

## Curriculum –Vita

**Dr. Ajay,**  
**Professor,**  
**Department of Physics,**  
**Indian Institute of Technology (IIT) Roorkee- INDIA**  
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### (Bio-sketch)

Dr. Ajay, Professor, Physics Department, Indian Institute of Technology (IIT) Roorkee, India, have more than 27 years post Ph.D. Research experience in the area of Theoretical Condensed Matter Physics along with Academic teaching and Administration at different levels. His current research interests lie in theoretical Modelling and Computational Simulations of Electronic properties in Strongly Correlated low dimensional quantum materials such as Superconductors-Quantum dots hybrid Josephson junction at infinite correlation regimes, twisted multilayer Graphene Nanostructures, and theoretical aspects of High temperature Superconductivity in Iron and Cuprates within Many Body strongly correlated Quantum Theoretical formalism based on Green's function Technique. After completing Ph.D. on Superconductivity in narrow band systems in 1995 under supervision of Prof.R.S.Tripathi, he joined the Condensed Matter Theory Group, under Prof. S.K.Joshi (Late) at National Physical Laboratory (NPL)- New Delhi, in September 1996 as Project Scientist ( Post-doctoral research assignment ) in "Transport Behaviour of Strongly Correlated Electronic systems a DST –New Delhi sponsored project research. He joined IIT Roorkee in 2008. Prior to joining IIT Roorkee, he has been working as Assistant Professor in the Department of Physics at G B Pant-University. Dr. Ajay has undertaken many International visits: The IESC, Cargese, France, The Abdus Salam International Centre for Theoretical Physics(ICTP) Trieste, Italy, International Institute of Advanced Scientific Studies (IIASS) University of Salerno- Italy, Cavendish Laboratory-London, University of Cambridge, UK, and Antalya-Turkey for Research interactions and in the pursuits of high end research tools & advanced Theoretical techniques. His research works (more than: 115) appeared in reputed international peer reviewed Journals and contributed extensively through sponsored research projects, supervision of Ph.D. (12) Scholars and research talks/presentations in International Conferences/ National Seminars. He has claimed Young Scientist Award- Govt. of Uttarakhand - India for his cutting edge research contributions in the field of High Temperature Superconductivity. He has also been awarded INSPIRE-Mentorship by Department of Science and Technology(DST) Govt. of India (for his continuous outstanding academic B.Tech, M.Sc. and Ph.D. teaching and leading research contributions to INSPIRE young minds) and membership of IAS, Expert member of UPSC-New Delhi, RPSC, JEE-Advance & UK Higher Education Selection, also members of several Editorial Boards and on the Reviewer panel of the various reputed reviewed National and International Journals.

### 1. Current Research Interests: Condensed Matter Physics (Theory)

#### (Electronic Properties of Strongly Correlated Quantum Materials)

Theoretical modelling and Computer Simulations of the electronic spectral, transport, magnetic and Superconducting properties of strongly correlated Quantum Materials such as, Electronic Properties of twisted multilayered Graphene, unconventional Superconductivity in Twisted Bilayer Graphene & Study of Superconducting Qubit in Superconductors-Quantum Dots Hybrid Quantum structures: As a basis for Quantum Computers, & Theoretical aspects of high Tc Cuprates and Iron based Superconductors

### 2. Professional Experience (27 years):

- **Professor (2020 – onwards):** Department of Physics, IIT Roorkee
- **Associate Professor (2015– 2020):** Department of Physics, IIT Roorkee,
- **Associate Professor (2012–2015)** Department of Applied Science,s IIT Rookree
- **Assistant Professor (2008– 2012):** Department of Applied Sciences, IIT Roorkee
- **Assistant Professor (1998–2008):** Department of Physics, G.B Pant Univ. of Ag& Tech.
- **Project Scientist (1996 –1998):** Condensed Matter Theory, NPL (CSIR), New Delhi,

### 3. Educational Qualifications:

- **Post-Doctoral (1996–1998):** Scientist: Condensed Matter Theory, NPL, New Delhi  
“Transport behavior of strongly correlated electronic systems”  
under the supervision of Prof. S. K. Joshi (Former DG: CSIR)-India
- **Ph.D .(1995):** (OGPA 4.64/5.00); G.B.Pant University of Ag&Tech. India:  
“Study of Superconductivity in Narrow Band Systems” (with Prof. R.S. Tripathi (Late))  
Invited among best thesis in India DAE-SSP: Sympo. at **IACS-Calcutta Dec. (1995)**
- **M.Sc.(Physics)(1990)** Meerut University- (**Awarded Merit Scholarship** )

### 4. Research Projects undertaken/Ongoing: 05:

(Annexure-I)

Title of the Project	Funding Institution & Amount	PI & Co-PI's
(I) “Transport Behavior of Strongly Correlated Electron Systems”	DST-at NPL New Delhi Completed(1996-1999), 10 lac	Prof. S.K.Joshi (PI) Dr. R. Lal Co PI Dr. Ajay ( Project Scientist)
(II) “Spectral properties of under-doped cuprates”	Completed (2005-2008 ) DST-New Delhi, 08.5 lac	Dr.Ajay (PI)
(III) “Thermo-elastic properties of mineral and metals under the effect of high temperature and pressure”	Completed-(2003-2006) CSIR-New Delhi. 08 Lac	Dr.B.R.K.Gupta(PI) Dr.Ajay (Co-PI)
<b>(IV): Ongoing</b> <b>Josephson Transport in coupled Quantum Dots Nanostructures:</b>	(Implemented <b>2021: Ongoing</b> ) Approved: <b>25.90 Lac</b> DST-SERB- New Delhi <b>CRG/2020/002212 (2021)</b>	Dr.Ajay( <b>PI</b> ) <b>IITR</b>  Prof.Vidhyadhiraja ( <b>Co-PI</b> ) Research Collaboration with JNCASRBanglore
<b>(V) Under evaluation _II</b> <b>A Theoretical study of Electronic Transport in Twisted Bilayer Graphene Nanostructures</b>	Under Evaluation ( <b>2022</b> ) ( <b>Ref. No-1156/NS</b> stage-II) <b>50.00 Lac</b> CSIR- New Delhi	Dr. Ajay ( <b>PI</b> ) <b>IITR</b>  Prof. G.D.Varma ( <b>Co-PI</b> )

**5(a). Ph.D. Supervised- 13 (Thirteen)****( Annexure-II)**

(07 Awarded + 06 Continuing as follows)

<b>S.No</b>	<b>Title of Thesis Research</b>	<b>Name of Student (Single/Jointly)</b>	<b>Year Award /Submission</b>
1.	<b>Study of the spectral properties of layered high Tc cuprate superconductors</b>	<b>Dr .Pradeep, Kumar Pathak (Single)</b>	<b>2005</b> (Awarded)
2.	<b>Influence of third dimension on the spectral and transport behavior of bilayer high Tc cuprate</b>	<b>Dr. Bhagya Sindhu Tewari (Single)</b>	<b>2008</b> (Awarded )
3.	<b>Study of Transport behavior across Nanoscopic superconducting quantum dots tunnel Junctions</b>	<b>Dr. Archana Dhyani (Single)</b>	<b>2009</b> (Awarded)
4.	<b>Josephson Transport in Superconducting Quantum Dots Nano Junction</b>	<b>Dr. Rajendra Kumar ( Single)</b>	<b>(2015)</b> (Awarded)
5.	<b>Electronic structure and Transport behavior in layered Graphene nanostructure</b>	<b>Dr. Sanjay Kumar (Single)</b>	(Awarded ) <b>(2014)</b>
6.	<b>The Study of Spectral properties of Iron based superconductors</b>	<b>Dr. Luxmi Rani (Single)</b>	<b>(2016)</b> (Awarded)
7.	<b>Thermodynamic properties of Iron based high Tc Superconductors</b>	<b>Madhavi Ahawalat (Single)</b>	<b>Sept (2022)</b> PDC-Awarded
8.	Tunable Josephson Transport across superconductor-multiple-coupled quantum dots Junction	Tarun Chamoli (Single)	(2016) Continuing..
9.	Theoretical Aspects of Superconductivity & Electronic band structure in Twisted Bilayer Graphene Nanostructures	Veer Pal (Single)	(2017) Continuing
10.	Spectral and Thermoelectric Transport Properties of Hybrid Superconductor Quantum Dot Nanostructures	Sachin Verma ( Single)	Enrol. July ( 2018) Continuing
11.	Tunable Thermal Transport in Superconductor- double coupled Quantum dots Josephson Junction	Bhupendra Kumar ( Single)	Enrol .Dec. (2019) Continuing..
12.	Theoretical and computational study of Quantum Transport in Semiconductor-Superconductors hybrid nano-wire	Udai Ram Ahir (Single)	Enrol. Dec. (2020)
13.	Josephson Transport in multi-terminal superconductor quantum dot nano-structures	Pujita Das (Single)	Enrol. Dec. (2022)

