

Curriculum-Vita: Dr. Ajay, Professor, IIT Roorkee

Dr. Ajay,
Professor,
Department of Physics,
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(Brief Profile)

Born on July 04, 1969, Dr. Ajay, Professor, Physics Department, Indian Institute of Technology (IIT) Roorkee, India, have more than 30 years post Ph.D. Research & Teaching experience and among leading researcher in the area of Theoretical Quantum Condensed Matter Physics with Academic Administration at different levels. His, current research interests lie in theoretical Modelling and Computational Simulations of Electronic properties in Strongly Correlated low dimensiona lNanoscope quantum materials such as Superconductors- Quantum dots hybrid Josephson junction finite and infinite correlation regimes, Superconducting Qubits based Quantum Computation as a potential of superconducting circuits for quantum information processing ,Electronic band structure in Twisted multilayer Graphene Nanostructures, and theoretical aspects of High temperature, possible Room Temperature Superconductivity in Iron and Cuprates within Many Body strongly correlated Quantum Theoretical formalismin finite & infinite correlation regimes . After completing his Ph.D. on Superconductivity in narrow band systems in 1995 under supervision of Prof.R.S.Tripathi, Dr. Ajay joined the Condensed Matter Theory Group, working on strongly correlated systems under Prof. S.K.Joshi (former DG CSIR) at National Physical Laboratory (NPL)- New Delhi, in September 1996 as Project Scientist and worked on "Transport Behaviour of Strongly Correlated Electronic systems a DST sponsored project research. Dr. Ajay joined IIT Roorkee in 2008. Prior to joining IIT Roorkee, he has been serving as Assistant Professor in the Department of Physics at G B Pant-University, Pantnagr. Dr. Ajay has undertaken many prominent International visits: The IESC, Cargese, Paris 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 learning high end research tools & advanced Theoretical techniques applicable for Quantum hybrid Nano-devices Dr. Ajay research works (more than: 133) appeared in reputed international peer reviewed Journals and contributed extensively through sponsored research projects, supervision of Ph.D. (11) & more than 30 (Master research projects) Scholars and research talks/presentations in International Conferences/ National Seminars. Dr. Ajay awaded by with Young Scientist Award- by Govt. of Uttarakhand -India for cutting edge research contributions in the field of High Temperature Superconductivity. Dr. Ajay 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. level teaching and leading research contributions to INSPIRE young minds). Granted International Award for Research & Innovation in Physics and Youth Scientific Empowerment 2025. Dr.Ajay granted membership of IAS, Expert member of UPSC-New Delhi, Rajasthan RPSC, JEE-Advance & UK Higher Education Selection and HPPSC, also members of several Editorial Boards and on the Reviewer panel of the reputed peer-reviewed National and International Journals of EPJB Springer EurNature, IOP, Elsevier and springer verleg.

1. Current Research Interests:

(Strongly Correlated Low dimensional Quantum Materials & Nano-devices)

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

2. Professional Experience (30 years Post-Ph.D.):

Professor (August 2020 – onwards): T14A-Rs.207600/- Department of Physics, IIT Roorkee

- **Associate Professor (2015– Aug. 2020):** Department of Physics, IIT Roorkee,
- **Associate Professor (2012–2015)** Department of Applied Science, IIT Roorkee

- **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):** National Physical Laboratory- NPL (CSIR), New Delhi,

3. Educational Qualifications:

- **Post-Doctoral (1996–1998):** Project Scientist: Condensed Matter Theory, National Physical Laboratory, New Delhi : India
“**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**”
(under Supervision: Prof. R.S. Tripathi (Late))
Invited among best thesis in India DAE-SSP: at **IACS-Calcutta Dec. (1995)**
- **M.Sc. Major: Physics, Meerut University (I-st Div. 73%) Merit Scholarship-(1990)**
- **B.Sc. : Physics, Chemistry, Mathematics, Meerut University (I-st Div. 72%) Merit Scholarship-(1988)**
- **(10+2): I-st Div with Distinction (D) in Physics-D, Chemistry-D, Mathematics,-D, Merit Scholarship (1986) UP Board, with merit Position in City-Saharanpur-UP-**
- **(10-th): I-st Div with Distinction (D) in Biology-D, UP Borad Allahabad(1984)**
(Visits Abroad in pursuits of High End cutting edge Theoretical Tools)
 - **Cavendish laboratory, University of Cambridge, UK** Research work on superconducting quantum dots Junction in SCES2011, at **Cambridge University UK, August 11-Sept. (2011)**
 - **Italy: Innovations in the Strongly Correlated Electronic Systems: Short Visit**
The Abdus Salam International Centre for Theoretical Physics(ICTP) Trieste- Italy during **August 6 - 17(2012).**
 - **France: IESC, Cargese, Advanced Rresearch Visit on “New Physics due to Spin Orbit Coupling in Correlated Electron Systems” CORSO.2015 at University of Paris-during August (three week- 2015).**

