Dr. Ritu Gupta

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Research Summary

06/2023–present: Department of Physics, IIT Ropar, India, Assistant Professor

04/2022–05/2023: Department of Physics, University of Geneva, Switzerland, Postdoctoral Researcher with Dr. Enrico Giannini and Prof. Fabian von Rohr

My focus was to grow high quality single crystals of layered two-dimensional novel magnetic and topological materials and characterize them using basic as well as advanced techniques.

05/2019 – 10/2021 Paul Scherrer Institute, Switzerland, Postdoctoral Researcher with Dr. Rustem Khasanov

My focus was to study in detail the phase diagram of strongly correlated electronic systems, through the interplay between various ground states including charge density wave, spin density wave, superconductivity, magnetism etc. To study such an interaction, pressure was used as the tuning parameter. Pressure up to 2.5 GPa could be applied with double-wall pressure cells made of CuBe and MP35N alloys. The comprehensive muon spin relaxation/rotation (μSR) technique in transverse field, zero field, and longitudinal field configuration was used to probe the magnetic and superconducting ground states. I was involved in the development of optical feedthrough in the pressure cell, which allowed the in-situ determination of pressure. Additionally, the user support at General Purpose Decay spectrometer (GPD) at Paul Scherrer Institute provided me an unique opportunity to participate in vast variety of other projects e.g. geometrically frustrated quantum spin-liquid candidates, topological magnets, Chevrel phases, Kagome lattice, topological superconductors etc.

Obtained Degrees

02/2019: Ph.D. degree in Physics, Indian Institute of Technology Kanpur, India**, CGPA 9.36/10.**
Supervisors: Prof. Zakir Hossain and Prof. K. P. Rajeev
Thesis title: *"Physical Properties of the Charge Density Wave Superconductor $LaPt_2Si_2$"*

07/2011: Master of Science in Physics, Dept. of Physics, Kurukshetra University, Haryana, India, **78.2%.**

06/2009: Bachelor of Science (Math, Physics, Chemistry), Maharshi Dayanand University Rohtak, India, **76.3%**.

06/2006: Higher Secondary, Central Board of Secondary Education, India, **75.6%**.

06/2004: Matric, Board of School Education Haryana, India, **82.2%**.

Research Interests

- Growth and characterization of novel quantum materials such as spin liquid candidates, topological Weyl semimetal, exotic superconductors, Kagome lattices etc.
- Unconventional Superconductivity.
- Single and polycrystal growth and design of novel Quantum Materials.
- Low Dimensional systems offering variety of unusual physical properties.

- Interplay between various ground states such as charge density wave, superconductivity, magnetism etc. using external perturbations.

Research Experience

Growth techniques

- Arc melting, Solid state reaction, flux method, chemical/physical vapor transport method.
- High pressure-high temperature synthesis, CZ pulling method.
- Growth of thin film using PLD and thermal deposition.
- High temperature muffle and tubular furnaces.

Characterization techniques

- Proficient in using XRD, SEM, EDX, WDS.
- Transport measurements using closed cycle refrigerator.
- Transport measurements under pressure using double-wall type piston cylinder cell.
- Expertise in Physical Properties Measurement System (PPMS) and Magnetic Properties Measurement System (MPMS).
- Analyzing μSR spectra using WiMDA, MANDiT, MUSRFIT, MUSREDIT software.
- Extensively worked with Heliox cryostat equipped with He-3 insert, Continuous flow cryostat, Glass cryostat
- AC Susceptibility measurements.
- Experience working with PYTHON, MATHCAD, MATHEMATICA, MATLAB.

Professional Activities

- Worked as user support and taking care of the instrument at PSI.
- Superuser and worked as a teaching assistant for PPMS and MPMS in Dept. of Physics, IIT Kanpur.
- PHY461, M.Sc. lab for 1st year students at Dept. of Physics, IIT Kanpur (2015-2017).
- PHY101, B.Tech lab for 1st year students at Dept. of Physics, IIT Kanpur (2012-2014).
- Bachelors project supervision **Arabadjieva Petia and Knorr Anna (2020)**, ETH Zurich, Switzerland
  Project title: *"Studying type-I superconductivity in classical Al using μSR technique"*.
- Masters project supervision **Dilay Bayat (2022-ongoing)**, Geneva University, Switzerland
  Project title: *"Growth and characterization of van der Waals magnetic materials"*.

