Field (tick one box only):			
☐ Agricultural Sciences	☐ Biology/Medical Sciences	☐ Chemistry	☐ Earth Sciences
☐ Engineering Sciences and Technologies	☐ Mathematical Sciences	✓ **Physics**	

Personal Details:			
Family name: **BISHT**		Given name(s): **PRAVEEN SINGH**	Title: (Dr./Prof.) **Dr.**
Gender: ✓ **Male** ☐Female	Date of Birth: **28/06/1967**	Place of Birth: **ALMORA (INDIA)**	Nationality: **INDIAN**
Passport Number: **H7394107**		Date and Place of Issue: **04/12/2009 DEHRADUN**	Date of Expiry: **03/12/2019**
Name and Mailing Address of Home Institution: **DEPRTMENT OF PHYSICS, KUMAUN UNIVERSITY, SOBAN SINGH JEENA CAMPUS, ALMORA – 263601(UTTARAKHAND) INDIA**			Phone: **+91(5962)235286**
			Fax: **+91(5962)235286**
			E-mail: **ps_bisht123@rediffmail.com**
			Homepage: **NA**
Accompanying Dependants: (Expenses for family members must be covered by the applicant)			
Name: **SMT. PURNIMA BISHT**	Relationship: **WIFE**		Period of stay: **2 Months**
Name: **KM. JIGYASHA BISHT**	Relationship: **DAUGHTER**		Period of stay: **2 Months**
Name: **MR. DIVYA CHAKSHU BISHT**	Relationship: **SON**		Period of stay: **2 Months**

Academic Background:			
Degrees held:	**Year Awarded:**	**Field:**	**University:**
Ph. D.	**1992**	**High Energy Physics**	**Kumaun University, Nainital**
M. Sc.	**1987**	**Physics**	**Kumaun University, Nainital**
B. Sc.	**1985**	**Physics, Chemistry, Mathematics**	**Kumaun University, Nainital**
Current Position:			
Associate Professor			

Field of specialization:	
Elementary Particle Physics (Theoretical), Quantum Field Theory, Mathematical Physics, Electrodynamics, Relativity, Higher Dimensional Physics etc.	
H-Index: 4	
Value: 60	**Source: http://65.54.113.26/Author/18902762/p-s-bisht**
List below ten of your most recent & important publications (please also attach your CV and complete list of publications to the form):	
1. **Quaternion Octonion Reformulation of Quantum Chromodynamics Pushpa, P. S. Bisht , Tianjun Li and O. P. S. Negi arXiv:1006.5552v1 [hep-th] 29 Jun 2010 International J of Theoretical Physics, 50 (2011), 594 – 606.**	

DOI 10.100/7s10773-010-0579-8
2. Magneto hydrodynamics in presence of electric and magnetic charges Pushpa, P. S. Bisht and O. P. S. Negi arXiv:1001.4141v1 [hep-th] 23 Jan 2010 Communications in Physics, 22 (2012), 111 – 124.
3. Generalization of Schwinger – Zwanziger Dyon to Quaternions O. P. S. Negi, H. Dehnen, Gaurav Karnatak and P. S. Bisht arXiv:1012.0279v1[physics.gen-ph] 24 November 2010 International J of Theoretical Physics, 50 (2011), 1908 – 1918. DOI 10.1007/s10773-011-0705-0
4. Generalized Split Octonion Electrodynamics B. C. Chanyal, P. S. Bisht and O. P. S. Negi arXiv:1011.3922v1 [physics.gen-ph] 17 November 2010 International J of Theoretical Physics, 50 (2011), 1919 -1926. DOI 10.1007/s10773-011-0706-0
5. Spontaneous Symmetry Breaking in Presence of Electric and Magnetic Charges Pushpa, P. S. Bisht and O. P. S. Negi arXiv:1011.3921v1 [physics.gen-ph] 17 November 2010 International J of Theoretical Physics, 50 (2011), 1927 – 1934. DOI 10.1007/s10773-011-0707-0
6. Dual Hall Effect Pawan Kumar Joshi, P. S. Bisht and O. P. S. Negi Journal Electromagnetic Analysis and Applications, 3 (2011), 22 – 26. doi:10.4236/jemaa.2011.31004
7. Quaternion - Octonion SU(3) Flavor Symmetry Pushpa, P. S. Bisht, Tianjun Li and O. P. S. Negi arXiv:1107.1559v1 [physics.gen-ph] 8 July 2011 DOI: 10.1007/s10773-011-1062-x International J of Theoretical Physics, 51 (2012) 1866 - 1875.
8. Quaternion Octonions Reformulation of Grand Unified Theories Pushpa, P. S. Bisht, Tianjun Li and O. P. S. Negi arXiv:1205.4617v1[physics.gen-ph] 29 February 2012 International J of Theoretical Physics, 51 (2012), 3228 – 3235. DOI: 10.1007/s10773-012-1204-9
9. Generalized Electromagnetic fields in Chiral Medium Jivan Singh , P. S. Bisht and O. P. S. Negi hep-th/0703109. J. Phys. A: Math. and Theoretical, 40 (2007), 11395 - 11402. doi: 10.1088/1751-8113/40/37/015
10. Octonion Quantum Chromodynamics B. C. Chanyal, P. S. Bisht, Tianjun Li and O. P. S. Negi arXiv:1204.0242v1[physics.gen-ph] 23 March 2012 International J of Theoretical Physics, 51 (2012), 3410 – 3422. DOI 10.1007/s10773-012-1222-7

HOST CENTRE Provide up to three host centres in order of preference choosing from the list of participating centres "AssocCentres.pdf" available from www.twas.org by entering 'assoc' in the top right box 'Search'):

Choice No.1	Choice No. 2	Choice No. 3
INSTITUTE OF THEORETICAL PHYSICS, CHINESE ACADEMY OF SCIENCES, P. O. BOX 2735, BEIJING 100080, P.	DEPARTMENT OF PHYSICS, LA PLATA NATIONAL UNIVERSITY, C. C. 67, 1900, LA PLATA, ARGENTINA	INSTITUTE OF MODERN PHYSICS, FUDAN UNIVERSITY, SHANGHAI 200433, P. R. CHINA

R. CHINA		

Have you ever visited any of these centres before? If so, please give dates and purpose of visit:

Yes, already visited three times and we have also collaborating work there in i.e.

***Visit First*: - INSTITUTE OF THEORETICAL PHYSICS, CHINESE ACADEMY OF SCIENCES, P. O. BOX 2735, BEIJING 100080, P. R. CHINA from 4th JULY 2009 to 13th SEPTEMBER 2009 as a CAS -TWAS visiting fellow.**

***Visit Second:* - INSTITUTE OF THEORETICAL PHYSICS, CHINESE ACADEMY OF SCIENCES, P. O. BOX 2735, BEIJING 100080, P. R. CHINA from 9th May 2011 to 8th July 2011 as a UNESCO -TWAS Associateship.**

***Visit Third*: - INSTITUTE OF THEORETICAL PHYSICS, CHINESE ACADEMY OF SCIENCES, P. O. BOX 2735, BEIJING 100080, P. R. CHINA from 12th June 2012 to 31st August 2012 as a UNESCO -TWAS Associateship.**

Names of scientists you collaborated with in these centres (if any):

Prof. Tianjun Li, INSTITUTE OF THEORETICAL PHYSICS, CHINESE ACADEMY OF SCIENCES, P. O. BOX 2735, BEIJING 100080, P. R. CHINA (Email: tli@itp.ac.cn)

Previous support received by the applicant:

From	Please indicate the type of support received, the programme under which the support was granted and when it was received.
✓ **TWAS**	**CAS – TWAS VISITING FELLOWSHIP on 2004, 2008 and UNESCO – TWAS Associateship during 2010 - 2012.**
☐ IFS	**NA**
☐ ISP	**NA**
✓ **ICTP**	**For attending the summer school at ICTP, Trieste from 9th September 2002 to 27th September 2002.**
☐ Other (please specify)	**NA**

Purpose of visit and outline of the research programme you wish to pursue at the Centre:

Annexure as project of UNESCO- TWAS Associateship (PSB)

Benefits which the Associateship will provide to you and your home institution:

To strengthen and stimulate academic cooperation between institutions of higher education in both countries i.e. People Republic of China and home Country. These links are intended to enhance academic exchanges on all levels, help in developing joint curricula in areas of high priority to both partners, and to establish technology transfer/exchange of the new ideas in the field of Theoretical Physics with particular relevance to global development. This programme will also give a new plan of action to promote the research work at my place with the interaction of global scientific community and upkeep the teaching of the subject to promote the students of our University for future.