4. Research Projects undertaken/Ongoing: 05+1:

(Annexure-I)

Title of the Project	Funding Institution	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 (2005-2 008) 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)
(IV): completed Josephson Transport in coupled Quantum Dots Nanostructures:	(Implemented 2021- completed-24) Approved: 25.90 Lac DST-SERB- New Delhi CRG/2020/002212 (2021)	Dr.Ajay(PI) IITR rof.Vidhyadhiraja CoPI JNCASR Banglore

(V) Under Evaluation : A Theoretical study of Electronic Transport in Twisted bilayer Graphene Nanostructures	Under Evaluation (2024) 50.00 Lac	Dr. Ajay (PI) Phys. Depart. IITR
(VI)Under Evaluation: Superconducting Quantum Dots- vs-Twisted bilayer Graphene Semiconducting hybrid Nano-Devices: A Nanoscale Technological Transformation from Quantum Coolers to Quantum Computers	Under Evaluation (2024) New York Academy of Sciences- USA : amounting worth 2 Core Tata Transformation Research Prize	Dr. Ajay (PI) Phys. Depart. IITR

5(a). Ph.D. Supervised- 11- Single supervision (Annexure-II)
(09 Awarded 10 + 01 Continuing Final Submission Shortly))

S.No	Title Ph.D. Thesis Research	Name of Student (Single/Jointly)	Year Award /Submission
1.	Study of the spectral properties of layered high Tc cuprate superconductors	Dr. Pradeep Kr. Pathak (Single)	2005 (Awarded)
2.	Influence of third dimension on the spectral and transport behavior of bilayer high Tc cuprate	Dr. Bhagya Sindhu Tewari (Single)	2008 (Awarded)
3.	Study of Transport behavior across Nanoscopic superconducting quantum dots tunnel Junctions	Dr. Archana Dhyani (Single)	2009 (Awarded)
4.	Josephson Transport in Superconducting Quantum Dots Nano Junction	Dr. Rajendra Kumar (Single)	(2015) (Awarded)
5.	Electronic structure and Transport behavior in layered Graphene nanostructure	Dr. Sanjay Kumar (Single)	(Awarded) (2014)
6.	The Study of Spectral properties of Iron based superconductors	Dr. Luxmi Rani (Single)	(2016) (Awarded)
7.	Thermodynamic properties of Iron based high Tc Superconductors	Dr, Madhavi Ahawalat (Single)	(2021) (Awarded)
8.	Tunable Josephson Transport across superconductor-multiple-coupled quantum dots Junction	Dr. Tanuj Cready hamoli (Single)	(2024) Awarded (Jan.-2024)
9.	Theoretical Aspects of Superconductivity & Electronic band structure in Twisted Bilayer Graphene Nanostructures	Veer Pal (Single)	(2017-2024) Final Stage (Final SRC- waiting)

10.	Spectral and Thermoelectric Transport Properties of Hybrid Superconductor Quantum Dot Nanostructures	Dr. Sachin Verma (Single)	(2024) Awarded (8 Feb. 2024)
11.	Tunable Thermal Transport in Superconductor- double coupled Quantum dots Josephson Junction	Dr. Bhupendra Kumar (Single)	Awarded (2025)

5(b). Master Theses / B.Tech. Project Dissertations Supervised: 33

(Annexure-III)

No	Title of Thesis /Dissertations	Name of Student	Year Awarded
1.	Study of superconductivity in infinite U- extended Hubbard model: Application to high T _c 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	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.		Bhupendra kumar	2018

	Tunable Josephson Transport in hybrid superconductor-quantum dots topological Tunnel Junction	M.Tech. (Solid State Electronic Material)	(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)	2021 (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)	(2022) (Awarded)
18.	Josephson Transport in Multi-terminal Josephson Junctions: Physics and Applications	Ranjan Kumar (M.Sc. Physics)	(2023) (Awarded)
19.	Application of high Tc Superconducting Qubits as a basis of Quantum Computer & Quantum device	Saurabh Thokada Integ. MSc Physics	(2023) (Awarded)

