakrishna Mission Vivekananda University(R.M.V.U)	Dept. of Physics & School of Mathematical Science R.M.V.U Belurmath, Howrah. Feb. 26, 2009
6. National Seminar on “Soft Computing Techniques and Their Applications”	U.G.C	R.K.M Vidyamandira & Indian Statistical Institute Belurmath, Howrah. March 7, 2009
7. National seminar on “ Chemistry in our	U.G.C	Dept. of Chemistry, R.K.M.Vidyamandira. Belurmath, Howrah.

lives

March 25, 2011.

**Bhabesh Roy**

○ **Refresher courses attended:**

1. Nano Science & Techninology U.G.C Jadavpur University

Jan. 4, 2007 to Jan. 22, 2007

2. Recent Perspective of Nano Science & Techninology U.G.C Jadavpur University

Dec. 4, 2008 to Dec. 26, 2008

○ **Workshops, seminars, symposia etc. including open university courses/M.Phil., Ph.D.**

1. National Seminar on “Indian Scientific Heritage: Aryabhata to Harish Chandra”

R.K.M Vivekananda University and Vijnana (Bengal Chapter) R.K.M Vivekananda University Belurmath Howrah Feb. 23-24, 2007

2. Symposium on “Vistas of the Present-Day Physics Research” Indian Physical Society and

Saha Institute of Nuclear Physics. Saha Institute of Nuclear Physics, Kolkata. March 30, 2007

3. Seminal on “Physics Experiments: Objective, Approaches and Learning” Indian Association of Physics Teachers (IAPT) Dept. of Physic Scottish Church College Kolkata, Dec. 8, 2007

4. International Conference on Magnetic Materials Saha Institute of Nuclear Physics(SINP) Experimental Condensed Matter Physics Division, SINP, Kolkata Dec. 11-16, 2007

5. National Seminar on “Global Warming –A Challenge in 21st Century” U.G.C Uluberia College Uluberia, Howrah Feb. 15-16, 2008

6. National Seminar on “Perspective in Nuclear Physics” U.G.C R.K.M Vidyamandira & R.K.M Vivekananda University Belurmath, Howrah. Feb. 22, 2008

7. National Conference on “Nano Science & its Impact on Society” U.G.C Dept. of Physics

Narasinha Dutta College Howrah. March 27-28, 2008

8. Workshop on “Theoretical High Energy Physics & Theoretical Condensed Matter Physics” Ramakrishna Mission Vivekananda University (R.M.V.U) Dept. of Physics & School of Mathematical Science R.M.V.U Belurmath, Howrah. Feb. 26, 2009

9. National Seminar on “Soft Computing Techniques and Their Applications” U.G.C R.K.M Vidyamandira & Indian Statistical Institute Belurmath, Howrah. March 7, 2009

10. National Seminar on “56th DAE – Solid State Symposium” Department of Atomic Energy RSM University, Kattankulathur, Tamil Nadu Dec. 19-23, 2011

11. Seminar on “Recent Trends in Fiber Optics and Optical Communication” U.G.C St. Paul’s Cathedral Mission College and I.A.P.T, RC-15 Kolkata Jan. 18, 2012

#### 18. Student projects

- percentage of students who have done in-house projects including inter-departmental
  - 4<sup>th</sup> Sem - 100% in-house project.
- percentage of students doing projects in collaboration with industries / institutes
  - 2<sup>nd</sup> year -- 15% students in collaboration with Department of Physics of Vivekananda University.

#### 19. Awards / recognitions received at the national and international level by

- Faculty
  - 1 (Prof Gautam Bhattacharya)
  - 2012 Highly Commended Award. Emerald LiteratNetwork.
- Doctoral / post doctoral fellows
- Students

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

National seminar on Perspective in Nuclear Physics, 22<sup>nd</sup> Feb., 2008.

#### 21 Student profile course-wise:

Name of the Course (refer question no. 2)	Applications received	Selected		Pass percentage	
		Male	Female	Male	Female
UG ( Hons ) 2008	796	30	NA	100%	NA
2009	989	30	NA	100%	NA
2010	730	12	NA		NA
2011	1093	17	NA		NA
2012	701	19	NA		NA

## 22. Diversity of students

Name of the Course (refer question no. 2)	% of students from the College	% of students from the State	% of students from other States	% of students from other countries
UG ( Hons ) 2008	0	100%	0	0
2009	0	100%	0	0
2010	0	100%	0	0
2011	0	100%	0	0
2012	0	95%	5%	0

**23. How many students have cleared Civil Services, Defense Services, NET, SLET, GATE and any other competitive examinations? Maximum number of students have cleared National Level competitive examinations like IIT-JAM , JEST etc.**

Year	Rank in IIT-JAM ( within 20 )	No. of admitted students to other institution
2012	3,14,19	Ecole polytechnic France-2, TIFR-3, IISc-1, HRI-1, IMSc-2

2011	1,13,14,16	IISc-4
2010	4,20	Cambridge Univ.-1, IIT-22
2009	12	TIFR-3, HRI-2, IISc-1,ISM-3,SNBose-3, IIT-20
2008	6,16,18	HRI-1, SNBose-1

Since we do not offer PG course it is not possible to keep a record of students' success in NET, SLET, GATE. However, the feed back from students suggests that a significant number of them have qualified for these examinations.