Signature of Applicant:	**Place and Date:**
	ALMORA 16/10/2012

Supporting statement from the head of the Applicant's Institution:	
Supporting Statement	
Annexure as Supporting statement of HEAD (PSB)	
Name and Title of Head of Institution	
1. **Prof. B. C. Joshi, Head Department of Physics, Kumaun University, S. S. J. Campus, Almora - 263601** 2. **Prof. H. S. Dhami, Dean, Faculty of Science and Director, Kumaun University, S. S. J. Campus, Almora - 263601**	
Signature:	Date:
Annexure as Supporting statement of HEAD (PSB)	**21/09/2012**

Department of Physics
Kumaun University
S.S. J. Campus
Almora-263601,
Uttarakhand (INDIA)
Phone/Fax- 05962-235286

Date: 21/09/2012

CERTIFICATE FOR RESEARCH LEAVE

This is to certify that Dr. Praveen Singh Bisht has been working as holds permanent faculty position since 22 May 1998 at Department of Physics, Kumaun University, S. S. J. Campus, Almora. This institution has no objection to forward the application of Dr. Praveen Singh Bisht for favorable action to the office of TWAS Associateships, ICTP Campus Strada Costiera 11, 34151 Trieste, Italy for **UNESCO - TWAS Associateships.**

This is also to certify that if the candidate is selected for this award, he will be granted paid research leave for the duration of the fellowship strictly according to the rules and regulations of Kumaun University, Nainital as well as the University Grants Commission, New Delhi.

(Professor B. C. Joshi)
Head of Physics Department

Head of the Physics Deptt.
Kumaun University,
NAINITAL-263001

(Professor H. S. Dhami)
Dean Faculty of Science
and
Director
Kumaun University,
S. S. J. Campus, Almora

Director
S. S. J. Campus,
ALMORA

BIODATA

01 Full Name – Dr. Praveen Singh Bisht (Dr. P. S. Bisht)

02 Date of Birth – 28th June 1967 (28-06-1967)

03 Name of Father – Sri Trinetra Singh Bisht

04 Name of Mother – Smt. Laxmi Bisht

05 (a) Designation – Associate Professor

05 (b) Present Address – Department of Physics
Kumaun University,
Soban Singh Jeena Campus,
Almora – 263601 (Uttarakhand) INDIA
Phone No – *+91-5962-235286,*
Fax - *+91-5962-235286, +91-5962231030*

06 Permanent Address – Shubham Lodge, Bisht Estate,
Village – Jangle (Buck), Almora – 263601 (Uttarakhand) INDIA
Phone No – *+91-5962-231331*
Mobile No - *+91-9412092013; +91-7409118621*
***E*-mail address:** ps_bisht123@rediffmail.com, psbisht1234@rediffmail.com,
psbisht123@gmail.com

07 Marital Status: - Married

08 Name of Wife: - Smt. Purnima Bisht

09 Sex: – Male

10 No of Children: - 02 (one daughter and one son)

11 Nationality: - Indian

12 Educational Qualifications:-

Degree	University/ Institute	Subject	Year of Passing	Div/Marks	Remarks
High School	U. P. Board, Allahabad	Hindi, English, Mathematics, Science, Biology	1981	II/ 58%	Distinction in Mathematics
Inter	----- do ----	Hindi, English, Mathematics, Physics, Chemistry	1983	I / 66%	Distinction in Mathematics and Physics
B. Sc.	Kumaun University, Nainital	Physics, Chemistry, Mathematics	1985	II/ 59%	
M. Sc.	----- do ----	Physics	1987	I / 64%	First position in the Institution
Ph. D.	---- do ----	Physics	1992	------	CSIR Fellowship
CCNA Instructor Course	Keane School of Excellence IIIT, Hyderabad	Cisco Networks	2003 & 2004	Sem-I, Sem-II, Sem-III & Sem IV	

M.Sc. Specialisation: - ***Electronics***

Title of Ph.D. Thesis: - *"QUATERNION, OCTONION FORMALISM FOR UNIFIED FIELDS OF DYONS AND GRAVITO-DYONS"*

Supervisor: Prof. O. P. S. Negi

13. Employment details/Other Experience: -

S. No	Post held	Institution	Duration	Nature of work
1	J.R.F	Kumaun Univ., S. S. J. Campus, Almora	July 1988 - June 1990	Research and Teaching
2	S.R.F	---- do ----	July 1990 – June 1993	Research and Teaching
3	Lecturer	---- do ----	23 Aug.1993 – 24 April 1997	Research and Teaching
4	Lecturer	Govt. P. G. College, Pithoragarh	25 April 1997- 22 May 1998	Research and Teaching
5	Lecturer	Kumaun Univ., S .S. J. Campus, Almora	22 May 1998 – 21 May 2002	Research and Teaching
6	Senior Lecturer	Kumaun Univ., S .S. J. Campus, Almora	22 May 2002 – 21 May 2007	Research and Teaching
7.	Associate Professor	Kumaun Univ., S .S. J. Campus, Almora	22 May 2007 – contd.	Research and Teaching

14. Area of Research: - Nuclear Physics, High Energy Particle Physics, Quantum field theory, Mathematical Physics and Climate Change etc.

15. Research Experience: - Actively engaged in research since last 25 years on various problems of High Energy Physics, Quantum Field Theory, Relativity and Gravitation. Major Fields of current interest is Tachyons, Monopoles, Dyons, Quaternion, Octonion, Higher-Dimensional Space-Time, QCD, SUSY, Standard Model and Unified field theories.

16. Research Guiding Experience: - Have more than 16 years experience of guiding research. Four students **(One NET (Eligibility test) qualified)** are enrolled for their Ph.D. and three students have already awarded Ph.D. degree under my supervision.

17. Teaching experience: - Having more than 24 years teaching in postgraduate and under graduate classes.
Subjects taught are: Quantum Mechanics, Particle and Nuclear Physics, Mathematical Physics, Relativity, Electrodynamics, Plasma, Electroronics, Computer Architecture etc.

18. List of publication: - Published 151 – research paper in the journal of international repute and in International /National Conferences / Seminars/ Workshops. Detailed list of publication is enclosed as **Annexure – I.**
Research work has been quoted, cited and refereed at many place in research papers and review articles.

19. Research schemes: -

(a) Research Project, sponsored by **CAS – TWAS Fellowship** programme in China from December, 2005 – February, 2006.
(b) UGC NET qualified Research Fellows are working for their Ph. D. on proposals approved by U. G. C., New Delhi to Kumaun University.
(c) Major Research Scheme sponsored by Uttarakhand State Council for Science and Technology, Dehradun from 1st May 2007 to 31st March 2011. **(Sanctioned Amount Rs. 5, 12, 000=00)**
d) Research Project, sponsored by **CAS – TWAS Fellowship** programme in China from July, 2009 – September, 2009.
e) Major Research Scheme submitted for funding in Uttarakhand State Council for Science and Technology, Dehradun.
f) Major Research Scheme submitted for funding in Department of Science and Technology, New Delhi

through Uttarakhand Centre for Climate Change, Kumaun University, Nainital.

g) Major Research Scheme submitted for funding in Council of Science and Industrial Research, New Delhi through Uttarakhand Centre for Climate Change, Kumaun University, Nainital.
h) Research Project, sponsored by **UNESCO – TWAS Associate scheme** in China from May, 2011 – July, 2011.
i) Research Project, sponsored by **UNESCO – TWAS Associate scheme** in China from June, 2012 – August, 2012.

20. Awards/Prizes –

a) C. S. I. R. National Fellowship from 1988 – 1993.
b) 2004 CAS – TWAS Visiting Scholar Fellowship in China. (International)
c) District Runner up for the Rank and Bolt award 2006.
d) 2008 CAS – TWAS Visiting Scholar Fellowship in China. (International)
e) Nominated for Who's Who in the World in 2009 and 2010 (Bibliography is published in 2009 and 2010 Edition).
f) UNESCO – TWAS, Associateship from 1st JULY 2010 to Contd. (International)
g) 2000 outstanding intellectuals of the 21st Century 2010 (International Biographical Centre, Cambridge, England).
h) Top 100 Educators 2010 (International Biographical Centre, St Thomas Place, Great Britain).
i) The International Plato Award for Educational Achievement (International Biographical Centre, Cambridge, England).