20.	Superconducting Qubits as a basis of Quantum Computer (Spark Internship)	Simarn Sinha (B,Tech . EPH IIT Bombay)	(2023) (Spark Intern) (Awarded)
21.	A study on Tunable Twisted Bilayer Graphene (TBG) based Josephson Junctions	Ankit Patel B.Tech EPH	(2023) Summer Project (Awarded)
22.	A Comparative Study of Quantum Logic Gates Suited for Current Algorithms'	Aarav Ratra B.Tech. EPH	(2023) Summer Project Awarded
23,	Study of Superconductivity in carbon C(60) molecule	Shivam Mishra M.Sc. Phys	(2024) (Awarded)
24,	A Computational study of Cooper pair transport in Multiple Terminal Josephson Junctions	Navin Kumar Integ. M.Sc Physics	(2024) Awarded
25.	A Numerical Analysis of Josephson Transport in Multiple coupled Quantum dots –Nanowire Hybrid Junction	Shrishti (M.Sc. Physics)	(2024) Awarded
26.	Superconducting diode Effect: Fundamental Concept, Materials and Device Aspects	Tanya Soni B.Tech (EPH) Lab. Based Project	(2024) Awarded
27.	Josephson-Coulomb Drag effect Between Graphene and LaAlO3/SrTiO3 Superconductors	Kashish Wadhwa B.Tech(EPH) Lab. Based Project	(2024) Awarded
28.	Quantum Dots Based Multi-terminal Josephson Junction:	Abhishek Sharma (M.Sc. Physics)	(2024) Awarded
29.	Effect of Strain on Electronic Properties of Twisted Bilayer Graphene	Dayal Singh (Integ. M.Sc. Physics)	(2024) Awarded
30.	Thermoelectric Transport in Superconductors-Quantum dots based Josephson Hybrid Devices	Aridaman Singh Chauhan (B.Tech. EPH-) IIT Mandi	(2024) (Spark Intern.) Awarded
31.	Physics of Thermodynamic Magnetic Oscillations: Existence of de Haas –van Alphen effect in Moire Graphener Nano- Structures	Harsh Sethia Integ. M.Sc. Physics: IITR	(2025) Awarded

32.	Fundamental Aspects in Josephson Junction based Transmon Qubits for Quantum Computing (SPARK-Internship-IITRoorkee)	Pronoy Bandyopadhyay Neogi (B.Tech. EPH-)IIT Roorkee	(2025) (Spark Intern.) II best SPARK Poster Awarded
33.	FEYNMAN'S PATH INTEGRAL Approach to Quantum Physics	Lab based Project PHN-300	SATHWIKA PULIPAKA (22123032)

6. Administrative (Academic, Research & Extension) Responsibilities:

(Annexure-IV)

XII-Professor In charge, Supt. Examination, Physics Dept. IIT Roorkee, (2022 - 2023)

XII- Member Institute Faculty Search Committee (IFAC) IIT Roorkee, (2021 - 2022)

XI-Member, Institute Complained Committee (ICC) IIT Roorkee, (2020 - 2023)

X-Member, Departmental Professorial Committee (DPRC), IIT Roorkee (2020 -onwards)

IX-Member, Departmental Research Committee(DRC) IIT Roorkee, (2019 - 2022)

VIII-Professor In charge, Administration & Mainten.,Physics.Dept. IIT Roorkee (2016-19)

VII-Member, Departmental Administration Committee, (DAC) IIT Roorkee, (2019- 2021)

VI- Professor In charge, B.Tech. Physics Laboratory, IIT Roorkee,-Campus (2010- 2013)

V- Professor In charge, Games & Sports, IIT Roorkee, SRE-Campus (2008- 2013)

IV- Member Institute Technical Committee, IIT Roorkee (2014-15)

III-Professor In charge, Security, IIT Roorkee, SRE-Campus (2008- 2013)

II-Staff Councilor, Board faculty of Sciences; GBPUA & Tech-Pant Nagar (2006-2008)

I-Warden (Assist.)– Chitanjan Bhawan-I GBPUA & Technology-Pant Nagar(2005-2006)

7. Research Publication in Reviewed International Journals:

(Contributed more than 135 Research publications) :

(a) Refereed International Journals: Q1/Q2 -(63) Annexure-V

- (b) Contributions in International Conferences/Symposia-35**
- (c) Contributions in National Conferences and Seminars-35**
- (d) Contributions as Book chapters and Monograph - 03**

8. Research Visits Abroad;06

Annexure-VI

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

V- 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).

IV- 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).

III- 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)

II- 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).