### 5(b). Master Theses/ Graduate Dissertations Supervised: 19

SNo	Title of Thesis /Dissertations	Name of Student (Id.No )	Year of Submission
1.	Study of superconductivity in infinite U- extended Hubbard model: Application to high Tc cuprates	Kuldeep Kholiya Id.No. 28754	2003 (Awarded)
2.	Role of interlayer coupling on the isotope effect in layered high temperature cuprate superconductors	Amarjeet Singh Id.No. 28725	2003 (Awarded)
3.	Study of role of pair transfer processes on isotope effect in superconducting TTF[Ni(dmit)2]2 systems	Manju Pant Id.No. 29668	2004 (Awarded)
4.	Interplay of single particle and Josephson Cooper pair tunneling on spectral properties of layered cuprate superconductors	Pooja Ahalawat Id.No. 28735	2005 (Awarded)
5.	Influence of pseudo gap and Interlayer coupling on Isotope effect in layered cuprate superconductors	Harendra Singh Bohra Id. No. 31727	2006 (Awarded)
6.	Electronic Spectrum of Mono and bilayer Graphene Nano-structures	Veer Pal (M.Sc. Physics)	2017 (Awarded)
7.	Spin-fluctuations as possible mechanism for high Temperature Superconductivity	Sachin Kumar (M.Sc. Physics)	2017 (Awarded)
8.	Tunable Josephson Transport in hybrid superconductor-quantum dots topological Tunnel Junction	Bhupendra kumar M.Tech. ( Solid State Electronic Material)	2018 (Awarded)
9.	Topological State of matter: Study of Spin Orbit interaction	Rahul Bidiyasar (M.Sc. Physics)	2019 (Awarded)
10.	Elements of BCS and GL theory applicable to Superconducting systems	Abhishek Pauchari (M.Sc. Physics)	2019 (Awarded)
11.	Study of Bose Einstein Condensation in Photon gas confined in a Cavity	Rajat Angivesh (M.Sc. Physics)	2019 (Awarded)
12.	Current - Phase characteristics of Superconductors Quantum dots Josephson Junctions	Udai Ram (M.Sc. Physics)	2020 (Awarded)
13.	Study of defect propagation in Graphene	Ashok Kumar ( M.Sc. Physics)	2021 (Awarded )
14.	Study of Superconductivity in Twisted Bilayer Graphene	Naveen Kumar (M.Sc. Physics)	2022 (Awarded)
15.	Electronic and Thermal Transport in multilayered Graphene nanostructure	Kapil Kr. Meena (M.Sc.) Physics	2022 (Awarded)
16.	The elements of Superconducting Qubits and Quantum Computation	Jayant singh ( B.Tech. EPH- Project)	( 2022) Awarded
17.	Study of Revelation of charge-4e and 6e superconductivity in Kagome superconductor CSV3SB5	Ankit Meena ( B.Tech. EPH- Project)	( 2022) Awarded
18.	Josephson Transport in Multi-terminal Josephson Junctions: Physics and Applications	Ranjan Kumar (M.Sc. Physics)	2022 (ongoing)
19.	Application of high Temperature Superconducting Qubits as a basis of Quantum Computer & Quantum device	Saurabh Thokada Integ. MSP	2022 Ongoing

#### **6. Administrative Responsibilities / Positions held:**

- **Member Senate (Senator))** Indian Institute of Technology Roorkee, (2020 - Continue)
- **Member Institute Faculty Search Committee(IFAC)** IIT Roorkee, (2021 - Onwards)
- **Member, Institute Complained Committee(ICC)** IIT Roorkee, (2020 - Continue)
- **Member, Departmental Professorial Committee (DPC)** IIT Roorkee, (2020 - Continue)
- **Member, Departmental Research Committee(DRC)** IIT Roorkee, (2019- Continue)
- **Professor Incharge, Administration & Maintenance, Phys. Dept. IIT Roorkee,** ( 2016 - 2019)
- **Member, Departmental Administration Committee, IIT Roorkee,** (2019- 2021)
- **Professor Incharge, B. Tech. Physics Laboratory, IIT Roorkee,- SRE Campus** (2010- 2013)
- **Professor Incharge, Games & Sports, IIT Roorkee, SRE-Campus**(2008- 2013)
- **Member Institute Technical Committee, IIT Roorkee** (2014-15)
- **Professor Incharge, Security, IIT Roorkee,SRE-Campus**(2008- 2013)
- **Staff Councillor, Board of faculty of Basic Sciences; GBPUA & Technology-Pant Nagar** (2006)
- **Assistant Warden – Chitanjan Bhawan-I ; GBPUA & Technology-Pant Nagar**(2005-2006)

#### **7. Research Papers Published: (Contributed more than 115 papers) :**

- (a) **Refereed International Journals: Q1/Q2 only -( 55) Annexure-II**
- (b) **Contributions in International Conferences/Symposia-27**
- (c) **Contributions in National Conferences and Seminars-32**
- (d) **Contributions as Book chapters and Monograph - 02**

#### **8. Research Visits Abroad:**

**USA, University of California, Los Angeles (UCLA)** Invited oral for Presentation related to **research work on twisted bilayer Graphene nanostructure** at International Conference on Advances in Functional Materials to be held at AAAFM-UCLA, deferred till June (2021) due to Covid pandemic.

- **France: IESC, Cargese,** presentation of research activities in International Summer School on “New Physics due to Spin Orbit Coupling in Correlated electron Systems” CORSO.2015 Organised by University of Paris-during August 4 - 14(2015).
- **Italy: Innovations in the Strongly Correlated Electronic Systems: School and Workshop”** organized by The Abdus Salam International Centre for Theoretical Physics(ICTP) Trieste- Italy during August 6 - 17(2012).
- **Cavendish lab. University of Cambridge, UK** to present research work on superconducting quantum dots Junction in SCES2011 , at **Cambridge University UK, August 29 Sept.03** (2011)
- **Turkey:** Antalya, to present (orally) research work on Electronic spectra of bilayer Cuprates’ during **International Conference on Superconductivity& magnetism ICSM 2010, April 25-30** (2010).
- **Italy:** XI Training Course in the “Physics of Strongly correlated electronic systems” sponsored by **International Institute of Advanced Scientific Studies (IIASS)** and organized by the **Physics Department, University of Salerno-Italy,** during **October 02-13(2006)**

**9(a) Honors/Awards/Scholarships:**

- **Young Scientist Award (2006)** under the discipline **Physics** by Uttarakhand Council of Science and Technology (UCOST), Govt of **Uttarakhand**, India.
- **Best Presentation Award**, National Seminar on Nanoscale Science and Technology, sponsored by UGC and DST India (2009)
- **Resource Person (Mentor) INSPIRE Programme** DST- Govt of India
- **Awarded Bursera Merit Scholarship** during M.Sc. and B.Sc. Program
- **International Travel Award-DST- Govt. of India** (2010)