21. Member of academic society:

a) Member of *"New York academy of Science", New York, U.S.A.*
b) Life member of *"Tensor Society of India", Luck now, India.*
c) *Life Member of "Peharu", Almora, India*
d) Life member of *"Indian Association of General Relativity and Gravitation", Pune, India.*
e) **Member and Reviewer of *"Mathematical Review, American Mathematical Society", New York, USA.***

22. Country visited abroad:

S. No	Country and Place visited	Purpose of visit	Duration	Name of the fellowship/ Sponsorship
1.	Abdus Salam International Centre for Theoretical Physics, Miramare, Trieste, Italy,	Participated in School and Conference on "Intersection Theory and Moduli"	September 9 – 27, 2002	Sponsored by ICTP, Trieste (ITALY)
2.	Faculty of Science, Fayoum University, Fayoum, Egypt	Participated in "4th International Conference on Nuclear and Particle Physics"	October 11 – 15, 2003	Sponsored by DST and CSIR, New Delhi
3.	University of Hue, Hue, Vietnam	Participated in "10th Vietnam School of Physics"	December 29, 2003 – January 9, 2004	Sponsored by Institute of Physics, Hanoi and ICTP, Trieste
4.	Institute of Physics, CAS, Beijing, China	TWAS – CAS Visiting Scholar Fellowship	December 2005 – February 2006	Fellowship of Chinese Academy of Sciences, China and Third World Academy of Sciences, ICTP, Italy
5.	Egyptian Nuclear Physics Association, Luxor, Egypt	Participated in "6th International Conference on Nuclear and Particle Physics"	November 17 – 21, 2007	Sponsored by DST, New Delhi and U- COST, Dehradun
6.	Department of Physics, Faculty of Science, University of United Arab Emirates, Al Ain, UAE	Participated in "UAE – CERN Workshop on High Energy Physics and Applications"	November 26 – 28, 2007	Sponsored by DST, New Delhi and U- COST, Dehradun
7.	Center of Science, Benasque, Spain	Participated in 2 Week Workshop on "Quantum Physics with Non – Hermitian Operators"	June 29 – July 11, 2008	Sponsored by Center of Science, Benasque, and University of Barcelona, Barcelona, Spain

8.	**Institute of Theoretical Physics, CAS, Beijing, China**	**TWAS – CAS Visiting Scholar Fellowship**	**July 2009 – September 2009**	**Fellowship of Chinese Academy of Sciences, China and Third World Academy of Sciences, ICTP, Italy**
9.	**Institute of Theoretical Physics, CAS, Beijing, China**	**UNESCO – TWAS Associateship**	**May 2011 –July 2011**	**Associateship of UNESCO and Third World Academy of Sciences, ICTP, Italy**
10.	**Center of Science, Benasque, Spain**	**Participated in the 10th International conference on "Quantum Field Theory under the influence of external conditions" (QFEXT11)**	**September 18, 2011 – September 24, 2011**	**Sponsored by Center of Science, Benasque, Spain**
11.	**Nanyang Technological University, Singapore**	**Participated in "1st IAS-CERN School Particle Physics and Cosmology and Implifications for Technology"**	**January 9, 2012 - January 31, 2012**	**Sponsored by CERN, Geneva, Switzerland and Nanyang Technological University, Singapore**
12.	**Institute of Theoretical Physics, CAS, Beijing, China**	**UNESCO – TWAS Associateship**	**June 2012 – August 2012**	**Associateship of UNESCO and Third World Academy of Sciences, ICTP, Italy**

23. Symposium /Seminar/ Workshop/ Conference / Advanced level Institute / Summer School / Refresher/ Orientation Course Attended: -

i) Participated in **"Advanced level Institute in Relativity and Gravitation"**, Department of Mathematics, Nagpur University, Nagpur, Oct.1 - 21, 1987. (Sponsored by University Grants Commission, New Delhi)

ii) Participated in **"International Global Conference on Mathematical Physics"**, Einstein foundation International, Nagpur, Oct. 20 - 26, 1987.

iii) Participated in "IXth High Energy Physics Symposium" I.I.T. Madras, Dec. 5 - 91988. (Sponsored by DAE, Govt. of India)

iv) Participated in "2nd Symposium in Recent Trends in Relativity and Geometry", Department of Mathematics, Kumaun University Campus, Almora, June 9 - 11, 1989. (Sponsored by UGC)

v) Participated in "National Seminar on Recent Trends in Relativity, Cosmology and Quantum Gravity", North Bengal University, Darjeeling, Nov. 4 - 5, 1989.

vi) Participated in XVth conference on Indian Association for General Relativity and Gravitation", North Bengal University, Darjeeling, Nov. 6 - 7, 1989.

vii) Participated in Mini workshop on "Gravitation and Gravitational Radiation", Department of Physics, H. N. B. Garhwal University, Srinagar, June 24 - 29, 1991. (Sponsored by IUCAA, Pune)

viii) Participated in National Seminar on "Science in Ancient India" Department of Physics, Kumaun University, Nainital. Oct. 12-16, 1991.

ix) Participated in Workshop on "Technical Sabdakosh on Science and Technology", Department of Hindi, Kumaun University Campus, Almora, June 25 - 28, 1997. (Sponsored by H.R.D., New Delhi).

x) Participated in "15th **International Conference on "General Relativity and Gravitation"**, Gr-15, IUCAA, Pune, Dec. 16 -21, 1997.

xi) Participated in National Seminar on "HIV Risks in Adolescents and Young Adults", Department of Zoology, Kumaun University Campus, Almora, May 28 - 30, 1998.

xii) Participated in ICMP- 99, **"International Conference on Mathematical Physics"**, Department of Mathematics, Nagpur University, Nagpur, Jan 11 - 16, 1999.

xiii) Participated in Orientational meeting on "Exact solutions of Gravitation and Cosmology", Department of Physics, DDU Gorakhpur University, Gorakhpur, Gorakhpur, Jan. 18 - 19, 1999.

xiv) Participated in 20th meeting of IAGRG and National Symposium on "Current Trends in General Relativity and Gravitation", Department of Physics, DDU Gorakhpur University, Gorakhpur, Jan. 20 - 21, 1999.

xv) Participated in National Symposium on "Supersymmetry Breaking", High Energy Particle Physics Group, Kumaun University, Nainital, May 17 - 18, 1999.

xvi) Participated in Workshop on "Technical Sabdakosh on Science and Technology", Department of Hindi, Kumaun University Campus, Almora, Sept. 27 - 30, 1999. (Sponsored by H.R.D., New Delhi).

xvii) Participated in National Symposium on "Research Methodology", Kumaun University, Nainital, Dec. 22 – 23, 1999.

xviii) Participated in workshop on "Information need assessment for land and water management in district Almora", Department

of Geography, Kumaun University, Almora Campus, Almora, May 18 - 19, 2000. (Sponsored by DST, Govt. of India)

xix) Contact Programme for Talent School students of District Almora, Uttaranchal, Oct. 1 - 7, 2000. Supported and organised by NCSTC, DST, New Delhi.

xx) Attended an Orientation course for the Programme Officers, National Service Scheme organised by the Training and Orientation Centre, Literacy House, Lucknow from 30 th Oct 2000 to 8 th Nov. 2000. (Sponsored by Ministry of Youth Affairs and Sports, Govt. of India)

xxi) Participated in "Reforms for a Resurgent Republic Seminar on Development Reforms", Kumaun University Campus, Almora, Jan. 18 - 19, 2001. (Organised by Department of Culture, Ministry of Tourism and Culture, Government of India and Lokbharti, Uttaranchal).

xxii) Participated in the Discussion Conference on "Cosmology – Aspects of Standard Model vis-à-vis Alternatives", Central India Research Institute, Nagpur, Jan. 28 - 29, 2001.

xxiii) Participated in the "21 st Meeting of the Indian Association for General Relativity and Gravitation", Central India Research Institute, Nagpur Jan. 30 - Feb.1, 2001.

xxiv) Participated in the National Symposium on "Mathematical Sciences", Department of Mathematics, Nagpur University, Nagpur, March 1 - 5, 2001.

xxv) Participated in symposium on "Learning of Science through Hands – on activities", organised by PAHAL sponsored by NCSTC (Department of Science and Technology, Govt. of India), May 10 – 12, 2001.

xxvi) Participated in Mini School on Astronomy and Astrophysics, Department of Physics, HNB Garhwal University, Srinagar, Oct.18 - 22, 2001.

xxvii) Contact Programme for Talent School students of District Almora, Uttaranchal, Oct. 21 - 27, 2001. Supported and organised by NCSTC, DST, New Delhi.

xxviii) Participated in Workshop on "Technical Sabdakosh on Science and Technology", Department of Hindi, Kumaun University, S. S. J. Campus, Almora, May 1 - 3, 2002. (Sponsored by H.R.D., New Delhi).

xxix) **Participated in "School and Conference on Intersection Theory and Moduli", Abdus Salam International Centre for Theoretical Physics, Miramare, Trieste, Italy, September 9 – 27, 2002.** (Sponsored by ICTP, Trieste, Italy)

xxx) Contact Programme for Talent School students of District Almora, Uttaranchal, Oct. 10 - 16, 2002. Supported and organised by NCSTC, DST, New Delhi.