#### 24. Student progression

Student progression	Percentage against enrolled
UG to PG	100%
PG to M.Phil.	NA
PG to Ph.D.	
Ph.D. to Post-Doctoral	
Employed	NA
<ul style="list-style-type: none"> <li>• Campus selection</li> <li>• Other than campus recruitment</li> </ul>	
Entrepreneurs	

#### 25. Diversity of staff

Percentage of faculty who are graduates	BSc (H)	MSc	Ph.D
of the same parent university	2		
from other universities within the State	1	2	3
from other universities from other States		1	

26. Number of faculty who were awarded Ph.D., D.Sc. and D.Litt. during the assessment period.

- Bhabesh Roy was awarded Ph D in 2010 by Jadavapur University (He

worked at Saha Institute of Nuclear Physics) for his thesis “

**27. Present details about infrastructural facilities**

- a) **Library** : i) Central Library - 4586  
ii) Departmental Library – 192  
iii) Journals : 1) Physics News, 2) Physics Education, 3) Resonance
- b) **Internet facilities for staff and students** :
- Three computers with internet facility for the faculty members.
  - 7 computers are available for the students in a separate room.
- c) **Total number of class rooms**: 4
- d) **Class rooms with ICT facility** : 2
- e) **Students' laboratories**
- 1) General physics Laboratory for 1<sup>st</sup> yr Hons, 1<sup>st</sup> yr general and 2<sup>nd</sup> yr General.
  - 2) Electrical and Electronics Lab for 2<sup>nd</sup> yr Hons.
  - 3) General physics Laboratory for 2<sup>nd</sup> yr Hons.
  - 4) Optics laboratory for 2<sup>nd</sup> yr Hons.
  - 5) Optics Laboratory for 3<sup>rd</sup> yr Hons.
  - 6) Computer Laboratory for all Hons.
  - 7) Electronics and non-electronics Laboratory for 3<sup>rd</sup> yr Hons
- f) **Research laboratories** : 1 \

**28. Number of students of the department getting financial assistance from College.**

<b>Year</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2008-09</b>	<b>2009-10</b>	<b>2010-11</b>	<b>2011-12</b>	<b>2012-13</b>
<b>No, of students</b>	<b>16</b>	<b>29</b>	<b>31</b>	<b>24</b>	<b>11</b>	<b>7</b>	<b>12</b>

**29. Was any need assessment exercise undertaken before the development of new program(s)? If so, give the methodology.**

- i) After we were conferred autonomy in 2010, we went for a thorough restructuring of our syllabus to update and modernize the courses to keep it in sync with the requirements of the students.
- ii) We further tried to rationalize the load of the curriculum at the undergraduate level to make it possible for the students to do justice to the syllabus in more focused manner.

iii) The syllabus for the practical papers was restructured to make the students more responsive to experiments.

**30. Does the department obtain feedback from**

**a. faculty on curriculum as well as teaching-learning-evaluation? If yes, how does the department utilize it?**

a) The departmental meetings, held on a regular basis, discuss the issues related to curriculum as well as the teaching-learning-evaluation.

b) The feedback given by individual teachers on the basis of his experience with a particular course is thoroughly discussed at these meetings and corrective measures are taken, if necessary.

**b. students on staff, curriculum as well as teaching-learning-evaluation and what is the response of the department to the same?**

a) Open forum

b) Online feedback from student after the final semester.

**c. alumni and employers on the programmes and what is the response of the department to the same?**

- Representatives of the alumni and prospective employers are members of our Board of Studies. They contribute significantly to our discussions and decision-making.

**31. List the distinguished alumni of the department (maximum 10)**

- Prof. Gouranga Chakraborty.
- Prof. Debajyoti Bhaumik.
- Prof. Dipak Ghose
- Prof Ajay Chaudhury
- Prof. Chandra Madhab Pal.
- Prof. Projnan Chattopadhyay.
- Dr. Debasis Majumdar

**32. Give details of student enrichment programmes (special lectures / workshops / seminar) with external experts.**

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

- a) Chalk and Talk
- b) Power point presentation
- c) Tutorials
- d) Assignments

**34. How does the department ensure that programme objectives are constantly met and learning outcomes monitored?**

- a) Continuous Assessment
- b) Providing problem-sheets and helping them to solve those
- c) Project evaluation by external experts.
- d) Remedial coaching
- e) Meeting with the students after the publication of end-semester examinations
- f) Annual Teacher-parent meeting

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

- Students' participation in extension activities
  - a) NCC
  - b) NSS
  - c) Blood Donation Camp
  - d) Army Flag Day Collection
- Faculty participation in extension activities
  - a) Prof Gautam Bhattacharya, Head of the Department, is associated with 'Green Energy and Sensor System' at BESU, West Bengal
  - b) Bhabesh Ray is associated with SINP, Kolkata

**36. Give details of "beyond syllabus scholarly activities" of the department.**

- a. Arnab Rudra, of 2007-2010 batch, participated in 3 summer projects at HRI, Allahabad, under the guidance of reputed scientists Ashok Sen, Rajesh Gopakumar and others
- b. Sankha Subhra Chatterjee went for a summer training camp at Institute of Mathematical sciences, Chennai.
- c. Three students of 2011-2014 batch are doing project work at the Physics Department

of Ramakrishna Mission Vivekananda University.

d. Annual publication of the wall magazine.