**9(b) Memberships/ Expert Committee:**

- **Member Editorial Board:** International Journal of Materials Physics (IJMP- 2013)
- **Member Editorial Advisory Board:** Journal of Materials Nano-Science (2014),
- **Member Graphene Council:** Research, Development, and Appli,- dedicated to Graphene Research,
- **On the panel of Reviewer** with Indian Journal of Pure and Applied Physics(IJPAP), a Journal published by NISCAIR- CSIR- New Delhi. India.
- **Reviewer, of International Journals: J. of Physics: Cond. Matter(IOP), Physica-C** (Superconductivity) and **Physica B** (Condensed matter Physics) & J. of Superconductivity and Noval Magnetism, & Pramana-IAS.
- **Reviewer, Current Science:** a science magazine with (IAS), Bangalore, India.
- **Member Physics Expert Committees, JEE-Advance, UPSC-New Delhi, RPSC, & UK-Higher Education** (2018, 2019, 2021, 2022)

**Annexure-III****10(a) Courses Taught at U.G. Level (Ajay)**

<b>S. No.</b>	<b>The Courses taught</b>	<b>UG/(B. Tech) / Students Response</b>
<b>1-</b>	PH-101(Physics-I) PH-201(Physics-II)	B. Tech. ( Ist year Group)
<b>2-</b>	PHN-001 (Mechanics),	B. Tech (Civil Engg.) (4.13/5.00)
<b>3-</b>	PHN-006 (Statistical and Quantum Mechanics)	B. Tech. (ECE and CSE group): 4.49 out of 5.00)
<b>4-</b>	PHN-104 (Mechanics &Relativity)	B. Tech. (EPH and MSP group): 4.20 out of 5.00)

**10 (b) Courses Taught at P.G. (M.Sc. and Ph. D) Level (Ajay)**

<b>S. No.</b>	<b>Courses taught</b>	<b>(M.Sc.) &amp; Ph.D./ Students Response</b>
<b>1-</b>	PHN-503 (Quantum Mechanics-I)	M.Sc. Physics: 4.323 out of 5.00
<b>2-</b>	PHN-305 (Properties of Matter and acoustics)	Int. .M.Sc. : 4.048 out of 5.00
<b>3-</b>	PHN-509 (Classical Mechanics):	M.Sc. Physics
<b>4.</b>	IPH-604 (Physics of Nano Systems)	M.Sc.(Phys) & Integ. M.Sc. : 4.375 out of 5.00
<b>5-</b>	IPH-05 (Superconducting Materials and Devices)	M.Sc.(Physics) & Integ. M.Sc.
<b>6 -</b>	PHN-786 (Adv. Statistical and Quantum Physics)	Pre-Ph.D. (Physics): Response ( 4.5/5.00)
<b>7.</b>	PHN-627: Quantum Theory of Solids	M.Sc.(Phy) & Integ. M.Sc, Pre-PhD, (4.45/5.00)

## Annexure-IV(A)

### (11A)- Publications in Refereed International Journals: 55 (Q1/Q2 only)

1. **Ajay**, S. Patra and R.S.Tripathi,  
Effect of an interband interaction on narrow band superconductivity;  
**Physical Review B**51, 12658-25664 (1995) **Q1**
2. **Ajay**, S.Patra and R.S.Tripathi,  
Effect of interlayer coupling on Neel Temperature in Copper oxide based antiferromagnets; **Physica Status Solidi (b)**188, 787-793(1995) **Q2**
3. **Amit Pratap, Ajay** and R.S.Tripathi,  
Magnetic properties of quasi-2D antiferromagnet:  
**Physica Status Solidi(b)**197, 453-464 (1996) **Q2**
4. **Amit Pratap, Ajay** and R.S.Tripathi,  
Effect of interlayer interactions in high- $T_c$  cuprate superconductors;  
**Journal of Superconductivity**, 9, 595 (1996) **Q2**
5. **Ajay**, R.S.Tripathi,  
Role of interlayer interactions on Transition Temperature in high - $T_c$  cuprates; **Physica C**  
(Superconductivity& Its Applications), 274, 73-80(1997) ) **Q2**
6. R. Lal, **Ajay**, R.L.Hota and **S.K.Joshi**,  
Model for c-axis resistivity of cuprate Superconductors;  
**Physical Review B** 57, 6126 - 6136 (1998) **Q1**
7. **Amit Pratap, Ajay** and R.S.Tripathi  
Spin wave contribution to Thermal Expansion in high  $T_c$  cuprate  
Superconductors;  
**Physica C** (Superconductivity& Its applications), 294, 270-274 (1998) **Q2**
8. **Ajay**,  
Role of interlayer coupling in the Superconducting state of layered cuprate superconductors;  
**Physica C** (Superconductivity& Its Applications) 361, 267-272 (1999) **Q2**
9. **Ajay**, R. Lal and S.K.Joshi,  
Study of doping dependent shift in the Chemical Potential of high  $T_c$  Cuprates by  $t-t'$ - J Model;  
**Physica C** (Superconductivity& Its Applications) 325, 201-209 (1999) **Q2**
10. **Govind, Amit Pratap, Ajay** and R.S.Tripathi,  
Thermodynamic properties of bilayer cuprate superconductors;  
**Physica C** (Superconductivity& Its Applications) 322, 42-50 (1999) **Q2**
11. **Govind, Amit Pratap, Ajay** and R.S.Tripathi,  
Specific Heat of Bilayered Cuprate Superconductors;  
**Solid State Physics**:(DAE-proceedings) 42 (1999)

12. **Govind, Ajay** and R.S.Tripathi,  
Superconducting properties of bilayer cuprates: Role of CuO chains,  
**Physica C**(Superconductivity & Its Applications) **334**, 215-228(2000) **Q2**
13. **Govind**, Amit Pratap, Ajay and R.S.Tripathi,  
Bilayer-exchange couplings and Neel Temperature of YBaCuO;  
**Pramana J. Physics** **54**, 423 - 429 (2000) **Q2**
14. **Amit Pratap**, Govind Ajay, and S.K.Joshi,  
Temperature dependence of the magnetisation and optical magnon gap in bilayer cuprate  
antiferromagnets; **Physica C** (Superconductivity& Its Applications) **353**, 296 (2001) **Q2**
15. **Govind**, Ajay and S.K.Joshi,  
Interplay of single particle and Copper pair tunneling on the superconducting state of bilayered high-  
Tc cuprates;  
**Physica-C** (Superconductivity Its Applications) **353**, 289-296 (2001) **Q2**
16. **M.Sharma**, Govind, Amit Pratap, Ajay and R.S.Tripathi,  
Role of dipole-dipole interaction on the magnetic dynamics of anisotropic layered cuprate  
antiferromagnet; **Physica Status Solidi(b** **226**,193-202(2001) **Q2**
17. **Govind**, Amit Pratap, Ajay, and R.S.Tripathi,  
Magnetic properties of undoped  $YBa_2Cu_3O_{6+x}$  Cuprate systems;  
**European Physical Journal B** **23**, 153-158 (2001) **Q2**
18. **Ajay**, Amit Pratap and S.K.Joshi,  
Role of Cu d-d inter-orbital electron correlations on the out- of- plane conduction in high Tc cuprates:  
**Physica C** (Superconductivity & Its Applications); 371,**139-145**(2002) **IF Q2**
19. Govind, **Ajay** and **S.K.Joshi**,  
Condensation energy of bilayered cuprate superconductors;  
**Pramana, J. of Phys.** **58**, 861-866 (2002) **Q2**
20. **M.P. Singh**, Govind, **Ajay** and B.R.K.Gupta,  
Role of bilayer-chains coupling on the supercurrent density in layered cuprate superconductors;  
**Solid State Phys.**(DAE-Proceedings) **45**, 397(2002)
21. **M.P.Singh**, **Ajay** and B.R.K.Gupta,  
Temperature Dependence of the supercurrent density in bilayer cuprate superconductors,  
**Physica C** (Superconductivity & Its Applications)383, 388-394 (2003) **Q2**
22. **M.P.Singh**, Govind, Ajay and B.R.K.Gupta,  
Role of CuO chains on the supercurrent density in layered cuprate superconductors; **Indian J.**  
**Phys.****77A** (5), 441(2003) **Q2**
23. **A.Singh**, P.K.Pathak, **Ajay** and R. Kishore  
Role of interlayer coupling on isotope effect in layered high-Tc cuprate superconductors;  
**Physica C** (Superconductivity& Its Applications) **415**, 145(2004) **Q2**