xxxi) Participated in workshop on "Science, Writing and Journalism", Organised by People's Association of Hill Area Launchers, Almora (Supported by DST and NCSTC, New Delhi) from 26 - 29, October 2002.

xxxii) Participated in "XV DAE symposium on High Energy Physics", Department of Physics, University of Jammu, Jammu from November 11 - 15, 2002. (Sponsored by DAE, Govt. of India)

xxxiii) Participated in IUCAA – Delhi University workshop on "Large – scale structures and the CMBR", Department of Physics and Astrophysics, University of Delhi, Delhi from November 16 – 20, 2002.

xxxiv) Participated in Workshop on "Technical Sabdakosh on Science and Technology", Department of Hindi, Kumaun University, S. S. J. Campus, Almora, June 16 - 18, 2003. (Sponsored by H.R.D., New Delhi).

xxxv) Attended the Instructor's training of CISCO Networking Academy Program (CNAP) Orientation, Semester1 and Semester 2 curriculum conducted by Cisco Regional Academy, Pantnagar from June 16, 2003 to July 03, 2003.

xxxvi) Contact Programme for Talent School students of District Almora, Uttaranchal, Sept. 29 - Oct. 5, 2003. Supported and organised by NCSTC, DST, New Delhi.

xxxvii) **Participated in "4th International Conference on Nuclear and Particle Physics", Faculty of Science, Fayoum University, Fayoum, Egypt, October 11 - 15, 2003.**

xxxviii) **Participated in "10th Vietnam school of Physics", University of Hue, Hue, Vietnam, December 29, 2003 – January 9, 2004.**

xxxix) Attended the Instructor's training of CISCO Networking Academy Program (CNAP) Semester III and Semester IV curriculum conducted by International Institute of Information Technology, Hyderabad from January 19 - 29, 2004.

xl) Participated in workshop on "Computer Laboratory Training in Physics", Department of Physics, Punjabi University, Patiala, Punjab from 24th – 28th June, 2004 (Sponsored by Punjabi University and IAPT).

xli) Attended a Refresher course for the Programme Officers, National Service Scheme organised by the Training and Orientation Centre, Literacy House, Luck now from 23rd Sept. 2004 to 29th Sept. 2004. (Sponsored by Ministry of Youth Affairs and Sports, Govt. of India)

xlii) Participated in Workshop on "Technical Sabdakosh on Science and Technology", Department of Hindi, Kumaun University, S. S. J. Campus, Almora, October 25 - 27, 2005. (Sponsored by H.R.D., New Delhi).

xliii) Participated in "XVI DAE-BRNS symposium on High Energy Physics", Saha Institute of Nuclear Physics, Kolkata from November 29 - December 3, 2004.

xliv) Participated in the "23 st conference of the Indian Association for General Relativity and Gravitation and symposium on recent trends in General Relativity, Cosmology and astrophysics", Department of Mathematics, University of Rajasthan, Jaipur from Dec. 7 - 10, 2004.

xlv) Participated in "**International Conference on Relativity – 2005**", Department of Mathematics, Amravati University, Amravati from Jan. 11 - 14, 2005.

xlvi) Participated in Workshop on "Technical Sabdakosh on Science and Technology", Department of Hindi, Kumaun University,

S. S. J. Campus, Almora, from December 9 - 11, 2005. (Sponsored by H.R.D., New Delhi).

xlvii) Contact Programme for Talent School students of District Almora, Uttaranchal, Sept. 18 - Sept. 23, 2006. Supported and organised by NCSTC, DST, New Delhi.

xlviii) Participated in Workshop on "Physics from atom to Galaxy: Theoretical and Technical Status", Department of Physics, HNB Garhwal University, Sri Nagar, from Oct. 9 - 11, 2006.

xlix) Participated in National seminar on "Relevance of Einstein's Contribution in 21st Century", Department of Physics, Kumaun University, Nainital from Nov. 10 - 11, 2006.

l) Appreciating Physics in Everyday life, Department of Physics, Kumaun University, S. S. J. Campus, Almora, Jan. 2 - Jan. 7, 2007. Supported and organised by NCSTC, DST, New Delhi.

li) Participated in "**IXth Conference of International Academy of Physical Sciences**", Department of Mathematics, Institute of Basic Science, Khandari, Agra from February 03 - 05, 2007.

lii) Participated in National Seminar on "Relevance of Indian Stotra Literature", Department of History, Kumaun University, S. S. J. Campus, Almora, from February 9 - 10, 2007.

liii) Participated in "**International Workshop on High Energy Physics**", Department of Physics, I. I. T. Roorkee, India from March 15 - 20, 2007.

liv) Participated in "**International Conference on Accelerator and Low Level Radiation Safety**", Inter University Accelerator Center, New Delhi from April 26 - 27, 2007.

lv) Participated in Workshop on "Technical Sabdakosh on Science and Technology", Department of Hindi, Kumaun University, S. S. J. Campus, Almora, from June 25 - 27, 2007. (Sponsored by H. R. D., New Delhi).

lvi) Participated in "6th International Conference on Nuclear and Particle Physics", Egyptian Nuclear Physics Association, Luxor, Egypt, November 17 - 21, 2007.

lvii) Participated in "UAE – CERN Workshop on High Energy Physics and Applications", Department of Physics, Faculty of Science, University of United Arab Emirates, Al Ain, UAE from November 26 - 28, 2007.

lviii) Worked as a local Coordinator in "Regional Seminar on Intellectual Property and Innovation Management in Knowledge Era", Almora, Jan. 28 – 29, 2008.

lix) Participated in "QUARK MATTER 2008 - 20th International Conference on Ultra – Relativistic Nucleus Nucleus Collisions", Jaipur (India), February 4 – 10, 2008.

lx) Participated in "Workshop on DELNET", Kumaun University, S. S. J. Campus, Almora, March 27, 2008.

lxi) Participated in 2 Week Workshop on "Quantum Physics with Non – Hermitian Operators", Center of Science, Benasque, Spain, June 29 – July 11, 2008.

lxii) Participated in Homi Bhabha Birth Centenary Celebrations International Conference on "Non- Hermitian Hamiltonians in Quantum Physics", Bhabha Atomic Research Centre, Trombay, Mumbai from Jan. 12 – 16, 2009.

lxiii) Contact Programme for Talent School students of District Almora, Uttarakhand, March 16 – March 22, 2009. Supported and organised by NCSTC, DST, New Delhi.

lxiv) Participated in "10th International Conference on Nucleus – Nucleus Collisions", China Institute of Atomic Energy, Beijing, China from August 16 – 21, 2009.

lxv) Participated as an Invited Speaker in "International Conference on Gravitation Theories and Astronomy (CGTA)", Nilkanthrao Shinde Science and Art College, Bhadrawati (MS) from December 28 – 30, 2009.

lxvi) Participated in National Conference on "Present Relevance of Indian Culture", Department of History, Kumaun University, Kumaun University, S. S. J. Campus, Almora from February 13 – 14, 2010.

lxvii) Participated in "Launching Workshop of Uttarakhand Centre on Climate Change (UCCC)", Kumaun University, Nainital on May, 1st 2010.

lxviii) Participated in Second Meeting of UCCC at Department of Geology, Kumaun University Nainital on 07 July 2010.

lxix) Participated as an Invited Speaker in State Level Conference on "The Role of Science and Technology in the Development of Uttarakhand State", Department of Physics, Govt. P. G. College, Bageshwar from October 23 -24, 2010.

lxx) Participated in International Conference on Cooling the Earth Tactics and Restoring Climate Order and Saving the Living Planet, Department of Environment Science, G. B. Pant University of Agriculture and Technology, Pantnagar from November 15 -17, 2010.

lxxi) Participated in International Workshop on Mountain Biodiversity and Impacts of Climate Change with Special Reference to Himalayan Biodiversity Hotspot, G. B. Pant Institute of Himalayan Environment and Developments, Kosi – Katarmal, Almora from December 6 – 8, 2010.

lxxii) Participated in Third Meeting of UCCC at Department of Geology, Kumaun University Nainital on 23rd December 2010.

lxxiii) Participated in Seven days Training Programme on **Geographic Information Science and Technology**, Centre of Excellence for NRDMS in Uttarakhand, Kumaun University, S. S. J. Campus, Almora from January 3 -9, 2011.

lxxiv) Participated in 7th International Workshop on "Neutrino – Nucleus Interactions in the few – Gev Region", HNB Garhwal University, Srinagar from March 7 – 11, 2011.