I- 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: (07)

Annexure-VII

- **International Award for Research & Innovation in Physics and Youth Scientific Empowerment – (2025)**
- **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 Merit Scholarship** during M.Sc.& B.Sc. by Meerut University
- **International Travel Award-DST- Govt. of India** (2010)

- **Received Merit honor in (10+2) for Distinctions** in; Physics, Chemistry, & Maths,

9 (b) Memberships/ Expert Committee: 17

Annexure-VIII

- **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 Application- dedicated to Graphene Research,
- **Reviewer, European Physical Journal :** EPJ B (Condensed matter and Complex structures (Recognized by European Physical Society)
- **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), Banglore, India.
- **Reviewer, Pramana:** Journal of Physics, (IAS)- Bangalore- India
- **Member Physics Expert Committees, JEE-Advance, UPSC-New Delhi, RPSC, & UK-Higher Education (2018, 2019, 2021, 2022)**
- **Foreign Membership:** PolyU Academy for Interdisciplinary Research (PAIR)
The Hong Kong Polytechnic University- (2021- 2022-2023- onwards)
- **Foreign Membership:** Division of Condensed Matter Physics: Association of Asia Pacific Physical Societies (AAPPS) Taiwan (2022 – Continue)
- **Convener: Prof. S. K. Joshi** , Lecture Series, Physics Depart- IIT Roorkee (2022-23)
and Organised Ist Lecture of the Series: Prof. Piers Coleman, Rutger's University, USA
<https://www.youtube.com/watch?v=QoCTbTzbW3I>
- Guest Editor Special issue offered "**Strongly Correlated Low dimensional Quantum Materials**".by Invitaton due to continuing excellent Research works Prof. Terry, publishing director in EDP Sciences Beijing office.**The European Physical Journal B(EPJB, <https://epjb.epj.org/>)** planning to launch a new special lissue on "Strongly Correlated Low dimensional Quantum Materials"(2024)

10 (a) Courses Taught at U.G. Level (Ajay) 6

Annexure-IX

S. No.	The Courses taught	UG/(B. Tech) / Students Response
1-	PH-101(Physics-I) PH-201(Physics-II)	B. Tech. (Ist year Group)

2-	PHN-001 (Mechanics),	B. Tech (Civil Engg.) (4.13/5.00)
3-	PHN-006 (Statistical & Quantum Mechanics)	B. Tech. (ECE and CSE group): 4.49 /5.00)
4-	PHN-104 Mechanics & Relativity	B. Tech. (EPH and MSP group): 4.20 /5.00)

10(b) : Courses Taught at P.G. (M.Sc. and Ph. D) Level (Ajay) 11

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

Annexure-X

(11A)- Publications in Refereed International Journals: 62 (Q1/Q2 only)

1. **Ajay**, S. Patra and R.S.Tripathi,
Effect of an interband interaction on narrow band superconductivity;
Physical Review B51, 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-2Dantiferromagnet:
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 supercoductors;
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- T_c 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 T_c 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 (2
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- T_c 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_c 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 bilayer 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_c 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_c 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_c 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 Supercrrrent 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)₂)₂ 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. Tewari¹, M. Ahlawat^{2*}, A. Dhyani^{3*}, and **Ajay**⁴
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; 95, 163, (2022) Q2
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_c superconductors;
Physica Status Solidi B (Wiley: Adv. Science News): 259, 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:
Physica Status Solidi B (Wiley: Advanced Science News): 260, 2200608, (2023) Q2
55. Bhupendra Kumar, Sachin Verma and **Ajay**
 Phase and Thermal Driven Transport across T-shaped double quantum dot Josephson junction **J. of Super. & Novel Magnetism, (Springer) 36, 831 (2023) Q1**
56. Sachin Verma , Tanuj Chamoli, and **Ajay**, Josephson transport across T-shaped and series-configured double quantum dots system at infinite-U limit, European Physical Journal B 96, 168, (2023). **(Springer-Nature) Q1**
57. Veerpal and **Ajay**: Evolution of Flat Band and Van Hove Singularities with Inter-layer Coupling in TBG: Emergent Phenomena in Quantum Materials . Journal of Physics: Conference Series **2518, 012013 (IOP -2023) Q1**
58. Sachin Verma, and **Ajay**: Seebeck power generation and Peltier cooling in a Normal metal-quantum dot superconductor Nanodevice, arXiv:2309.09008v1, Journal of low Temperature Physics, (2024). **(Springer-nature) Q2**
59. Sachin Verma , B. S. Tiwari, A. Dhyani, and **Ajay**, Revisiting thermoelectric transport across strongly correlated quantum dot: A Green's function equation of motion theory perspective, [arXiv:2308.09927v1](https://arxiv.org/abs/2308.09927), (2024).
60. Veerpal and **Ajay**: "Twist angle, Strain, Corrugation and Moire Unit Cell in Twisted Bi- layer Graphene" : Modelling and Simulation in Materials Science and Engineering <https://dx.doi.org/10.1088/1361-651X/ad2786> 32, 035013 (2024)
- 61- Veerpal¹, B.R.K. Nanda², and **Ajay**²" Evolution of flat band segments and Van Hove singularities in twisted bilayer Graphenes: ¹Department of Physics, Indian Institute of Technology Roorkee, Uttarakhand, INDIA, ² Department of Physics, Indian Institute of Technology Madras(IITM), Chennai, INDIA ,ready to be communicated Physical Review B (2024)APS Q1
- 62 Thermo-Electric Properties of Superconductor Quantum Dots Hybrid Devices Bhupendra Kumar², Sachin Verma² and **Ajay**² .²Department of Physics,