24. P.K.Pathak, **Ajay**, and S.K.Joshi,  
Spectral properties of doped bilayer high T<sub>c</sub> cuprates: Role of interlayer coupling, **Physica C**(Superconductivity& Its Applications) 423, 127-136(2005) ) **Q2**
25. P.K.Pathak, and **Ajay**,  
Electronic spectra of optimal doped bilayered and trilayer cuprate superconductors, **Physica C**(Superconductivity& Its Applications) 423, 137-151(2005) **Q2**
26. P.K.Pathak, and **Ajay**  
Electronic spectra of doped bilayer high T<sub>c</sub> cuprates within t-t'-t''-U model  
**Physica C** (Superconductivity& Its Applications) 444,31-39 (2006) **Q2**
27. P. Ahalawat, P.K.Pathak, and **Ajay**  
Interplay of single particle and Josephson Cooper pair tunneling on the electronic spectra in bilayer cuprate superconductors  
**Physica C** (Superconductivity& Its applications) 455, 46-51 (2007) **Q2**
28. B.S. Tewari, **Ajay** , and R. Kishore  
Influence of three site exchange interaction on electronic spectra of high T<sub>c</sub> layered cuprates,  
**Physica C** (Superconductivity& Its Applications) 468,237-243 (2008) **Q2**
29. B.S.Tewari, A. Dhyani, and **Ajay**  
Influence of inter unit cell resonant tunneling on the out-of-plane electronic transport behavior in layered high T<sub>c</sub> cuprates;  
**European Physical Journal B** 66, 67-74 (2008) **Q1**
30. A. Dhyani, B.S.Tewari, and **Ajay**  
Josephson supercurrent through nano- superconducting quantum dots Junction;  
**Physica E** (Nanostructure & Low dimensional systems)41,1179(2009) **Q1**
31. A. Dhyani, B.S.Tewari, and **Ajay**  
Interplay of Single particle and Josephson tunneling on the Supercurrent across the superconducting quantum dot Junction: **Physica E** (Nanostructure &Low dimensional systems) **42**, 162 (2009) **Q1**
32. **Ajay**, B.S.Tewari, and Govind,  
Influence of C-axis inter unit cell resonant tunneling on the spectral function in bilayer cuprates: **Int. Journal of Modern Physics** , 2, 759 (2011) **Q2**
33. Sanjay Kumar, and **Ajay**  
Electronic spectra of monolayer and bilayer Graphene nano-structures:  
**J. of Comput. and Theo. Nanoscience.** 10, 1-13(2013) **Q2**
34. Luxmi Rani and **Ajay**  
Electronic spectra of Iron Pnictide Superconductors: Influence of Multi-orbitals hopping and Hund's Coupling **J. of Superconductivity and Novel Magnetism**-26, 527(2013) **Q2**

35. Sanjay Kumar, and **Ajay**  
Quasi-Particle spectrum and Density of electronic states in AA- and AB- Stacked bilayer Graphene:  
**The European Physical Journal B**: 86,111 (2013) **Q1**
36. Luxmi Rani and **Ajay**  
Single particle spectral function in Iron Pnictide Superconductors within two band model: **American Institute of Physics (AIP)**: Proceeding:1591,1618(2014)
37. Luxmi Rani and **Ajay**  
Quasi Particle Dispersion and Density of States in Superconducting State of Iron Pnictide Superconductors , **Materials Express** -04,1-15(2014) **Q2**
38. Gagan Rajput, Rajendra Kumar, and **Ajay**  
Tunable Josephson in Hybrid Parallel Coupled Double Quantum Dotsuperconductor Tunnel Junction: **Superlattice & Microstructures**(Elsevier)-73-193-202( 2014) **Q2**
39. Sanjay Kumar, and **Ajay**  
Quasi-particle spectrum in trylayer graphene Trilayer Graphene: Role of Onsite Coulomb interaction and Interlayer Coupling, **Physica E (Nano-structures & Low dimens. )**65,36-43(2015) **Q1**
40. Luxmi Rani and **Ajay**  
Influence of Multi-Orbital Hopping and Anisotropy in Intra & Inter Orbital Coulomb Interaction on Electronic Spectra in Iron Pnictide Superconductors: **Physica C (Superconductivity &Applications)** 510, 31-41(2015) **Q2**
41. A. Dhyani, Rajendra Kumar, B.S.Tewari, and **Ajay**  
Tunable Josephson Supercrrent Through a Two Level Quantum Dot-Superconductors Tunnel Junction: **Journal of Computational Electronics** ( Springer-Verlag)-14, 139-145( 2015) **Q2**
42. Sanjay Kumar, and **Ajay**  
Electronic Spectrum of Trilayer Graphene :  
**Indian J. of Physics**(Springer) 88(8), 813-829 (2015) **Q2**
43. Sanjay Kumar, and **Ajay**  
Influence of Interlayer Coupling and Intra layer Coulomb Interaction on electronic Transport in Bilayer Graphene:  
**Current Applied Physics**, 15, 1205-1215(2015) **Q2**
44. Luxmi Rani and **Ajay**  
Influence of Multi-Orbital Hopping, Coulomb correlations and Hund's Coupling on Transition Temperature in doped Iron based Superconductors  
**J. of Supercond. & Nov. Magn.** 29, 67-77(2016) **Q2**
45. Luxmi Rani and **Ajay**  
Influence of Multi-Orbitals and anisotropic Coulomb Interactions on Isotope effect Coefficient in doped Iron based Superconductors;  
**Physica C (Superconductivity & Its Applications)** 537,17- 22(2017) **Q2**

46. Tanuj Chamoli and **Ajay** ;  
Tunneling conductance in superconductor-hybrid double quantum dots Josephson Junction :  
**American Institute of Physics (AIP) Proceedings 1953, 120027 (2018)**
47. B.S. Tewari, M. Tewari , A. Dhyani, and **Ajay**  
Study of inter-band pair transfer and density of States on Isotope effect in TTF(Ni(dmit)<sub>2</sub>)<sub>2</sub>  
Organic Superconductors.  
**Physica C**, (Superconductivity and its Application )1353591(2019) **Q2**
48. Sachin Verma and **Ajay**  
Influence of superconductivity on the magnetic moment of quantum impurity  
embedded in BCS superconductor :  
**J. Phys.: Condens. Matter 33, 085603, (2020) Q1**
49. B.S. Tewari<sup>1</sup>, M. Ahlawat<sup>2\*</sup>, A. Dhyani<sup>3\*</sup> and **Ajay**<sup>4</sup>  
Influence of pseudo-gap and interlayer coupling on isotope effect in bilayer cuprates:  
**Physica C** ( Supercond. & Its applicat )Elsevier: V-587, **1353895) (2021) Q2**
50. Tanuj Chamoli and **Ajay**  
Andreev bound states in Superconductor-Quantum Dot-Superconductor junction at infinite-U limit:  
**J. of Super. & Noval Magnetism, (Springer) (2021) Q2**
51. Sachin Verma and **Ajay**  
Non-equilibrium thermoelectric transport across normal metal-Quantum dot-Superconductor hybrid  
system within the Coulomb blockade regime:  
**J. Phys.: Condens. Matter 34, 155601 (2022) Q1**
52. Tanuj Chamoli and **Ajay**  
Josephson Transport through parallel Double coupled quantum dots at infinite-U limit: **The  
European Physical Journal B**; EPJB-D-22-00198R1(Accepted) **(2022) Q1**
53. Madhavi Ahalawat; Luxmi Rani; **Ajay** ,  
Influence of multi-orbitals and Hund's coupling induced pseudogap on specific heat jump in iron  
pnictide high T<sub>c</sub> superconductors;  
**Physica Status Solidi B** (Wiley: **Advanced Science News**): 2200192 **(2022) Q2**
54. Sachin Verma and **Ajay**  
A Strongly Correlated Quantum-Dot Heat Engine with Optimal Performance:An Non-equilibrium  
Green's function Approach:  
**The European Physical Journal B**; EMID:65bc8ba74f7da366; Review R1 **(2022) Q1**
55. Bhupendra Kumar, Sachin Verma and **Ajay**  
Phase and Thermal Driven Transport across T-shaped double quantum dot Josephson junction  
**Physica E** ( Low dimensional Systems& Nanostructures) PHYSE-D-22-00754-ReviewR1 **(2022) Q1**