lxxv) Participated in "1st ICQM – ICQD - ICQS Joint Annual Workshop - World of Hall Physics", International Center for Quantum Materials, Peking University, Beijing, China from June 21 – 22, 2011.

lxxvi) Participated in the "4th International Workshop on Emergent Phenomena in Quantum Hall Systems", International Center for Quantum Materials, Peking University, Beijing, China from June 23 – 26, 2011.

lxxvii) **Participated as an Invited Speaker in the 10th International conference on "Quantum Field Theory under the influence of external conditions"(QFEXT11), Center of Science, Benasque, Spain, September 18, 2011 – September 24, 2011.**

lxxviii) **Participated in the International conference on "Issue for Climate Change, Land Use Diversification and Biotechnological Tools for Livelihood Security (ICLDBT – 2011)", Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut from October 8 -10, 2011.**

lxxix) Participated as an Invited Speaker in National Seminar on "Recent Trends in Micro and Macro Physics (NSRCTMMP – 2011), Department of Physics, Govt. P. G. College, Gopeshwar from October 12 - 13, 2011.

lxxx) Participated in the "6th Uttarakhand State Science and Technology Congress", Kumaun University, S. S. J. Campus, Almora from Nov. 14 - 16, 2011.

lxxxi) Participated as an Invited Speaker in the "14th International Conference of International Academy of Physical Sciences (CONIAPS-XIV) on Physical Sciences Interface with Humanity", S. V. National Institute of Technology, Surat December 22 – 24, 2011.

lxxxii) Participated in the "National Conference on Recent Trends in Material Science and Nano Structure (RTMSNS – 12)", Government P. G. College, Rudrapur January 3 – 4, 2012.

lxxxiii) **Participated in "1st IAS-CERN School Particle Physics and Cosmology and Implifications for Technology", Nanyang Technological University, Singapore January 9, 2012 - January 31, 2012.**

lxxxiv) Participated in the "National Seminar on Changing Scenario of Higher and Madhya Pradesh University Act - 1973", Vikram University, Ujjain February 18 – 19, 2012.

lxxxv) Participated as an Invited Speaker in the "Three day Training Workshop on Application of Remote Sensing and GIS in Climate Change Studies for Research Scholars", Uttarakhand Centre on Climate Change, Kumaun University, S. S. J. Campus, Almora March 1 -3, 2012.

lxxxvi) Participated as an Invited Speaker in the "Training Workshop For NSS Program Officers on Climate Change: Impacts, Mitigation and Adaptation", Uttarakhand Centre on Climate Change, Kumaun University, S. S. J. Campus, Almora March 28 - 29, 2012.

lxxxvii) Participated in the "National Seminar on Geographic Information Science: Opportunity and Challenges in 21st Centaury", Centre of Excellence for NRDMS in Uttarakhand, Kumaun University, S. S. J. Campus, Almora May 1, 2012.

lxxxviii) Participated in the International Event "The First Two Years at the LHC", Institute of Theoretical Physics, CAS, Beijing, China during June 5, 2012 – August 10, 2012.

24. Administrative experience: - Worked as

a) **Programme Officer NSS** – Kumaun University, Soban Singh Jeena Campus, Almora since Dec. 1, 1998 to Nov. 25, 2005.

b) **Assistant Proctor** - Kumaun University, Soban Singh Jeena Campus, Almora since Feb.19, 1999 to March 20, 2003.

c) **Member of Library committee** – Kumaun University, Soban Singh Jeena Campus, Almora since May 28, 1999 to March 31, 2003.

d) **Member Flying Squad** of Kumaun University Examination in 1997 and 1998.

e) **Team Manager** of Kumaun University Sports.

f) **Member of Admission Committee** in Kumaun University, Almora Campus, Almora for Undergraduate and Postgraduate classes since 1998 and from 2005 - 2007 acts as a convenor of B. Sc. I admission committee.

g) **Observer in B. Ed. Entrance Exam.** Kumaun University, Nainital in 2000 and 2001.

h) **Teacher In charge** Physics Association, Physics Department, Kumaun University, S. S. J. Campus, Almora from July 1998 to **contd.**

i) **Member of Fee Concession Committee** since 1998 to **contd.**

j) **Presiding officer** in 1998 General Election of India.

k) **Instructor, CISCO Local Academy,** Kumaun University, S. S. J. Campus, Almora since March 2003 to June 2006.

l) **In charge Library,** Physics Department, Kumaun University, S. S. J. Campus, Almora since 1st September 2003 to **contd.**

m) **Member** Departmental Committee since 1st July, 2006.

n) Member of the management Committee of Vijaypur Intermediate College, Almora since 1st July 2006 to contd.

o) Assistant Dean Student Welfare - Kumaun University, Soban Singh Jeena Campus, Almora since Dec. 22, 2006 to **contd.**

p) Assistant Superintend, Kumaun University Main and improvement Exam since 2009 to contd.

q) Member of Anti Ragging Committee, Kumaun University, S. S. J. Campus, Almora since 1st September 2009 to **contd.**

r) **Core Coordinator (Physics),** Uttarakhand Centre for Climate Change, Kumaun University since 1st December 2009 to contd.

r) Member of Kumaun University Academic Council and University Court from 1st January 2010 to 31st December 2010.

s) Assistant Superintend (Invigilation duty), Kumaun University Main and improvement Exam since 2010 to contd.

t) Assistant Controller (Central Evaluation), Kumaun University Main Exam since 2010 to contd.

u) District Coordinator (Almora), Uttarakhand Council of Science and Technology, Dehradun 15th October 2012 to contd.

25. Particulars of references: -

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4. Prof. U. C. Naithani
   Head of the Physics Department,
   H. N. B. Garhwal Central University,
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26. Any other Information: - Worked several times as a referee in various scientific journals of International repute.

It is declared that the above mentioned information's are correct to the best of my knowledge and belief.

Date: - 16 - 10 - 2012
Place: - ALMORA

(P. S. Bisht)

LIST OF PUBLICATIONS

1. Quaternion non-Abelian gauge theory of fields associated with dyons,
   P. S. Bisht, O .P. S. Negi and B. S. Rajput
   IXth High Energy Physics Symposium, I. I. T. Madras, Dec.5 - 9, 1988, pp. II - 6, Vol.1.
2. Dyons and gravito-dyons in biquaternionic formulation,
   P. S. Bisht , O. P. S. Negi and B. S. Rajput
   IXth High Energy Physics Symposium, I. I. T. Madras, Dec.5 - 9, 1988, pp. II - 6, Vol.1.
3. Quaternion gauge theory for generalised fields of dyons and gravito-dyons,
   P. S. Bisht, O. P. S. Negi and B. S. Rajput
   Abstract book in "12th International Conference on General Relativity and Gravitation",
   Colorado (U.S.A.) July 2 - 8, 1989 Vol. I (D4), 156.
4. Matrix biquaternion formulation for dyons and their gravitational analogues,
   P. S. Bisht, O. P. S. Negi and B. S. Rajput
   Abstract book in "12th International Conference on General Relativity and Gravitation",
   Colorado (U.S.A.) July 2 – 8, 1989 Vol. I. (D4), 155.
5. Quaternion gauge theory of dyons and their gravitational analogue,
   P. S. Bisht, O. P. S. Negi and B. S. Rajput
   Abstract book in National Seminar on "Recent Trends in Relativity, Cosmology and Quantum Gravity (1989) pp. 7, (Q2).
6. Biquaternions and gravitational analogue of dyons,
   P. S. Bisht, O. P. S. Negi and B. S. Rajput
   Abstract book in National Seminar on "Recent Trends in Relativity, Cosmology and Quantum Gravity (1989) pp. 7, (Q2).
7. Biquaternion formulation of gravito-dyons,
   P. S. Bisht, O. P. S. Negi and B. S. Rajput
   Ind. J Pure and Applied Phys., 28 (1990), 157 -161.
8. Matrix biquaternion formalism and tachyonic dyons,
   P. S. Bisht, O. P. S. Negi and B. S. Rajput
   Ind. J Pure and Applied Phys., 29 (1991), 457 - 460.
9. Matrix biquaternion formalism for unified fields of dyons,
   P. S. Bisht, O. P. S. Negi and B. S. Rajput
   Proc. Symposium in "Recent Trends in Geometry and Relativity", Kumaun University Campus, Almora (1991). pp.23.
10. Quaternion gauge theory of dyonic fields,
    P. S. Bisht, O.P.S. Negi and B. S. Rajput
    Prog. Theor. Phys., 85 (1991), 157 - 168.
11. Null tetrad formulation of dyons,
    P. S. Bisht, O. P. S. Negi and B. S. Rajput
    IL Nuovo Cimento, 104A (1991), 337 - 348.
12. Null tetrad formulation of non-Abelian dyons,
    P. S. Bisht, O. P. S. Negi and B. S. Rajput
    International J. Theoretical Phys., 32 (1993), 2099 - 2123.
13. Octonion formulation for unified fields of dyons and gravito-dyons,
    P. S. Bisht and O. P. S. Negi
    Unpublished Pre-print (1993).
14. Quaternion formulation for unified fields of dyons and gravito-dyons,
    P. S. Bisht, O. P. S. Negi and B. S. Rajput
    Ind. J. Pure and Applied Math., 24 (1993), 543 - 549.
15. Split octonion electrodynamics,
    P. S. Bisht and O. P. S. Negi
    Ind. J. of Pure and Applied Phys., 31 (1993), 292 - 296.
16. Biquaternions and gravitational analogue of dyons,
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    Pre-print (1993).
17. Split octonion and generalised fields of dyons,
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    Pre-print (1993).
18. Null tetrad formulation of gravito-dyons,
    P. S. Bisht and O. P. S. Negi
    Ind. J. of Pure and Applied Phys., 32 (1994), 1.
19. Unified split octonion fields of dyons and gravito-dyons,

