Website Information
Department of Physics
Dayananda Sagar University

Faculty details:

Faculty Name:	Dr. Suresh Pittala
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Research Area:	Quantum Materials, High entropy Oxides, Multiferroic materials (bulk and thin films); Magnetoelectric nanocomposites; Multiferroics for electric-field control of magnetism and ultrahigh-density non-volatile memories; Spintronics and spin-transport in nano systems; Ferroelectrics, Thermoelectrics; Magnetic topological insulators, Nanomaterials.
Publications (Past 5 years)	*Total peer-reviewed publications: 32 (First Author: 12, Co-Author: 20); Conference proceedings: 29. Listed below are publications from the past 5 years (2021–2025):* 1. Junbeom Maeng, Gwan Hyeon Park, Junhyuk Ji, Daehee Jang, Suresh Pittala, Jungseub Ha, Hansol Bae, Sandya Rani Mangishetti, Won Bae Kim, *“N-doped Carbon Nanotube-Graphene Nanoarchitecture Electrodes with Solid-state Biopolymer Electrolyte for High Performance Flexible Supercapacitors”*, Carbon 243, 2025, 120545. (DOI: https://doi.org/10.1016/j.carbon.2025.120545). 2. Gwan Hyeon Park, Junbeom Maeng, Tanwir Ansari, Jungseub Ha, Suresh Pittala, Jaehyun Heo, Subin Kim, Sandya Rani Mangishetti, Won Bae Kim, *“Superior magnetocapacitance in ferro/ferrimagnetic $Fe_3O_4/Fe/Fe_3C$ integrated N-doped carbon hybrid nanostructures under mild magnetic fields”*, Journal of Materials Chemistry A 13, 2025, 13028. (DOI: https://doi.org/10.1039/D5TA01387A). 3. P. Pramanik, A. D. Singha, M. Reehuis, S. Pittala, D. C. Joshi, T. Sarkar, M. Tovar, A. Hoser, J.-U. Hoffmann, S. Thota, *“Interplay of lattice-spin-orbital coupling and Jahn-Teller effect in noncollinear spinel $Ti_xMn_{1-x}(Fe_yCo_{1-y})_2O_4$: A neutron diffraction study”*, Journal of Physics: Condensed Matter 36, 2024, 355601. (DOI: https://iopscience.iop.org/article/10.1088/1361-648X/ad4adc/meta). 4. T. Pullarao, Leelashree S, G. Nagaraju, B. Ravi Kumar, S. Srinath, Yugandhar Bitla, Pittala Suresh, *“Influence of (Sr, Zr) Co-Doping Ions on the Enhanced Magnetic and Dielectric Response of $BiFeO_3$”*, Journal of Electronic Materials 53, 2024, 786. (DOI: https://link.springer.com/article/10.1007/s11664-023-10867-z). 5. Sandya Rani Mangishetti, Daehee Jang, Junil Choi, Gaddam Rajeshkhanna, Suresh Pittala, Song Kyu Kang, Junhyuk Ji, Minho Kim, Seung Gyu Jung, Jungseub Ha, Jihoon Kim, Junbeom Maeng, Gwan Hyeon Park, Jaejin Bae, Won Bae Kim, *“N-doped graphene leaves on carbon nanotubes and NiMn2O4-*