**37. State whether the programme / department is accredited/ graded by other agencies.**

Give details.      **No.**

**38. Detail any five Strengths, Weaknesses, Opportunities and Challenges (SWOC) of the department.**

**Strength:**

- i) The versatile teaching staff.
- ii) Equal emphasis both on theory and experiment.
- iii) Acceptance of our students at national and international levels.

**Weakness:**

- i) Limited Number of full time teaching staff.
- ii) Reliance on too many superannuated teachers
- iii) No full time Laboratory staff.

**Opportunity:**

- i) Freedom in syllabus framing and evaluation process.
- ii) To enter into more collaborative ventures with Ramakrishna Mission Vivekananda University and other reputed Institutes.
- iii) Creation of a vibrant academic atmosphere in the department with the help of reputed and experienced teachers.

**Challenges:**

- i) To maintain the academic standard of the department in spite of the weaknesses mentioned earlier.

**39. Future plan of the department.**

- i) To apply for Major Research Project to make the department a hub of research activities.
- ii) To enrich the laboratories with new equipment
- iii) To increase the number of books in departmental library.

### **Bhabes Roy.**

1. Size-induced metal insulator transition and glassy behaviour in La<sub>0.5</sub> Sr<sub>0.5</sub> CoO<sub>3</sub> nanoparticle, B. Roy and S .Das, Applied Phys. Letter. 92, 233101 (2008).
2. Magnetic cluster glass behaviour and grain boundary effect in Nd<sub>0.7</sub> Ba<sub>0.3</sub> MnO<sub>3</sub> , B. Roy and S .Das, Applied Phys. Letter. 104, 103915 (2008).
3. Magnetic and electrical transport properties of La<sub>0.5</sub> A<sub>0.5</sub> CoO<sub>3</sub> nanoparticle(A = Sr, Ca, and Ba ), B. Roy and S .Das, J. Alloy Compd. 509, 5537 (2011).

### **Goutam Bhattacharya.**

1. An Efficient Method for Maintaining Constant AC Voltage Using dsPIC30F2020 Controller. pp 61-64. Vol. 3, Number 1, 2010. Journal of Electrical and Electronics Eng.
2. Green Energy Source(GES) based on multi criteria decision analysis(MCDA). pp 271-286. Vol. 5, No 2, 2011. International Journal of Energy Sector.
3. Towards Stable Grid Voltage Through Load Sharing in Indian Grid Connection. pp 4205 4210 26<sup>th</sup> European Photovoltaic Energy Conference and Exhibition.
4. Towards Constant Load Voltage Indian Grid Connected PV System Using dsPIC Controlled Power Conditioning Unit. pp 661-665,, Vol. 4, 2012 Elsevier.

### **Siddhartha Ray**

1. The study  $\alpha$  and  $^{14}\text{C}$  cluster states of  $^{18}\text{O}$  through the resonant breaking reaction  $^{12}\text{C} ( ^{18}\text{O}, ^{14}\text{C} )$  at  $E ( ^{18}\text{O} ) = 64.5 \text{ MeV}$ .  
[ with S. Adhikari, C. Basu, et al ] Int. Jour. Mod Phys. E(2009).
2. Reaction mechanism in  $^{16}\text{O} + ^{40}\text{Ca}$  at an incident energy of  $E( ^{16}\text{O} ) = 86 \text{ MeV}$  through inclusive measurements of  $\alpha$  and proton spectra.  
[ with Chinmay Basu, S. Adhikari et al ] Phys. Rev. C 76, No. 3 (2007) 034609.
3. Reaction mechanism with loosely bound nuclei  $^7\text{Li} + ^6\text{Li}$  at forward angles in the incident energy range 14 – 20 MeV.  
[ with S. Adhikari, C. Samanta et al ] Phys. Rev. C 74, 024602 (2006).

### **Sobhendu Kumar Ghatak**

1. Magnetic behavior of Disorder Ising Ferrimagnet in a high magnetic field. Philosophical Magazine, Vol-92, Issue 1-3, p-120, 2012.
2. Effect of Rotating Acoustic Stimulus on Heart rate variability in Healthy Adults. The open Neurology Journal 6, 71-77, 2012  
[ Co-authors B. Roy, R. Choudhury et al ]