Indian Institute of Technology Roorkee, Uttarakhand, INDIA. Physica E-
Low dimensional System, Elsevier Q1(2024)

(11B)- Publications in Journals (Five years 2020-2024):16

Annexure-XI

1. 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**
2. 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**
3. B.S. Tewari¹, M. Ahlawat^{2*}, A. Dhyani^{3*}, and **Ajay**⁴
Influence of pseudo-gap and interlayer coupling on isotope effect in bilayer
cuprates:
Physica C (Supercond. & Its applicat: Elsevier: V-587, 1353895) (2021) Q2
- 4 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**
5. 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
6. Tanuj Chamoli and **Ajay**
Josephson Transport through parallel Double coupled quantum dots at infinite-U
limit:
The European Physical Journal B; 95, 163, (2022) Q2
7. Madhavi Ahalawat; Luxmi Rani; **Ajay** ,
Influence of multi-orbitals and Hund's coupling induced pseudogap on specific
heat jump in iron pnictide high T_c superconductors;
Physica Status Solidi B (Wiley: Advanced Science News): 259, 2200192, (2022) Q2
8. Sachin Verma and **Ajay**
A Strongly Correlated Quantum-Dot Heat Engine with Optimal Performance:An
Non-equilibrium Green's function Approach:
**Physica Status Solidi B (Wiley: Advanced Science News): 260, 2200608,
(2023) Q2**

9. Bhupendra Kumar, Sachin Verma and **Ajay**
Phase and Thermal Driven Transport across T-shaped double quantum dot Josephson Junction: **J. of Super. & Novel Magnetism**, (Springer) **36**, 831–841 (2023) **Q2**
10. Bhupendra Kumar, Sachin Verma , Tanuj Chamoli, and **Ajay**, Josephson transport across T-shaped and series-configured double quantum dots system at infinite-U limit, European Physical Journal B **96**, 168, (2023). (**Springer-Nature**) **Q1**
11. Veerpal and **Ajay**: Evolution of Flat Band and Van Hove Singularities with Inter-layer Coupling in TBG: Emergent Phenomena in Quantum Materials . Journal of Physics: Conference Series **2518**, 012013 (**IOP -2023**) **Q1**
12. Sachin Verma, and **Ajay**: Seeback power generation and Peltier cooling in a Normal metal-quantum dot superconductor Nanodevice arXiv:2309.09008v1, Accepted J of low Temperature Physics, (2024). (**Springer-nature**) **Q2**
13. Sachin Verma , B. S. Tiwari, A. Dhyani, **and Ajay**, Revisiting thermoelectric transport across strongly correlated quantum dot: A Green's function equation of motion theory perspective,arXiv:2308.09927v1, Under Peers Review (2024).
14. Veerpal and **Ajay**: "Twist angle, Strain, Corrugation and Moire Unit Cell in Twisted Bi- layer Graphene" : Modelling and Simulation in Materials Science and Engineering(MSMSE)- **106955.R1 Accepted (2024) (IOP- Science) Q2**
- 15- Veerpal¹, B.R.K. Nanda², **and Ajay**²" Evolution of flat band segments and Van Hove singularities in twisted bilayer Graphenes: ¹Department of Physics, Indian Institute of Technology Roorkee, Uttarakhand, INDIA, ² Department of Physics, Indian Institute of Technology Madras(IITM), Chennai, INDIA ,ready to be communicated Physical Review B (2024)APS **Q1**
- 16- Thermo-Electric Properties of Superconductor Quantum Dots Hybrid Devices Bhupendra Kumar², Sachin Verma² **and Ajay**² .²Department of Physics, Indian Institute of Technology Roorkee, Uttarakhand, INDIA. Physica E- Low dimensional System, Elsevier **Q1(2024)**

11C)- Contribution as Book Chapters and Monograph (Ajay): (03)

Annexure-XIII

1. Udai 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 :((2021)A monograph contribution in **CARBON NANOMATERIAL ELECTRONICS: publisher: Springer Nature, Singapore (2020)**