Conferences and workshops

- Muon spin Relaxation/Rotation conference in Parma, Italy, 2022.
- 3rd European School on Crystal Growth, Paris, France, 2022.
- 7th European conference on Crystal Growth, Paris, France, 2022.
- PSCES workshop, IIT Mandi, India, 2018.
- Aperiodic SCES Conference, Annecy, France, 2017.
- DAE SSPS conference, Amity University, Greater Noida, India, 2015.

Awards/Scholarships

1. **INSPIRE Faculty fellowship** (Department of Science and Technology, India), 2023.
2. **Raman Charpak Exchange Fellowship** (Department of Science and Technology, India), 2016 (to perform part of research work at NEEL Lab, Grenoble France).
3. **Junior Research Fellowship (JRF), AIR32** (Council of Scientific and Industrial Research, India), 2012.
4. **Graduate Aptitude Test in Engineering (GATE), AIR44** (Ministry of Human Resources and Development, India), 2012.
5. **Joint Entrance Screening Test (JEST), AIR121** (The Science and Engineering Research Board, India), 2012.

6. **Promotion of Scientific Education (POSE),** (Department of Science and Technology, Haryana) in the years 2009-2011 (For being top meritorious student in the field of Science and Technology in the state).

Funding/Grants received so far

1. ***"*MAGICAL 2D – novel MAGnetic and topologICAL 2D materials*"*** INSPIRE Faculty Program 2022 (Department of Science and Technology, India), 1 crore (INR); 01/08/2023 – 31/07/2028.

Peer-Reviewed Publications

Summary: A total of 30 papers with 11 as first author with Journals Included 12 Phys. Rev. B, 1 Phys. Rev. Lett., 2 Phys. Rev. Res., 1 Phys. Rev. Mater., 1 Phys. Rev. Appl., 1 Nature, 2 Nature Communications, 2 Comm. Phys. (Nature), 1 NPJ quantum Materials (Nature), 4 JPCM, 1 JAP, 1 Frontier of Physics, 1 Supercond. Science and Technol.