**(11B)- Publications in Refereed International Journals (Last Five years): 11**

1. Luxmi Rani and **Ajay**,  
Influence of Multi-Orbital Hopping, Coulomb correlations and Hund's Coupling on Transition Temperature in doped Iron based Superconductors  
**J. of Supercond. & Nov. Magn.** 29, 67-77 (2016) **Q2**
2. Luxmi Rani and **Ajay**  
Influence of Multi-Orbitals and anisotropic Coulomb Interactions on Isotope effect Coefficient in doped Iron based Superconductors;  
**Physica C (Superconductivity & Its Applications)** 537, 17-22 (2017) **Q2**
3. B.S. Tewari, M. Tewari, A. Dhyani, and **Ajay**  
Study of inter-band pair transfer and density of States on Isotope effect in  $TTF(Ni(dmit)_2)_2$  Organic Superconductors. **Physica C ( Supercond. & Its Applications)** -1353591(2019) **Q2**
4. Sachin Verma and **Ajay**  
Influence of superconductivity on the magnetic moment of quantum impurity embedded in BCS Superconductor : **J. Phys.: Condens. Matter** 33, 085603, (2020) **Q1**
5. B.S. Tewari<sup>1</sup>, M. Ahlawat<sup>2\*</sup>, A. Dhyani<sup>3\*</sup>, and **Ajay**<sup>4</sup>  
Influence of pseudo-gap and interlayer coupling on isotope effect in bilayer cuprates:  
**Physica C ( Supercond. & Its applicat: Elsevier: V-587, 1353895) (2021) Q2**
6. Tanuj Chamoli and **Ajay**  
Andreev bound states in Superconductor-Quantum Dot-Superconductor junction at infinite-U limit:  
**J. of Super. & Noval Magnetism, (Springer) (2021) Q2**
7. Sachin Verma and **Ajay**  
Non-equilibrium thermoelectric transport across normal metal-Quantum dot-Superconductor hybrid system within the Coulomb blockade regime:  
**J. Phys.: Condens. Matter** 34, 155601 (2022) **Q1**
8. Tanuj Chamoli and **Ajay**  
Josephson Transport through parallel Double coupled quantum dots at infinite-U limit:  
**The European Physical Journal B; EPJB-D-22-00198R1(Accepted) (2022) Q1**
9. Madhavi Ahalawat; Luxmi Rani ; **Ajay** ,  
Influence of multi-orbitals and Hund's coupling induced pseudogap on specific heat jump in iron pnictide high T<sub>c</sub> superconductors;  
**Physica Status Solidi B (Wiley: Advanced Science News): 2200192 (2022) Q2**
10. Sachin Verma and **Ajay**  
A Strongly Correlated Quantum-Dot Heat Engine with Optimal Performance:An Non-equilibrium Green's function Approach:  
**The European Physical Journal B; EMID:65bc8ba74f7da366; Review R1 (2022) Q1**
11. Bhupendra Kumar, Sachin Verma and **Ajay**  
Phase and Thermal Driven Transport across T-shaped double quantum dot Josephson junction  
**Physica E ( Low dimensional Systems& Nanostructures) PHYSE-D-22-00754-Review R1 (2022) Q1**

### **(11C)- Contribution as Book Chapters and Monograph (Ajay): (02)**

1. Uday Ram Ahir, Sachin Verma and **Ajay**  
A study of current phase characteristic of the quantum dot Josephson junction, as full chapter-**A Comprehensive guide to Superconductivity (Ch-5)**  
by **Nova Science Publishers, Inc. NY, USA (2020) , ISBN: 978-1-53618- 901-8**
2. Veer Pal and **Ajay**  
"Electronic properties of bilayer and trilayer Graphene nanostructures: a many- body theoretical model approach" (accepted) as :  
A monograph contribution in **CARBON NANOMATERIAL ELECTRONICS:**  
**publisher: Springer Nature, Singapore (2020)**

### **(11D)- Contributions in International Conferences and Seminars (Ajay): 27**

1. **Ajay** and R.S.Tripathi:  
Role of Interlayer Interactions in High-T<sub>c</sub> Cuprate Superconductors: Presented at International Conference on Strongly Correlated Electron Systems, held at Goa (India) **27-30, Sept.(1995)**
2. **Ajay**, and R.S.Tripathi:  
Intra and Interlayer Pairings in High-T<sub>c</sub> Cuprate Systems: International Seminar on CDDM, held at University of Kurukshetra(India) **22-24, Jan. (1996).**
3. Govind, **Ajay** and S.K.Joshi,  
Condensation energy of bilayered cuprate superconductors: International Symposium on Advances in Superconductivity and Magnetism: Mechanism, Materials and Devices, organised by TIFR- held at Mangalore University, Mangalore: **24-28, Sept. (2001).**
4. **Ajay**, B. S. Tewari, Govind and S.K.Joshi,  
Electronic spectra of bilayer high T<sub>c</sub> cuprates: role of intra and interunit cell couplings, Presented at International Workshop on the Physics of Mesoscopic and Disordered Materials held at , Physics Department IIT-Kanpur, Dec. 04-08 **(2006)**
5. **Ajay**,  
Electronic spectra of strongly correlated layered high T<sub>c</sub> cuprate superconductors; proceeding "XI training course in the Physics of Strongly Correlated Systems" organized by International Institute of Advanced Scientific Studies(**IIASS**), and University of Salerno, **Vietri Sul Mare –Italy**, during 02-13 Octo. **(2006)**
6. P.K.Pathak, B.S.Tewari, **Ajay** and R.Kishore,  
Pseudogap in the electronic spectra of doped high T<sub>c</sub> cuprate in normal state, (Oral) presented in International Conference on Condensed Matter Physics (ICCMP-2007) held at University of Rajasthan, during 25-28 Nov. **(2007)**

**7. M.P.Singh, B.S.Tewari, Ajay**

Temperature dependence of anisotropy in the supercurrent density in layered cuprate superconductors,(Oral) presented at International Conference on Condensed Matter Physics (ICMP-2007) held at University of Rajasthan, during 25-28 Nov. **(2007)**

**8. S.Tewari, Ajay and S.K.Joshi,**

Influence of long range hoppings and three site exchange interaction on the electronic spectra of bilayer cuprate Superconductors: presented at Summer School on “From BCS to Exotic Superconductivity”, held at Cargese, **France**, during July 16 to 28, **(2007)**

**9. A.Dhyani, B.S.Tewari, and Ajay**

Interplay of Single particle and Josephson tunneling on the Supercurrent across the superconducting quantum dot Junction: **(Oral)** in International Symposium on metallurgy, Materials Science, & Engineering, held at Department of metallurgy and Materials Engineering, IIT- Chennai, Dec. -10-12 **(2008)**

**10. Ajay, B.S.Tewari, and Govind**

Influence of Intra cell Coupling and Inter cell Resonant tunneling on the Electronic spectra of Bilayer High T<sub>c</sub> Cuprites, Presented(Orally) in the International Conference on Superconductivity and Magnetism(ICSMT-2010), Organised by Ankara University, antalya, **Turkey**, during **25-30 April (2010)**

**11. Sanjay Kumar and Ajay,**

Study of electronic transport behavior in Graphene multilayered Nanostructures” presented in International Conference on Quantum effects of Solids of Today (ICONQUEST-2010), Organised by National Physical Laboratory- New Delhi India, during **21-23 December (2010)**

**12. Dhyani, B.S.Tewari, and Ajay,**

Study of Josephson Supercurrent across a correlated Quantum dot coupled to s- wave Superconducting leads presented in the International Conference on Strongly Correlated Electronic Systems (**SCES 2011**) at **Cambridge, UK**. During August 29- September 3, **(2011)**

**13. Sanjay Kumar and Ajay,**

Spectral Properties of Correlated Monolayer and Bilayer Graphene Nanostructures: presented at **Innovations in the Strongly Correlated Electronic Systems: School and Workshop**” organized by The Abdus Salam **International Centre for Theoretical Physics (ICTP) Trieste- Italy** during **August 6 – 17 (2012)**.