- 3- Aridaman Singh Chauhan¹ , Bhupendra Kumar² , Sachin Verma² and **Ajay²** ,

Thermo-Electric Properties of Superconductor Quantum Dots Hybrid Devices
Department of Physics, Indian Institute of Technology, Mandi, Himachal Pradesh, INDIA. 2
Department of Physics, Indian Institute of Technology Roorkee, Uttarakhand, INDIA. Email:
b22259@students.iitmandi.ac.in, bhupendra k@ph.iitr.ac.in, sverma2@ph.iitr.ac.in and
ajay@ph.iitr.ac.in (Spark Internship plan book Chapter(2024)

(11D)- Contributions in International Conferences(Ajay): 35

Annexure-XIV

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

Role of Interlayer Interactions in High-T_c 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_c 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 Manglore University, Mangalore: **24-28, Sept. (2001)**.

4. **Ajay**, B. S. Tewari, Govind and S.K.Joshi,

Electronic spectra of bilayer high T_c cuprates: role of intra and interunit cell couplings, 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_c 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_c 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 (ICCMP-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_c Cuprites, Presented(Orally) in the International Conference on Superconductivity and Magnetism(ICSM-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 Nanostuctures” 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 - 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: **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: **International Conference On Recent Advances in Physics for Interdisciplinary Development (ICRAPID2014)** 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, Hunds 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-Plani (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,

Non-equilibrium thermoelectric transport across normal metal-Quantum Dot- Superconductor hybrid system within the Coulomb blockade regime: **Oral presentation (Offline)** at the **International Conference on Quantum Materials and Technologies (ICQMT-2022)** held at **Milas-Bodrum, Turkey during 16th -22nd October 2022.**

26. Sachin Verma and **Ajay**,
Theoretical study of Strongly Correlated Normal metal /Superconductor-Quantum-Dot Thermoelectric Particle-exchange Heat Engines, presentation (Offline) at **the 4th PRL CONFERENCE ON CONDENSED MATTER PHYSICS (PRL CCMP 2023)** held on **6th February to 8th February 2023 at the Physical Research Laboratory (PRL)**, Ahmedabad, India

27. **M. Ahalawat and Ajay**
“Study of Specific heat in Iron Based Superconductors: A Theoretical Three-Orbital Model Analysis” IEMPHYS-21: Internat. 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).
28. **M Ahalawat and Ajay**
“Influence of Pseudogap on Specific Heat in Bilayer High-Tc 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).

29. Bhupendra Kumar, Sachin Verma and **Ajay**,
Josephson current across T-shaped double quantum dot Josephson junction, oral presentation at the **4th International Conference on Condensed Matter & Applied Physics** (ICC 2023), Oct 9-10, Bikaner in joint auspices of condensed matter research society (CMRS), (2023)

30. **Ajay (Invited talk)** out of Research work with Research scholars : Tanuj Chamoli and Sachin Verma: Quantum computing organized by the Department of Electronics and Telecommunication Engineering, Fr. C. Rodrigues Institute of Technology, Vashi, Navi Mumbai **05-09 January (2023)**

31. Sachin Verma and **Ajay**: Theoretical study of Strongly Correlated Normal metal/Superconductor-QuantumDot Thermoelectric Particle-exchange Heat Engines, Sachin Verma and **Ajay**, poster presentation at the PRL CONFERENCE ON CONDENSED MATTER PHYSICS (PRL CCMP) organized by the Physical Research Laboratory (PRL), Ahmedabad, India, during Feb. 6-8, (2023).

32. Sachin Verma and **Ajay**,
Thermoelectric transport through strongly correlated quantum-dot based hybrid devices: ORAL talk (Online) at the *Workshop on Classical and Superconducting*

Quantum Technologies organized by Cracow University of Technology, Poland during **March 15-16, (2023)**

33. Ajay, (Invited) Participant: Invitation **G(20) Summit** based on **B(20) RAISE-** Theme (Responsible, Accelerated, Innovative, Sustainable, and Equitable Business)-CII Partnership Summit, Hotel Taj Palace(New Delhi (India) **13-15 March (2023)**

34. Veerpal and Ajay, ‘Electronic Properties of Twisted Bilayer Graphene: A Computational Simulation Based Study’ in EESTER-2023 organized by IIT Madras during 04-12 January **2023. (Oral presentation)**

35. Veerpal and Ajay, “Electronic propertied of twisted bilayer and trilayer Graphene Nanostructures-A Quantum Theoretical Model Approach” accepted for presentation in international conference “34th International conference on Diamond and Carbon Materials” to be organized 1 st -5 th September **2024**, Dresden, Germany. (Elsevier)