P. S. Bisht and O. P. S. Negi
Ind. J. of Pure and Applied Phys., 32 (1994), 183 - 185.

20. Isomorphic matrix representation for unified fields of dyons,
P. S. Bisht and O. P. S. Negi
Pre-print (1995).
21. Inconsistencies associated with octonion formalism of dyons,
P. S. Bisht and O. P. S. Negi
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22. Symmetric gravi-electric and magnetic fields of dyons,
O. P. S. Negi, **P. S. Bisht** and A. S. Rawat
Abstract book on 15th International Conference on "General Relativity and Gravitation", IUCAA, Pune during Dec. 16 - 21, 1997, Sec. A3 (42), pp 56.
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24. Isomorphism between matrices and biquaternion formulation of dyons,
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25. Revisiting quaternion formulation and electromagnetism,
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IL Nuovo Cimento, 113B (1998) 1449 - 1467.
26. Quaternion Analyticity for null tetrad representation of dyons,
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27. Role of quaternions in Super symmetric Quantum Mechanics,
O. P. S. Negi and **P. S. Bisht**
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28. An octonion realization of Lorentz Group and its extension to full super algebra,
O. P. S. Negi and **P. S. Bisht**
National Symp. on "Super symmetric Breaking", HEP, Kumaun University, Nainital, May 17 - 18, 1999 .pp. 16.
29. Quaternion Dirac equation for generalised fields of dyons,
O. P. S. Negi, **P. S. Bisht** and Shalini Dangwal
National Symp. on "Super symmetric Breaking", HEP, Kumaun University, Nainital, May 17 - 18, 1999. pp. 24.
30. Quaternion spontaneous symmetry breaking and Weinberg Salam model,
A. S. Rawat, O. P. S. Negi, **P. S. Bisht** and B. S. Rajput
Ind. J. of Pure and Applied Phys., 38 (2000), 390 - 394.
31. Supersymmetric behaviour of Tachyons,
M. C. Pant, **P. S. Bisht** and O. P. S. Negi
Ind. J. of Pure and Applied Phys., 38 (2000), 440 - 445.
32. Dirac Spinors and Tachyon Quantization,
M. C. Pant, **P. S. Bisht**, O. P. S.Negi and B. S. Rajput
Canadian J. of Physics, 78 (2000), 303 - 315.
33. Isomorphism matrices and biquaternion formulation of dyons,
P. S. Bisht, Shalini Bisht and O. P. S. Negi
Proceedings of International Conference of Mathematical Physics, "Quest for Mathematical Physics", Edited by T. M. Karade, B. S. Rajput and R. N. Tewari, Vol. I (2001), 53.
34. Quaternion Analyticity of dyons in null tetrad formalism,
P. S. Bisht and O. P. S. Negi
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35. Scalar fields of Tachyons,
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36. Quaternion Gauge and Gravi electromagnetism,

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39. Octonion Gauge Formulation for Generalised Fields of Dyon,
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43. Quaternionic Quantum Mechanics,
P. S. Bisht and O. P. S. Negi
4th conference on "Nuclear and Particle Physics, Faculty of Science, Fayoum, Egypt from Oct. 11 - 15, 2003, pp34 (RQP 5).
44. Split Octonion Electrodynamics and Unified fields of dyons,
P. S. Bisht and O. P. S. Negi
Proceedings of 4th International conference on "Nuclear and Particle Physics, Faculty of Science, Fayoum, Egypt from Oct. 11 - 15, 2003, (2004), 177 - 198.
45. Role of solar energy in Uttaranchal,
P. S. Bisht and O. P. S. Negi
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46. Quaternion, Octonion Unified fields of dyons and gravito-dyons,
P. S. Bisht, Shalini Dangwal and O. P. S. Negi
http://sinai.mech.fukui-u.ac.jp/GA-Net/archive No 25 (June 2005), 4.
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47. Quaternionic charge and split octonion electrodynamics,
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Abstract book on "23rd conference of the Indian Association for General Relativity and Gravitation", Department of Mathematics, University of Rajasthan, Jaipur , Dec. 7 - 10, 2004, pp.4 [Q-8].
48. Octonion Metric Realizations of Unified fields of dyons,
P. S. Bisht
Abstract book on "International conference on Relativity- 2005", Department of Mathematics, Amarvati University, Amarvati, Jan. 11 - 14, 2005, pp.35 [GR-II(32)].
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Ind. J. of Pure and Appl. Phys, (2012), (Communicated).
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51. Octonion generalisation for field equation of dyons,
Bimal Pande, **P. S. Bisht** and O. P. S. Negi
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52. Resemblance between biquaternion analyticity and null tetrad formulation of dyons,
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M. C. Pant, **P. S. Bisht**, and O. P. S. Negi
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56. Generalised electromagnetic fields of dyons in curved space - time,
A.S. Rawat, **P. S. Bisht** and O. P. S. Negi
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60. Unified Angular Momentum of Dyons,
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http://sinai.mech.fukui-u.ac.jp/GA-Net/archive No 25 (June 2005), 3.
hep-th/0608153.
61. Quaternion analysis of electromagnetic fields in presence of electric and magnetic sources,
P. S. Bisht, Jivan Singh and O. P. S. Negi
15th Annual conference of Purvanchal Academy of Sciences (PAS), T. D. P. G College, Jaunpur during Nov 19 – 20, 2005.
62. Quaternion analysis of superluminal electromagnetic fields of dyons,
P. S. Bisht, Jivan Singh and O. P. S. Negi,
1st Uttaranchal Science Congress, Organized by UCOST, DehraDun from Nov 10 - 11, 2006.
63. Quantization of Klein - Gordon and Non - Relativistic fields of Tachyons,
P. S. Bisht, M. C. Pant and O. P. S. Negi
(2009), (Preprint).
64. Split octonion wave equation and eight dimensional kinematics,
P. S. Bisht , B. Pande and O. P. S. Negi
(2008) (Preprint).
65. Group Theoretical representation of octonion basis elements,
P. S. Bisht , B. Pande and O. P. S. Negi
(2008) (Preprint).
66. Tachyonic fields in four-dimensional space-time,
P. S .Bisht, M. C. Pant and O. P .S. Negi
(2009), (Communicated).
67. Non Symmetric metric realization of complex tangent space for generalised fields of dyons,
P. S. Bisht , B. Pande and O. P. S. Negi
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68. Non Symmetric metric realization of quaternionic tangent space for generalised fields of dyons,
P. S. Bisht, B. Pande and O. P. S. Negi
(2009) (Preprint).
69. Non Symmetric metric realization of octonionic tangent space for generalised fields of dyons,
P. S. Bisht, B. Pande and O. P. S. Negi
(2009) (Preprint).
70. Octonion metric realisation and unified fields of dyons and gravito-dyons,
P. S. Bisht, B. Pande and O. P. S. Negi
(2009) (Preprint).
71. Dirac particle in generalised electromagnetic fields of dyons with non-symmetric complex, quaternion and octonionic tangent spaces,
P. S. Bisht, B. Pande and O. P. S. Negi
(2009) (Preprint).
72. Super symmetric gauge theory of BPS monopoles and dyons,

P. S. Bisht, B. Pande and O. P. S. Negi
(2009) (Preprint).

73. Sieberg - Witten analysis of super symmetric gauge theory for N=2 dimensions,
P. S. Bisht, B. Pande and O. P. S. Negi
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74. Hyper complex number system and central charges in super symmetric gauge theories for N=2 and N= 4 dimensions,
P. S. Bisht, B. Pande and O. P. S. Negi
(2008) (Preprint).
75. Octonion realization of supersymmetry,
P. S. Bisht, B. Pande and O. P. S. Negi
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76. Non - Symmetric Metric Analysis for Abelian and Non- Abelian Gauge Structure of Dyons,
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Date: - 16 - 10 - 2012
Place: ALMORA

(P. S. Bisht)

Detailed and precise description of Research work

PROJECT INFORMATION

Title: - "ROLE OF QUATERNIONS AND OCTONIONS IN SUPERSYMMETRY"

Purpose of visit: -

To strengthen and stimulate academic cooperation between institutions of higher education in both countries i.e. host and home country. These links are intended to enhance academic exchanges on all levels, help in developing joint curricula in areas of high priority to both partners, and to establish technology transfer/exchange of the new ideas in the field of Theoretical Physics with particular relevance to global development. This programme will also give a new plan of action to promote the research work at my place with the interaction of global scientific community and upkeep the teaching of the subject to promote the students of our University for future.