**14. Sanjay Kumar and Ajay,**

Spectral Properties of Correlated Trilayer Graphene: presented (Oral) at **International conference on Materials Science and Condensed Matter Physics**, held at Berlin, **Germany**, during **May 22 – 23 (2013)**.

**15. Sanjay Kumar and Ajay,**

Electronic Properties of Correlated Multilayer Graphene: A Tight Binding Approach, presented (Invited Talk) at **International conference on Nanotechnology (Nanotech. Dubai)**, held at Dubai during **Oct. 28-30 (2013)**.

**16. Luxmi Rani and Ajay,**

Influence of Anisotropy in Coulomb Interaction on Density of Electronic States in Iron Pnictide Superconductors: Presented in **International Conference On Recent Advances in Physics for Interdisciplinary Development (ICRAPID2014)** held at Satyabama University- Chennai, India during **23-24 January (2014)**

**17. Rajendra Kumar and Ajay,**

Study of Electronic Spectral density of Cooper Pair in double Coupled series Quantum Dots Superconductors Nanoscopic Junction; presented in **International Conference on Emerging Materials and Applications-ICEMA-2014**, held at IIT Roorkee, -India during **5-6 April (2014)**

**18. Luxmi Rani and Ajay,**

A Theoretical Study of Nature of Pairing Symmetry in Superconductors: Orally presented at **International Conference on Emerging Materials and Applications-ICEMA-2014**, held at IIT Roorkee, -India during **5-6 April (2014)**

**19. Luxmi Rani and Ajay,**

Influence of Multi-Orbital, Hund's Coupling and Electronic Correlations on Electronic Spectrum in Iron Based Superconductors" presentation of research activities in International Summer School on "New Physics due to Spin Orbit Coupling in Correlated electron Systems" **CORSO.2015 Organised by University of Paris- at IESC- Cargese, -France** during **August 4 - 14 (2015)**.

**20. Tanuj Chamoli and Ajay,**

Tunneling Conductance across Nanoscopic Superconducting double coupled quantum dots, Presented at **International Conference on Condensed Matter & Applied Physics (ICC)** Bikaner November **(2017)**

**21. Ajay**

A Theoretical Model Study of Electronic spectrum and Transport behavior in twisted bilayer Graphene Nanostructures (**Invited talk**, at Symposium of Carbon Electronic Nanomaterials- (**collaborative Indo- Israel activities**) **BITS-Plan (IOE)** held during **8 - 9 Nov. (2019)**

**22. Tanuj Chamoli and Ajay,**

Study of Sub-gap states in Superconducting double coupled quantum dots Josephson Junctions, accepted (oral) for presentation at **International Conference on Functional Materials** held at **IIT Kgp**, 6-8 January (2020)

**23. Veer Pal and Ajay,**

Electronic transport in AB-bilayer and twisted bilayer graphene nanostructures: **Invited Oral Presentation** at International Conference on Advances in Functional Materials to be held at University of California, Los Angeles, USA (AAAFM-UCLA, ) June (2021)

**24. Sachin Verma and Ajay,**

**A theoretical model study of Hybrid superconductor quantum dot nano-structure and beyond:** International Online Conference on Nanomaterials (ICN 2021) 09th -11th April 2021 Kottayam, Kerala, India

**25. Sachin Verma and Ajay,**

**Influence of superconductivity on the magnetic moment of quantum impurity embedded in BCS superconductors:** Invited talk at Superconductivity Group Seminar IPM –Russia 06 April (2021)

**26. M. Ahalawat and Ajay**

“Study of Specific heat in Iron Based Superconductors: A Theoretical Three-Orbital Model Analysis” IEMPHYS-21: International conference on Advanced Physics (virtual mode), organized by Institute of Engineering, Kolkata in association with IEM Society of Physics Students (SPS)-**American Institute of Physics** and SMART Society, **USA**, 01-03, April (2021).

**27. M. Ahalawat and Ajay**

“Influence of Pseudogap on Specific Heat in Bilayer High-T<sub>c</sub> Cuprate Superconductors” The 4th International Conference on **Advanced Materials Science and Engineering (AMSE 2022)** (virtual mode), organized at Osaka International Convention Centre, **Osaka, Japan**, 18-20, March (2022).

**(11E)- Contributions in National Conferences and Seminars (Ajay): 32**

**1. Ajay, S.Patra, and R.S.Tripathi:**

Effect of Interband Interaction on Narrow Band Superconductivity, DAE, Solid State Physics Symposium held at University of Rajasthan, Jaipur (India) **Vol. 37C, pp.139(1994).**

**2. Ajay, S.Patra, and R.S.Tripathi**

Effect of Interlayer Coupling on Neel Temperature in Copper Oxide Based Antiferromagnets; DAE, Solid State Physics Symposium held at University of Rajasthan, Jaipur (India) **VI-37C, pp.316 (1994).**



3. Amit Pratap, **Ajay**, and R.S.Tripathi:  
Magnetic Dynamics of Layered Antiferromagnet: Condensed Matter Days, held at Institute of Physics, Bhubaneswar, **15-16, Aug. (1995)**.
4. **Ajay**,  
Study of Superconductivity in Narrow Band Systems Including Excitonic correlation, Presented at DAE, Solid State Physics Symposium held at IACS Calcutta (India) **Vol.38C, pp.47(1995)**.
5. M.Sharma, Amit Pratap, **Ajay**, and R.S.Tripathi,  
Role of Dipolar Interaction in Magnetic Dynamics of Layered Antiferromagnets: DAE, Solid State Physics Symposium held at Kochi (India) **Vol.39C(1997)**.
6. **Ajay** and S.K.Joshi,  
Doping dependence of the Chemical Potential in high T<sub>c</sub> cuprates;  
Proce. DAE Solid State Physics Symposium held at Kalpakkam (India) **27-31 Dec.(1999)**
7. Govind, **Ajay**, Amit Pratap, and R.S.Tripathi  
Specific heat of bilayer cuprate superconductors; DAE, Solid State Physics Symposium held at Kalpakkam (India) **27-31, Dec.(1999)**
8. Govind, **Ajay**, Amit Pratap, and R.S.Tripathi,  
Role of CuO chains on the superconducting properties of bilayered cuprate superconductors; National Seminar on material Science: Trends and Future, held at SLIET-Longowal, Sangrur-India, **24-25, Feb.(2000)**
9. **Ajay**, Amit Pratap and S.K.Joshi,  
Electron correlation effects on the out of plane conduction in cuprates;  
Proce. of National Conference on RDDM, held at Department of Physics, Panjab University, Chandigarh (India), **15-16 March (2001)**.
10. M.P.Singh, **Ajay**, Govind, and B.R.K.Gupta,  
Role of bilayer-chains coupling on the supercurrent density in layered cuprate superconductors, Proceedings of DAE, Solid State Phys.45, 397, Dec. 27-31 **(2002)**
11. P.K.Pathak, **Ajay**, and S.K.Joshi,  
Bilayer-splitting effects in the electronic spectra of high T<sub>c</sub> cuprates,  
DAE, Solid State Physics Symposium held at Guru Nanak Dev University Amritsar, during 27-31 Dec. **(2004)**
12. **P.K.Pathak**, and **Ajay**,  
Electronic spectra of multilayer high T<sub>c</sub> cuprate superconductors,  
Proceedings of Indian Science Congress held at Nirma University of Science & Technology, Ahmedabad, during 3-7, Jan. **(2005)**
13. P.K.Pathak, **Ajay**, and S.K.Joshi,  
Density of States of bilayer high T<sub>c</sub> cuprates: role of intrabilayer coupling, Presented at 50-th DAE, Solid State Physics Symposium held at Bhabha Atomic Research Centre, Mumbai, during 05-09 Dec. **(2005)**