(11E)- Contributions in National Conferences (Ajay): 35

Annexure-XVI

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 Tc 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 bialer 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 Tc 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 Tc 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 Tc 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 Tc
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 NagarIndia **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 Psuedogap 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)**
33. Sachin Verma and **Ajay**
Thermoelectric transport properties of strongly correlated quantum-dot based hybrid devices: A non-equilibrium many body Green's function approach: Poster presentation (Offline) at the **CONFERENCE ON EMERGENT PHENOMENA IN QUANTUM MATERIALS (E-QMT 2022)** organized by the Department of Physics, Indian Institute of Technology, Roorkee, India during October 12th-14th , **2022**.
34. Bhupendra Kumar, Sachin Verma and **Ajay**
Phase and Thermal Driven Transport across T-Shaped Double Quantum Dot Josephson Junction: presentation (Offline) at the **CONFERENCE ON EMERGENT PHENOMENA**

IN QUANTUM MATERIALS (E-QMT 2022) organized by the Department of Physics, Indian Institute of Technology, Roorkee, India during October 12th-14th, 2022.

35. Bhupendra Kumar, Sachin Verma and **Ajay**,
Josephson current across T-shaped double quantum dot Josephson junction, oral presentation at the **4th International Conference on Condensed Matter & Applied Physics** (ICC 2023), Oct 9-10, Bikaner in joint auspices of condensed matter research society (CMRS), (2023)

(12) National and International Collaborations/ Research Interaction:

Annexure-XVII

Group/ Institute Visited	Collaborators & Nature of Research works	Duration of Visit
VIII- Department of Physics, IITM Chennai-India	Prof. BRK Nanda, PI- Atomistic Numerical Simulation of Electronic properties of Nanostructured /Moiré Twisted Bi-layer Graphene Devices	Continuous Collaboration, June 18- 22, (2024– onwards)
VI- Theoretical Science Group, Jawaharlal Nehru Centre for Advanced Scientific Research- JNCASR- Bangalore	Prof. S. Vidhyadhiraja Collaboration on “ Theoretical model studies of Kondo effect in DQD- Josephson Nanostructures”	Continuing Collaboration, June 17- 29, (2019 – onwards)
V- International Centre for Theoretical Sciences(ICTS) - Bangalore	Prof. Subhro Bhattacharya Research Interaction on " Tunneling conductance and symmetry of order parameter in Superconductors double Quantum dots Josephson Junction”	(4-10 March 2019)
IV-Condensed Matter Theory Group, National Physical Laboratory, New Delhi . India	Prof. S.K. Joshi, (Former DG-CSIR) & Dr. Govind (Scientist-H) published collaborative research “ On Electronic transport in high Tc Cuprates & Iron Superconductors and Semiconductors hybrid structures.	Used to visit frequently as required (1998- continuing)
III- INPE- Sao Paulo, Brazil	Prof. Ram Kishore , 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)
II- Condensed Matter Theory	Prof. A.K. Mishra &	From Feb. 16, 2002-

Institute of Mathematical Sciences (IMSc) .Chennai	Prof. G. Baskaran Worked on Ortho-Fermi Statics and Strongly Correlated Electronic Systems	To- Feb.22, 2002
I- Institute of Physics (IOP) Bhubaneswar -Orissa - India	Prof. S.N.Behera (Director – IOP Worked on charge density wave & Antiferromagnetic ordering in Strongly Correlated electronic systems.	From July 31-st 1995 - to- August 30, 1995

Annexure-XVIII

(13) - Events Abroad /INSPIRE Advanced Trainings (17):