Outline of research work:-

The search for unity and simplicity has been the theme of physics ever since Newton first showed that celestial and terrestrial mechanics could be unified. Maxwell's replaced the words "electricity and magnetism" by the single word "electromagnetism" and wrote down the Maxwell's equation. The laws of physics, as we try to state them, have a basic character that reflects our understanding of reality at the deepest philosophical level. One of the major unresolved problem of theoretical physics in the first phase of 20^{th} century was the formulation of a theory consistent with relativity and quantum theory, into the view of nature known as quantum field theory leads to yet another departure, not implied by either relativity of quantum theory alone, from our conventional understanding, involving in this case the very nature of elementary particles. These are advocated "as field quanta", that is, the quantum excitations of different fundamental fields, in except analogy to the way in which photons, the particle like units of electromagnetic energy, are understood as quantum excitations of the electromagnetic field. Einstein's dream for the general theory of relativity was a step ahead towards the understanding of geometrical unified picture of fundamental forces of nature. This theory sees gravity as the manifestation of a curvature of space and time by which the motion of all objects is seen not as the result of actual gravitational "forces" acting on the object, but as the object's attempt to follow the straightest possible path (the geodesic). The principle of gauge invariance explained not only the

geometrical character of Einstein's general theory of relativity but also succeeded in providing a satisfactory description of all the forces of nature. The gauge principle, which might also be described as a principle of local symmetry, is the direct consequence the invariance properties of physical laws. Three key distinct concepts nowadays related together i.e. symmetry, conservation laws and gauge fields, gave rise the fundamental conceptual description of elementary particles, their field's quanta's and interactions of course the role of number system (hyper complex numbers) is an important factor for understanding the various theories of physics from macroscopic to microscopic level. Real number system explains well the classical Newtonian mechanics, complex numbers play an important role for the explanation beyond the frame work of quantum theory and relativity, and quaternions are having relations with Pauli-matrices explained non-Abelian gauge theory.

The asymmetry between electricity and magnetism became very clear at the end of 19^{th} century with the formulation of Maxwell's equations. Magnetic monopoles were advocated to symmetrize these equations in a manifest way and considerable literature has come in force. The literature turned partially negative casting doubts and it seemed reasonable to understand the aesthetically unappealing features of monopole. The quantum mechanical excitation of fundamental monopoles include dyons which are particles carrying both electric and magnetic charges. Dyons arise automatically from the semi-classical quantization of global charge rotation degree of freedom of monopoles. In view of the explanation of CP violation in terms of non-zero vacuum angle of world, the monopoles are necessary dyons and Dirac quantization condition permits dyons to have analogous electric charge. Renewed interests in the subject of monopole has gathered enormous potential importance in connection of quark confinement problem in quantum chromo dynamics, possible magnetic condensation of vacuum, leading to absolute color confinement in QCD, its role as catalyst in proton-decay, the possible explanation of CP-violation in terms of non-zero vacuum angle of world in magnetic gauge and unification of gravitational fields with other interactions. On the other hand the quaternions are extensively used in the context of relativity, quantum mechanics, superluminal and Subluminal Lorentz transformations and gauge theories. Left-right handed Weinberg-Salam theory of electromagnetic interaction with $SU(2)_L$ X $SU(2)_R$ X U(1) gauge structure has been explained better in terms of quaternions. Fields associated with monopoles and dyons are reexamined with compact, simpler, unique and consistent theory in terms of quaternions. Super symmetry and super gravity theory as well as existing grand unified theories of fundamental interactions also have better respect for hyper

complex number system (i.e. algebra of real numbers, complex numbers, quaternions and octonions).

Besides the potential importance of monopoles and dyons as the intrinsic part of all current grand unified theories which unify the strong and electro weak gauge interaction it is believed that Monopoles and dyons can provide even more ambitious model which purport to unify gravitation with these fundamental interactions. A possibility of such grand unification is proposed with the application of division Algebra of generalized fields of dyons to investigate the self-consistent quaternion quantum field theory of monopoles and dyons to understand the fundamental structure relevant for their production and detection. Although there are lacks of evidences for the existence of magnetic monopoles and dyon as well as for super symmetry, there are several remarkable, physical reasons for believing that super symmetry plays a fundamental role in particle physics. Even though no super symmetric particles have been discovered, they have all been given names. They are named after their partners. Bosonic ordinary particles have fermonic super partners with the same name except with the suffix ``ino" added, while fermonic ordinary particles have bosonic (scalar) super partner names with the prefix ``s" added. So for example, the photino, Higgsino, Z-ino, and gluino are the partners of the photon, Higgs, Z-boson, and gluon respectively. And the squark, sneutrino, and selectron are the scalar super partners of the quark, neutrino, and electron respectively. There are several super partners which have the same quantum numbers and so can mix together in linear combinations. Since these do not necessarily correspond to any one ordinary particle, they are given different names. For example, the photino, Higgsino, and Z-ino can mix into arbitrary combinations called the neutralinos, and the charged W-ino and charged Higgsino combine into particles called charginos. Division algebras are proposed to the existence and symmetries of various sets of auxiliary fields for ten dimensional Super Yang Mills is of special interests to Physicists both because it contains maximum number of super symmetries consistent with Yang-Mills and because it is described by the mass less sector of 10-dimensional superstring.. Keeping these facts in mind along with the importance of applications of division algebra [namely the algebras of real numbers (R), Complex numbers (C), quaternions (Q) and Octonions (O)] to various problems of super symmetry, super symmetric quantum mechanics, super symmetric gauge theories and higher dimensional space time, it is proposed to extend the previous work done by the applicant at his place and TWAS – CAS visiting fellowship and UNESCO – TWAS Associateship during 2004, 2008, 2011 and 2012 on Electromagnetic Duality, Quaternion and Super symmetric Gauge Theories of Dyons along with the self consistent quantum field theories of monopoles, dyons and their quaternion formulation in simple compact and consistent form. It is proposed

- To undertake the study of role of monopoles and dyons in super symmetric gauge theories
- To undertake the study of algebraic structure of electro weak interaction and standard model along with the gravity.
- To establish the connection between quaternion elements and the generators of SU(2) Yang Mill's gauge theory and accordingly the electro weak gauge interaction are planned to be studied in terms of $U(1)\times SU(2)$ gauge structure of quaternion while the theory of strong interaction has been planned to be investigated in terms of octonion basis elements and theories of non associative algebra.
- To make an attempt to link the existence and properties of the division algebras with the existence and properties of super symmetric field theories in various space-time dimensions.
- To investigate in a systematic way the relations between ring division algebras, off–shell SSYM and higher dimensional self–duality.
- To study the bosonic and fermionic degrees of freedom associated with the constituents of division algebra [namely the algebras of real numbers (R), Complex numbers (C), quaternions (Q) and Octonions (O)].
- To construct Yang Mills theories with simple super symmetry in 2, 4, 6 and 10 dimensions respectively associated with the algebras of real numbers (R), Complex numbers (C), quaternions (Q) and Octonions (O).
- To establish the connection between the auto-morphism group G_2 of octonions and it's imbedding with other gauge groups required for minimal super symmetry.
- To study the various roles of Real, Complex, Quaternion and Octonion algebras in the 3, 4, 6 and 10 space time dimensions.
- To study the manifestly and super symmetric invariant higher dimensional actions with the different dimensions of division algebras.
- To study the dimensional reduction of higher dimensional super symmetries from 4 to 2, 6 to 4 and 10 to 6 dimensions.