14. P.K.Pathak, and **Ajay**,  
Bilayer and trilayer-splitting effects in the electronic spectra of multilayered high  $T_c$  cuprates, Presented at 50-th DAE, Solid State Physics Symposium held at Bhabha Atomic Research Centre, Mumbai, during 05-09 Dec. **(2005)**
15. M.Pant, B.S.Tewari and **Ajay**,  
Role of interband pair transfer processes on isotopic effect in Superconducting TTF  $[\text{Ni}(\text{dmit})_2]_2$  System, oral presentation at Uttaranchal State Science Congress, Dehradun, Nov. 10-11, **(2006)**
16. **Ajay**, P.Ahalawat, P.K.Pathak,  
Peak-dip hump line shape in the electronic spectra of bilayer high temperature cuprate superconductors, oral presentation at Uttaranchal State Science Congress, Dehradun, Nov 10-11, **(2006)**
17. B.S.Tewari, and **Ajay**,  
Influence of three site exchange interaction on electronic spectra of layered high  $T_c$  cuprates, presented at 51-th DAE, Solid State Physics Symposium held at Barktullah University, Bhopal, during 26-30 Dec. **(2006)**
18. H.S.Bohara, B.S.Tewari, **Ajay** and R.Kishore  
Influence of Interlayer coupling and pseudogap on Isotope effect in layered high  $T_c$  cuprate superconductors, Presented at 51-th DAE, Solid State Physics Symposium held at Barktullah University, Bhopal, during 26-30 Dec. **(2006)**
19. M.P.Singh, B.S.Tewari and **Ajay**,  
Temperature and carrier density dependence of anisotropy in supercurrent density in layered cuprate superconductors, Presented at 51-th DAE, Solid State Physics Symposium held at Barktullah University, Bhopal, during 26-30 Dec. **(2006)**
20. **Ajay**,  
Emerging trends in Nano-science and Nanotechnology, presented (oral) at Second Uttaranchal State Science Congress sponsored by UCOST and held at Kumaon University at Nainital during Nov. 11-12, **(2007)**
21. A. Dhyani, B.S.Tewari, and **Ajay**  
Electronic Transport behavior through nanoscopic superconducting quantum dots Josephson Junction: presented (poster) at Winter School on "Physics of Nanoscopic Low Dimensional systems", held at HRI, Allahabad, during Jan 29 – Feb2 **(2008)**
22. B.S.Tewari, and **Ajay**  
Influence of the third dimension on the electronic spectra and out-of-plane transport in layered high  $T_c$  cuprates, Presented at 53 rd DAE, Solid State Physics Symposium held at Bhabha Atomic Research Centre (BARC) Mumbai during 15-18 Dec. **(2008)**
23. A. Dhyani, B.S.Tewari, and **Ajay**  
Role of Josephson Cooper pair tunneling on S-QD-S Junction, Presented at 54 th DAE, Solid State Physics Symposium held at M.S. University, Baroda, Vadodara, India , during **14 -18 Dec. (2009)**

24. A. Dhyani, B.S.Tewari, and **Ajay**,  
Electronic Structure and Quantum Transport in Nanoscale Superconducting- Quantum dot Junction: to be presented (Oral) in National Level Symposium on Nanoscale Science & Technology to be held at Physics Department M.S. College, during Feb. 21-22, **(2009)**
25. Luxmai Rani and **Ajay**,  
Superconductivity in Iron based materials: Prospects and Promises, Invited talk presented at Recent Trends in Materials Science and Nano- Structures , organized by UCOST- Uttarakhand and held at Govt P.G. College, Udham Singh Nagar India **During January 02 - 03 (2012)**
26. Luxmi Rani and **Ajay**,  
Spectral Function of Electronic States in Iron Pnictide Superconductors within two band model: Orally presented, Department of Atomic Energy(DAE) Solid State Physic (SSP) Symposium, held at **Thapar University**, Patilala, India during **December 18-21 (2013)**
27. Luxmi Rani and **Ajay**,  
Electronic Band structure and Fermi Surface Studies in Multiorbital's Iron Based Superconductors , PRL-Conference on Condensed Matter Physics (**PRL-CCMP**) Physical Research Laboratory . Ahmedabad, India, **April 11-13 (2016)**,
28. Madhavi Ahawalat and **Ajay**,  
Study of Specific heat and Pseudogap in Iron Based Superconductors, Presented Orally, at **National Conference on Condensed Matter Physics (ICCMP)** Calcutta, 6-7 Nov. **(2017)**
29. **Ajay**  
Emerging Trends in High Tc Superconductors: Prospectus and Promises (**Invited INSPIRE Lecture, DST-INSPIRE Camp at ITM University Gwalior . held during the 06-09 August (2019)**)
30. **Ajay**  
Emerging Trends in High Tc Superconductors: Prospectus and Promises (**Invited INSPIRE Lecture, DST-INSPIRE Camp at- ITM University Gwalior . held during the 06-09 August (2020)**)
31. **Ajay**  
(**Invited talk: Prof. S. K. Joshi Memorial Session**): Theoretical study of Josephson Transport in superconductors Quantum dots (a collaboration with Research scholars: Tanuj Chamoli and Sachin Verma) Superconductors Hybrid Structures: Conference on Quantum Matter Hetero-structures-II(QMH-II), February, 18-19(**2021**)
32. Veerpal and **Ajay**,  
Exotic Electronic Properties of Twisted Bilayer Graphene-**Emergence of Twistronics** Emergent Phenomena in Quantum Materials **E-QMAT (Physics Dept. IIT Roorkee)- India, 12-14 Oct.(2022)**

**(12) Details of National and International Collaborations/ Research Interaction:**  
**Annexure-V**

<b>Group/ Institute Visited</b>	<b>Collaborators &amp; Nature of Research works</b>	<b>Duration of Visit</b>
<b>Theoretical Science Group, Jawaharlal Nehru Centre for Advanced Scientific Research- JNCASR- Bangalore</b>	<b>Prof. S. Vidhyadhiraja</b> Research Collaboration on “ Theoretical model studies of Kondo effect in DQD- Josephson Nanostructures”	Continuing Collaboration, (recent visit June 17- 29, (2019)
<b>International Centre for Theoretical Sciences(ICTS) -Banglore</b>	<b>Prof. Subhro Bhattacharya</b> Research Interaction on " Tunneling conductance and symmetry of order parameter in Superconductors double Quantum dots Josephson Junction”	(4-10 March 2019)
<b>Condensed Matter Theory Group, National Physical laboratory-NPL New Delhi . India</b>	<b>Prof. S.K. Joshi, &amp; Dr. Govind</b> published collaborative research work “ On Electronic transport high Temperature Cuprate Superconductors”	visit frequently (1998-2008)
<b>INPE- Sao Paulo, Brazil</b>	<b>Prof. Ram Kishore</b> , Published Research work on- Isotope effect and Three site Exchange Interaction & electronic structure of Layered high Tc Cuprate Superconductors	Oct.-Dec. 2006 (Prof. Kishore used to Visits our group frequently)
<b>Condensed Matter Theory Institute of Mathematical Sciences(IMSc) .Chennai</b>	<b>Prof. A.K. Mishra &amp; Prof. G. Baskaran</b> Worked on Ortho-Fermi Statics applicable to Strongly Correlated Electronic Systems	From Feb. 16, 2002- To- Feb.22, 2002
<b>Institute of Physics (IOP) Bhubaneswar -Orissa - India</b>	<b>Prof. S.N.Behera (Director - IOP)</b> Worked on the problem of charge density wave & Antiferromagnetic ordering in Strongly Correlated electronic systems.	From July 31-st 1995 - to- August 30, 1995