- 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 International 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.**
- 12-** **Ajay**, (Invited) Participation by Invitation **G(20) Summit** based on **B(20) RAISE**-Theme (Responsible, Accelerated, Innovative, Sustainable, and Equitable Business)-CII Partnership Summit, Hotel Taj Palace(New Delhi (India) **13-15 March (2023)**
- 13-** **Ajay**, (Invited) Participation by Invitation: Symposium on Innovation with the theme “**Igniting the Entrepreneurial Spirit in Academia**” GDC (Gopalakrishnan Deshpande Centre for Innovation and Entrepreneurship at Sudha & Shankar Innovation Hub,with the central theme “**Igniting the Entrepreneurial Spirit in Academia**” at the T.T. Jagannathan Auditorium, **24, January(2024.)**
(Online) <https://youtube.com/live/ZeG5Ouex08s?feature=share>
- 14-** **Ajay, IITR** , Invited by DST- to participate in the Brainstorming Meeting National Quantum Mission (NQM) , held on **February 20th, 2024** from 11.30 Hrs. to 13.00 Hrs. at the STEIN Auditorium of the India Habitat Centre, New Delhi. **(2024)**
- 15-** **Ajay, IITR** , Selected & participated in The LEADS Programme for Leadership in Science & Technology organized by INSA and NCGG-New Delhi jointly and scheduled from **April 1st to April 7th, 2024 at INSA, New Delhi (2024)**
<file:///C:/Users/user/Desktop/Lead-INSa-2024/INSA-LEADS-BOOKLET-2024.pdf>)
- 16-** Invited to deliver PM Shree KV1 at Roorkee by director of refresher Course, around 40 PG teachers refresher couser across the country Dr. Ajay, Professor Department of Physics, Indian Institute of Technology-Roorkee (IITR) Uttarakhand- India and deliveredPG Lectures on Paradigm of Mordern Physics And on Magnetism to PGT- Refresher Course-Physics; 06ganised at **PM Shree KV1- Roorkee during 14 days refresher PGT refresher course during June, 7-20(2024)**
- 17-** **Ajay, IITR** , Invited by FAST-INDIA- to participate the Panel discussion Meeting : **A manifesto on “India’s Journey Towards a Top 3- Science & Technology Nation**, held

on July 01- 2024 from 17.30 Hrs. to 19.300 Hrs. in online mode by FAST-India team-New Delhi. ,(2024)

15- List of References:

Annexure-XIX

1-Prof. Ashutosh Sharma (President INSA- New Delhi) & Institute Chair Professor, Department of Chemical Engineering IIT Kanpur- India E-mail: ashutos@iitk.ac.in Mobile No: +919935397366	2-Prof. Rajeev Ahuja, Director, IIT Ropar Panjab- India E-mail: director@iitrpr.ac.in Mobile No: +919779789800
3-Prof. Shekhar Mande, (Former DG CSIR) Emeritus Professor, Savitri Phule Pune University Maharashtra -India E-mail: shekhar.mande@gmail.com Contact No: +91-20-25691065(O)	

16- Strength as Current Research Activities overlap with national vision :

Annexure-XXI

Currently, my group at IIT Roorkee involved in cutting edge research activities on Josephson Superconducting Qubits based Quantum Computing along the line of National Quantum Mission. Theoretical modelling & Numerical Simulations of the electronic and thermoelectric Transport properties of Strongly Correlated Quantum Nanostructures layered hybrid Devices & Moiré structures in twisted Bi-layer Graphene (TBGs), where electronic correlations and coupling effects play a dominant role in fine tuning the Electronic properties of these complex Nano-systems to harness into Nano-Devices for cutting edge Quantum Technologies and Practical applications. A high light of current sponsored research activities being carried out by my Research Group at Physics Department, IIT Roorkee out of research projects presented in highlight below:

- **Josephson Transport in Superconducting- double coupled Quantum Dots Devices: SERB-DST)**

Superconducting Qubits based Quantum Computing:

<https://link.springer.com/article/10.1140/epjb/s10051-023-00640-w>

Recently, our Group 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 particles (bound pairs of electrons) states around the Fermi level in superconducting electrodes (source and drains) called Andreev, Bound states and offer 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, Josephson Tunneling, and Kondo effect Singlet- due Resonance & 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 Computer.

- **Thermoelectric Transport in Hybrid- Superconductor- Nano-Quantum Devices:**

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

Continue: Brief Statement on Current Research Activities: Annexure-XVI

- **Electronic & Thermodynamic Properties of Iron Based High T_c Superconductors:**

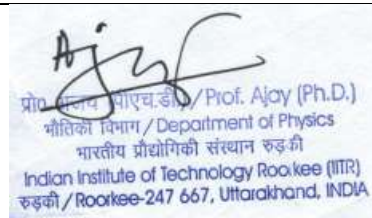
On the basis of electronic structure, in normal and superconducting state, our group attempted the angle resolved photoemission spectroscopic (ARPES) and electronic band structure data and theoretically confirmed (on the basis of Q1 and Q2 journals published works) that the band structure consisting 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 (CsFe_2Se_2 , KFe_2Se_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 T_c cuprates and are thoroughly published in peer reviewed International Journals.

- **Electronic structure & Transport Properties in Twisted Multilayer Graphene(TBG) Moire's Quantum Nano-structures:**

Our Group also investigated 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 moiré 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 microscopic 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 moiré 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 (130) outstanding research papers in reputed international Journals / Conferences Series have been continuously published by our group in high impact factor (Q1/Q2) peer's reviewed Journals as evident from enclosed research publications List.

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