Briefly explain expected outcomes from the fellowship visit and its overall relevance to career development:-

The proposal is based on mathematical and theoretical research. Certainly the outcomes and results are expected to carry out the experimental investigation towards the verification of tests of duality, current status of supersymmetry and supersymmetric gauge theories, tests of existence

of monopole and dyons, role of quaternion analysis and existence of grand unified theories for the interaction between the elementary particles. The quest is not only the fascinating one but along the way one is lead to reexamine the fundamental questions in physics. On the other hand the plan of action for the utilization of research/out come expected from this project may be taken to justify the results from experimental point of view. The proposed visit under UNESCO – TWAS Associateships will help the applicant to promote his theoretical and experimental skill through his global and international interaction among scientists and researchers at one end and to upkeep his knowledge of understanding for socioeconomic cultures of host country and India.

It will be a mile stone in the academic and administrative career development of the applicant in order to promote the research activities at his place of work in both countries and thus, the academic achievements and scientific contribution through this project will definitely lead to a significant contribution for the welfare of society and peace. It will also have important impacts to the enhancement of the inter relationship for exchange of scientific and technological contributions among the countries of third world and other counties of the world. To work in a prestigious institute under prestigious fellowship is itself a reward for those who are working in various areas of mathematical physics and as such the proposed visit will definitely help the applicant to answer the many new questions associated with the existence of monopoles, dyons, quaternions, octonions, supersymmetry, geometrical algebra, gauge theories, super gravity and super strings etc. After availing this fellowship the candidate may be able to promote the research activities at his university for the assessment of various the research problems of students working with him for their higher educational and professional degrees.

Date: 16/10/2012

Place: ALMORA

(P. S. Bisht)

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Ref: - Phys/2012/15 Date: - October 16, 2012

To Whom It May Concern

To,
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ICTP Campus,
Strada Costiera 11
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associateship@twas.org

Sir,

I am pleased to recommend Prof. (Dr.) Praveen Singh Bisht, Associate Professor, Department of Physics, Kumaun University, Soban Singh Jeena Campus, Almora – 263601 (Uttarakhand) INDIA for the **UNESCO – TWAS Associateship.**

Prof. (Dr.) PS Bisht has proven excellent research capability in the field of applying advanced non-commutative algebraic techniques to theoretical problems of electromagnetism, gravitation, CP Violation, Super symmetry, String Theory, Standard Model and Second quantization of fields. Such techniques play an important role in theoretical physics. It nowadays (in all fields) relies heavily on the application of Clifford algebra (beginning with Dirac algebra, Pauli algebra, space-time algebra, super symmetry,) etc. Dr. Bisht's skillful applications of quaternions (real and complex), octonions, spinor theory, etc. with particular emphasize on the role of monopoles (dyons) in generalized and unified electromagnetism, gravitation and quantum field theory are very original, realistic and promising approaches – alternative to or possible to be combined with string theory.

Dr. Bisht has attended numerous conferences / workshops / seminars/ schools both domestic and international and demonstrated his research results there; among these are conferences in Italy, Egypt, China, Singapore, Spain, UAE and Vietnam. He has published his research results in several refereed papers in Journals of high international reputation and in addition he has many publications in conference proceedings. I personally know Dr. P. S. Bisht, since last 25 years. He was awarded Ph. D. degree under my supervision on "**Quaternion, Octonion formalism for unified fields of dyons and gravito-dyons**" by Kumaun University. I have the proud to say that Dr. Bisht has already been awarded the CAS - TWAS fellowship at the Institute of Physics, Beijing for the duration 19 December 2005- 02 February 2006, Institute of Theoretical Physics, Beijing for the duration July 2009 – September 2009 and UNESCO – TWAS Associateship up to 30th June 2013.

I found Dr. Bisht laborious, hard working and a man of independent thinking. He has been teaching (UG and PG classes) in Kumaun

University from last 19 years. He has the capacity of independent guiding research. Three students are already awarded Ph. D. and four students are enrolled for their Ph. D. under his supervision in Kumaun University. In my opinion he is also a very good administrator and very popular teacher between the students. I am very much hopeful that he will be given an opportunity through **UNESCO – TWAS Associateship.**

I therefore strongly recommend his candidature for the UNESCO – TWAS Associateship.

Yours sincerely

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November 12, 2012

Dear Sir/Madam,

It is my pleasure to recommend Dr. Praveen Singh Bisht to renew the UNESCO TWAS Associateship.

I have known Dr. Bisht for more than three years. He visited the Institute of Theoretical Physics (ITP), Chinese Academy of Sciences (CAS) from July to September 2009 via the Fellowship of Chinese Academy of Sciences, China and Third World Academy of Sciences, ICTP, Italy. In addition, he visited the ITP-CAS from May 2011 to July 2011 and from June 2012 to August 2012 via the Associateship of UNESCO and Third World Academy of Sciences, ICTP, Italy. During Dr. Bisht's visits at the ITP-CAS, I am his supervisor on research.

Dr. Bisht and I have collaborated on dyon physics as well as the quaternionic and octonion formulations of Yang-Mills theories. On dyon phyiscs, we have studied the different symmetric properties of the generalized Maxwell-Dirac equation along with their quantum properties. Applying the parity (**P**), time reversal (**T**), charge conjugation (**C**), and their combined operations such as **PT**, **CP** and **CPT** transformations to various equations of generalized fields of dyons, we have shown that the corresponding dynamical quantities and equations of dyons are invariant under these discrete symmetries.

We have made an attempt to develop the quaternionic formulation and octonion reformulation for $SU(2)$ and $SU(3)$ Yang-Mills theories, respectively. Starting with the Lagrangian density, we have discussed the field equations of $SU(2)$ and $SU(3)$ gauge fields for global and local gauge symmetries. We have shown that the three quaternion units explain the structure of $SU(2)$ Yang-Mills fields while the seven octonion units provide the consistent structure of $SU(3)$ gauge symmetry. In particular, $SU(2)$ and $SU(3)$ can be considered as $SU(2)_L$ and $SU(3)_C$ gauge symmetries in the Standard Model.

Starting with the quaternionic formulation of isospin $SU(2)$ group, we have derived the relations for different isospin components with quark states. Extending this formalism to the case of $SU(3)$ group we have considered the theory of octonion variables. Accordingly, the octonion splittings of $SU(3)$ group have been reconsidered. Also, various commutation relations for $SU(3)$ group and its shift operators have also been derived and verified for different isospin multiplets, *i.e.* **I**, **U**, and **V** spins.

From the usual definitions of octonions, we studied the relations between octonion basis elements and Gell-Mann λ matrices of $SU(3)$ symmetry on comparing the multiplication tables for Gell-Mann λ matrices of $SU(3)$ symmetry and octonion basis elements. Consequently, the quantum chromo

dynamics (QCD) has been reformulated and it was shown that the theory of strong interactions could be explained better in terms of non-associative octonion algebra. Further, the octonion automorphism group $SU(3)$ has been suitably handled with split basis of octonion algebra showing that the $SU(3)_C$ gauge theory of colored quarks carries two real gauge fields which are responsible for the existence of two gauge potentials respectively associated with electric charge and magnetic monopole and supports well the idea that the colored quarks are dyons.

We considered the global $SU(2)$ and $SU(3)$ unitary flavor symmetries systematically in terms of quaternion and octonion respectively. We showed that these symmetries are suitably handled with quaternions and octonions in order to obtain their generators, commutation rules and symmetry properties. Accordingly, Casimir operators for $SU(2)$ and $SU(3)$ flavor symmetries are also constructed for the proper testing of these symmetries in terms of quaternions and octonions.

We discussed the Grand Unified theories (GUTs) in terms of quaternions and octonions by using the relation between quaternion basis elements with Pauli matrices and Octonions with Gell-Mann λ matrices. Connection between the unitary groups of GUTs and the normed division algebra has been established to re-describe the $SU(5)$ gauge group. We have thus described the $SU(5)$ gauge group and its subgroup $SU(3)_C \times SU(2)_L \times U(1)_Y$ by using quaternion and octonion basis elements. As such the connections between $U(1)_Y$ gauge group and complex number, between $SU(2)_L$ gauge group and quaternions, and between $SU(3)_C$ and octonions are established. Therefore, the division algebra approach to the theory of unification of fundamental interactions as the case of GUTs leads to the consequences towards the new understanding of these theories which incorporate the existence of magnetic monopole and dyon.

From Dr. Bisht's previous research and his collaborations with me, I think that he is a very hard working and bright gentleman. In addition, he understands theoretical particle physics deeply, is technically strong, and has pretty good background in mathematical physics. About his personality, he is very affable and patient. Therefore, I strongly recommend Dr. Bisht to renew the UNESCO TWAS Associateship.

If you have any questions regarding this recommendation, please do not hesitate to contact with me.

Sincerely Yours,

Tianjun Li

Tianjun Li
Professor of Physics
Institute of Theoretical Physics
Chinese Academy of Sciences