## Annexure-VI

### 13- Participation Training Abroad / Advanced Courses (Ajay):

1. Winter School on “**Computational Condensed Matter Physics**” Sponsored by, Science and Engineering Research Council (SERC), Department of Science & Technology, Govt. of India, held at Department of Physics, H.P.University, Shimla, from **October 30- November, 18 (1995) 20 days**.
2. Workshop on “**Correlations in Quantum Systems**” organised by Centre for Theoretical Studies, Indian Institute of Technology, Kharagpur, **13-16 October (1998) 04 days**.
3. All India **Refresher Course in Theoretical Physics**, Sponsored by Indian Academy of Sciences(IAS), Bangalore, held at Physics Department, University of Hyderabad, Hyderabad from **18-30 November (2001) 13 days**.
4. **Refresher Course in Physics**, sponsored by University Grant Commission (UGC) New Delhi, and held at Department of Physics, Kumaon University, Nainital-Uttaranchal, from **June 13- July 03 (2003) 21 days**.
5. Training on “**Research Prioritization, Project Formulation, Appraisal, Monitoring and Evaluation**” organized by the Department of Agriculture Economics, College of Agriculture, G.B.Pant University of Ag.&Tech-Pantnagar, and sponsored by SAU research management-Uttaranchal DASP, from **05 –09 January (2004) 05 days**.
6. Short Term Course on “**Application of Optimization Technique in Research & Design**” organized by departments of Civil Engg.& Electronics & Communication Engg., College of Technology, G.B.Pant University of Ag.&Technology-Pantnagar, from **July 08 - 14, (2004) 07 days**.
7. XI Training Course in the “**Physics of Strongly correlated electronic systems**” sponsored by **International Institute of Advanced Scientific Studies (IIASS)** and organized by the **Physics Department, University of Salerno-Italy**, during **October 02-13(2006), 12 days**.
8. International Workshop on “**The Physics of Mesoscopic and Disordered Materials**” **MESODIS** held at the Physics Department, Indian Institute of Technology(IIT)Kanpur, during , **December 04-08 (2006) , 05 days**.
9. Participated and delivered Lectures in Short Term Course “ **Nanotechnology: Opportunity &Challenges**” on Nanoelectronic devices, and Josephson Transport in Nanoscopic superconducting-Quantum Dot Junctions, held at National Institute of Technical Teachers Training and Research(**NITTTR**), Chandigarh during **17- 21 May (2010)**
10. Participated and presented a research paper in **Innovations in the Strongly Correlated Electronic Systems: School and Workshop**” organized by The Abdus Salam **Internationa Centre for Theoretical Physics(ICTP) Trieste- Italy** during **August 6 - 17(2012) 12 days**.
11. Participation and presentation of research activities in International Summer School on “New Physics due to Spin Orbit Coupling in Correlated electron Systems” **CORSO.2015 Organised by University of Paris- at IESC- Cargese,-France** during **August 4 - 14(2015), 10 days**.

## 14 - Brief Current Research Statement: Annexure-VII

Currently, my group involved in the research activities with emphasis on Computational and theoretical modelling of the electronic properties of Strongly Correlated Quantum Nanostructures where electronic correlations and many body effects play a dominant role in these systems. A high light of current sponsored research activities being carried out by my Research Group at IIT Roorkee out of research projects presented in highlighted below:

- **Josephson Transport in Superconducting- coupled Quantum Dots Junction: (SERB-DST)**

Currently, we have published leading research on the theoretical model analysis of the many body effects on the electronic conductance through a nano-scopic superconducting quantum dot junction where there is a coupling between the single particle states at the quantum dot and two particle (bound pairs of electrons) states around the Fermi level in superconducting electrodes (source and drains). To understand the physics of Josephson's supercurrent through such junctions, we have included the contribution of quantum many body effects: competing single particle and Josephson Cooper pairs tunneling, on dots Coulomb interaction as well as level energy on the dots as a function of the temperature of the junction. We have employed infinite U Slave Boson treatment on Josephson Supercurrent and also competing superconducting correlations and Kondo effect as well as Singlet- doublet transition in phase diagram in single, double and triple Quantum dots- Superconductor junctions in the light of recent experimental data and find potential application in Modern Superconducting Quantum electronic devices and basis of Quantum Computers.

- **Thermoelectric Transport in Hybrid- Superconductor- Nano-Quantum systems**

The thermoelectric properties of the low-dimensional materials coupled to metallic reservoirs have attracted a great deal of interest due to their potential application in power generation and refrigeration. Currently, our group is involved in the study of heat transport through hybrids superconductor-low-dimension systems and lays down the foundation for novel thermoelectric devices. We have implemented cutting edge analytical techniques (EOM, Slave-Boson, and SOPT) to study the thermoelectric transport properties of the hybrid superconductor quantum dot(s) and graphene nanostructures. Also we have extended these studies at the advanced level non-equilibrium steady-state thermoelectric transport properties of a single-level QD coupled to normal metallic and BCS superconducting reservoirs by using the equations of motion method within the Hubbard-1 decoupling scheme. The analysis of the thermoelectric transport through more complex superconductor quantum dot configurations and the effect of Kondo interaction on the thermoelectric transport through these hybrid nanostructures is currently in progress.

- **Electronic Properties of Iron Based High Tc Superconductors:**

On the basis of electronic structure, in normal and superconducting state, our group attempted the angle resolved photoemission spectroscopic (ARPES) and electronic band structure data and theoretically confirmed (on the basis of Q1 and Q2 journals published works) that the band structure consisting of hole pockets at the Brillouin zone (BZ) centre i.e.  $\Gamma(0, 0)$  and electron pockets at the BZ corners i.e.  $M(\pm\pi, 0)$  or  $(0, \pm\pi)$ . Strong Fermi surface nesting pointed out between the hole and electron pocket with wave vector  $(\pi, 0)$ . Electron doping ( $\text{SmFeAsO}_{1-x}\text{F}_x$ ,  $\text{CeO}_{1-x}\text{F}_x\text{FeAs}$ ) shrinks hole-like pockets, while hole doping ( $\text{La}_{1-x}\text{Sr}_x\text{OFeAs}$ ) shrinks electron-like pocket located at different part of Brillouin zone. Electronic structure of iron chalcogenide ( $\text{CsFe}_2\text{Se}_2$ ,  $\text{KFe}_2\text{Se}_2$ ) close to Fermi level is also important to predict electronic properties of these material in two and three band models and compared the theoretical results. As an extension, the analysis of various other superconducting properties like Isotope effect and thermodynamic properties in these systems and also high Tc cuprates and are thoroughly published in peer reviewed International Journals.

**Electronic transport properties in Twisted Multilayer Graphene Quantum structures**

**(CSIR)** My Group also implemented the Electronic band structure of correlated AA, and AB stacked bilayer and trilayer Graphene within tight binding model and also extend the work to calculate conductivity in layered Graphene nanostructures within Kubo formulation based on current- current correlations. Graphene based layered materials with a relative twist have shown moir'e super lattice along with parent triangular lattice, flat band near Dirac point, emergence of unconventional superconductivity, and correlated insulator behavior and many more. These properties change with change in twist angles with number of layers, giving rise to emergence of 'Twistronics'. We have developed a tight binding model Hamiltonian for commensurate twisted bilayer graphene including various relevant intra-layer and inter-layer contributions and electronic correlation effects. Our theoretical model analysis provides a better understanding of moir'e pattern in twisted bilayer graphene and agrees qualitatively with the recent experimental works on electronic properties of twisted bilayer Graphene and offer an opportunity to explore electronic transport properties of twisted bilayer Graphene

Several outstanding research papers in reputed international Journals have been already published by our group in high impact factor (Q1/Q2) Journals as evident from research publications.

( Annexure-IV-A)