1. Accepted in **Phys. Rev. B**, (Impact factor 3.908), **R. Gupta**, D. Das, Fabian Von Rohr, Catherine Wittevin, & R. Khasanov, Isotropic s-wave superconductivity in disordered type-II dirac semimetal PdTe2.
2. **Nature Communications** 14, 153 (2023), (Impact factor: 17.694), Z. Guguchia, C. Mielke III, D. Das, **R. Gupta** et al., Tunable nodal kagome superconductivity in charge ordered RbV3Sb5.
3. **Journal of Physics: Condensed Matter** 28, 485601 (2022), (Impact factor: 2.745), C. Mielke, H. Liu, D. Das, J.-X. Yin, L.Z. Deng, **R. Gupta** et al., Local spectroscopic evidence for a nodeless magnetic kagome superconductor CeRu2.
4. **Phys. Rev. B** 106, 144505 (2022), (Impact factor: 3.908), T. Shang, Y. Chen, W. Xie, D. J. Gawryluk, X. Y. Zhu, H. Zhang, Z. X. Zhen, B. C. Yu, Y. Xu, Q. F. Zhan, **R. Gupta** et al., Evidence of unconventional pairing in quasi two-dimensional CuIr2−xRuxTe4 superconductor.
5. **Comm. Phys. (Nature) 5**, 232 (2022), (Impact factor: 6.497), **R. Gupta** et al., Two types of charge order with distinct interplay with superconductivity in the kagome material CsV3Sb5.
6. **Phys. Rev. Research** 4, 023244 (2022), (Impact factor: NA), R. Khasanov, D. Das, **R. Gupta** et al., Charge order breaks time-reversal symmetry in CsV3Sb5.
7. **Phys. Rev. Mater.** 6, 064804 (2022), (Impact factor: 3.989), T. Shiroka, T. Shang, M. Juckel, M. Krnel, M. K˙onig, U. Burkhardt, P. Kozelj, **R. Gupta** et al., Conventional superconductivity in the binary beryllium alloys MoBe22 and WBe22.
8. **Supercond. Sci. Technol.** 35, 084066 (2022), (Impact factor: 3.219), **R. Gupta** et al., A brief review of Physical Properties of Charge density Wave Superconductor LaPt2Si2.
9. **Comm. Phys. (Nature)** 5, 107 (2022), (Impact factor: 6.497), C. Mielke III, W. Ma, V. Pomjakushin, O. Zaharko, S. Sturniolo, X. Liu, V. Ukleev, J.S. White, J.-X. Yin, S.S. Tsirkin, C.B. Larsen, T.A. Cochran, M. Medarde, V. Poree, D. Das, **R. Gupta** et al., Intriguing magnetism of the topological kagome magnet TbMn6Sn6.
10. **Phys. Rev. B** 105, L180402 (2022), (Impact factor: 3.908) M. Majumder, **R. Gupta** et al., Spin-liquid signatures in the quantum critical regime of pressurized CePdAl.
11. **NPJ Quantum Mater. (Nature)** 7, 49 (2022), (Impact factor: 7.036), **R. Gupta** et al., Microscopic evidence of anisotropic multigap superconductivity in the CsV3Sb5 kagome superconductor.
12. **Phys. Rev. B** 105, 134414 (2022), (Impact factor: 3.908), T. J. Hicken, M. N. Wilson, S. J. R. Holt, R. Khassanov, M. R. Lees, **R. Gupta** et al., Magnetism in the Néel skyrmion host GaV4S8 under pressure.
13. **Phys. Rev. Appl.** 17, 024065 (2022), (Impact factor: 4.985), P. Naumov, **R. Gupta** et al., Optical setup for a piston-cylinder pressure cell: A two-volume approach.
14. **Nature**, 602, 245-250 (2022), (Impact factor: 49.96), C. Mielke III, D. Das, J.-X. Yin, H. Liu, **R. Gupta** et al., Time-reversal symmetry-breaking charge order in a kagome superconductor.
15. **Phys. Rev. Lett.** 127, 217002 (2021), (Impact factor: 9.185), D. Das, **R. Gupta**, C. Baines, H. Luetkens, D. Kaczorowski, Z. Guguchia, and R. Khasanov, Unconventional Pressure Dependence of the Superfluid Density in the Nodeless Topological Superconductor α-PdBi2.
16. **Phys. Rev. B** 104, 155124 (2021), (Impact factor: 3.908), E. Gati, S. L. Bud'ko, L. L. Wang, A. Valadkhani, **R. Gupta** et al., Pressure-induced ferromagnetism in the topological semimetal EuCd2As2.
17. **Phys. Rev. B** 104, L100508 (2021), (Impact factor: 3.908), R. Khasanov, D. Das, D. J. Gawryluk, **R. Gupta**, & C. Mielke III, Isotropic single gap-superconductivity of elemental Pb.

18. **Nature Communications** 12, 3920 (2021, (Impact factor: 14.92), V. Grinenko, D. Das, **R. Gupta**, B. Zinkl, N. Kikugawa, Y. Maeno, C. W. Hicks, H.-H. Klauss, M. Sigrist, & R. Khasanov, Unsplit superconducting and time-reversal symmetry breaking transitions in Sr2RuO4 under hydrostatic pressure and disorder.
19. **Phys. Rev. B** 103, 174511 (2021, (Impact factor: 3.908), **R. Gupta**, T. P. Ying, Y. P. Qi, H. Hosono & R. Khasanov, Superconducting gap symmetry of the noncentrosymmetric superconductor W3Al2C.
20. **Phys. Rev. B** 103, 104418 (2021), (Impact factor: 3.908), J. Sugiyama, W. Higemoto, D. Andreica, O. K. Forslund, E. Nocerino, M. Månsson, Y. Sassa, **R. Gupta** et al., Pressure dependence of ferromagnetic phase boundary in BaVSe3 studied with high-pressure μSR.
21. **Phys. Rev. B** 103, 075111 (2021, (Impact factor: 3.908), E. Gati, J. M Wilde, R. Khasanov, L. Xiang, S. Dissanayake, **R. Gupta** et al., Formation of short-range magnetic order and avoided ferromagnetic quantum criticality in pressurized LaCrGe3.
22. **Phys. Rev. B** 102, 144515 (2020), (Impact factor: 3.908), **R. Gupta**, C. Löhnert, C. Wang, D. Johrendt, H. Luetkens, S. Malick, T. Shiroka, Z. Hossain, & R. Khasanov, Isotropic s-wave superconductivity in the noncentrosymmetric charge density wave superconductor SrPt2As2.
23. **Phys. Rev. B** 102, 014514 (2020) [link], (Impact factor: 3.908), R. Khasanov, **R. Gupta**, D. Das, A. Leithe-Jasper & E. Svanidze, Single-gap versus two-gap scenario: Specific heat and thermodynamic critical field of the noncentrosymmetric superconductor BeAu.
24. **Phys. Rev. Res.** 2, 023142 (2020), (Impact factor: NA), R. Khasanov, **R. Gupta**, D. Das, A. Amon, A. Leithe-Jasper & E. Svanidze, Multiple-gap response of type-I noncentrosymmetric BeAu superconductor.
25. **Frontiers in physics** 8, 2 (2020), (Impact factor: 3.56), **R. Gupta**, A. Maisuradze, ND Zhigadlo, H. Luetkens, A. Amato & R Khasanov, Self-Consistent Two-Gap Approach in Studying Multi-Band Superconductivity of NdFeAsO0.65F0.35.
26. **Journal of Applied Physics** 125, 143902 (2019), (Impact factor: 2.877), **R. Gupta**, A. Thamizhavel, P. Rodière, S. Nandi, KP Rajeev & Z. Hossain, Electrical resistivity under pressure and thermal expansion of LaPt2Si2 single crystal.
27. **Journal of Physics: Condensed Matter** 30, 475603 (2018), (Impact factor: 2.745), **R. Gupta**, KP Rajeev & Z. Hossain, Thermal transport studies on charge density wave materials LaPt2Si2 and PrPt2Si2.
28. **Phys. Rev. B** 97, 184509 (2018), (Impact factor: 3.908), D. Das, **R. Gupta**, A. Bhattacharyya, PK Biswas, DT Adroja & Z. Hossain, Multigap superconductivity in the charge density wave superconductor LaPt2Si2.
29. **Journal of Physics: Condensed Matter** 29, 255601 (2017), (Impact factor: 2.745), **R. Gupta**, SK Dhar, A. Thamizhavel, KP Rajeev & Z. Hossain, Superconducting and charge density wave transition in single crystalline LaPt2Si2.
30. **Journal of Physics: Condensed Matter** 28, 195702 (2016), (Impact factor: 2.745), **R. Gupta**, UB Paramanik, S. Ramakrishnan, KP Rajeev & Z. Hossain, Coexistence of superconductivity and a charge density wave in LaPt2(Si1−xGex)2($0 \le x \le 0.5$).

Conference Papers

1. **AIP Conference Proceedings** 1, 1731 (2016), (Impact factor: NA), **R. Gupta**, Z Hossain & KP Rajeev, Investigation on charge density wave in LaPt2(Si1−xGex)2.
2. **Open space between aperiodic order and strong electronic correlations Conference** (2017), (Impact factor: NA), **R. Gupta**, P Lejay, Manuel Nunez-Regueiro, Christine Opagiste, Pierre Rodière, SK Dhar, A Thamizhavel, K Rajeev, Z Hossain, Correlation of charge density wave and superconductivity in LaPt2(Si1−xGex)2.

Manuscripts under preparation

1. **R. Gupta**, D. Das, V. Grinenko, D. Kaczorowski & R. Khasanov, Clear splitting between time reversal symmetry breaking and superconducting transition temperature in a well-known charge density wave superconductor.

Reviewing Experience

1. Reviewer of JPCM (IOP), Phys. Rev. B and Phys. Rev. Lett. (APS), Communication Materials (Nature).