	graphene hybrid nanocomposites with ionogel film for flexible symmetric and asymmetric supercapacitors", Chemical Engineering Journal 472, 2023, 144863. (DOI: https://www.sciencedirect.com/science/article/abs/pii/S1385894723035945). 6. M. Aziziha, S. Akbarshahi, S. Pittala, S. Ghosh, R. Sooriyagoda, A. H. Romero, S. Thota, A. D. Bristow, M. S. Seehra, M. B. Johnson, *"Identification of a Fe-Dependent Optical Mode in $CuAl_{1-x}Fe_xO_2$"*, Journal of Physical Chemistry C 125, 2021, 6. (DOI: https://pubs.acs.org/doi/abs/10.1021/acs.jpcc.0c10440). 7. P. Suresh, B. K. Hazra, B. R. Kumar, T. Chakraborty, P. D. Babu, S. Srinath, *"Lattice effects on the multiferroic characteristics of (La, Ho) co-substituted $BiFeO_3$"*, Journal of Alloys and Compounds 863, 2021, 158719. (DOI: https://www.sciencedirect.com/science/article/abs/pii/S0925838821001262).
Sponsored Projects (Past and Ongoing)	• **Project Title:** Magnetoelectric spin orbit (MESO) based logic for beyond CMOS computing applications Principal Investigator: Dr. Suresh Pittala **Scheme & Sponsoring Agency:** DST-SERB (EEQ/2022/000984) — ₹50 Lakhs, 3 years **Duration:** 10 March 2023 – 9 September 2026 [Ongoing] • **Project Title:** Multiferroicity in hexagonal $Lu_{1-x}A_xFeO_3$ (A = Sr, Zr, La, Nd) ceramics Principal Investigator: Dr. Suresh Pittala **Scheme & Sponsoring Agency:** UGC-DAE Consortium for Scientific Research (CRS/2022-23/01/724), 3 years **Duration:** 17 March 2023 – 16 March 2026 [Completed] • **Project Title:** Synthesis and Investigation of Structural and Magnetic Properties of Ce_2NiMnO_6 double perovskite for Spintronic Applications Principal Investigator: Dr. Suresh Pittala **Scheme & Sponsoring Agency:** UGC-DAE Consortium for Scientific Research (CRS/2024-25/1994), 3 years **Duration:** 10 March 2025 – ongoing [Ongoing]
Profile Links: Scopus and Orcid	**Google Scholar:** Profile (Citations: 1315; h-index: 20; i10-index: 24) **ORCID:** 0000-0003-3187-466X **Web of Science ResearcherID:** O-2322-2016 **Scopus ID** : 56514048800
Research Activities (Write about your best research results max of 2-3 pages including diagrams)	**1. Magnetic Ground State of Bulk Hexagonal $LuFeO_3$** Hexagonal $LuFeO_3$ is a rare candidate for room-temperature multiferroicity, but bulk single-phase samples had never been synthesized prior to this work; earlier studies were confined to strained thin films. I stabilized single-phase hexagonal $LuFeO_3$ ($P6_3cm$) in bulk ceramic form via a controlled-temperature sol-gel route. Combined neutron diffraction, magnetometry, and specific-heat measurements established antiferromagnetic ordering at $T_n \approx 130$ K with an in-plane 120° antiferromagnetic spin structure (ordered moment 2.84 $\mu B/Fe^{3+}$ at 6 K). Spin-orbit coupled DFT+U calculations confirmed the Γ_1 configuration (below, right) as the true bulk ground state — distinct from the Γ_2 pattern reported for strained thin films — demonstrating that

substrate strain, not intrinsic physics, dictates the spin pattern seen in earlier thin-film literature. Room-temperature P-E loops and anomalies in dielectric constant, specific heat, and lattice parameters at T_n together established genuine magnetoelectric and magnetoelastic coupling.

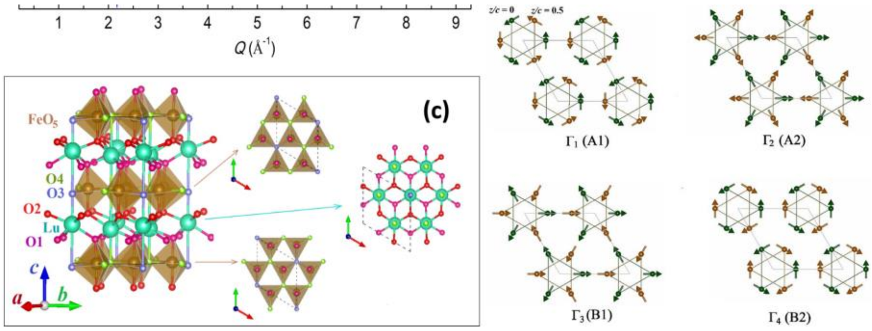

Figure 1. Refined crystal structure of h-$LuFeO_3$ showing corner-sharing FeO_5 trigonal bipyramids and the triangular Lu sublattice (left), and the four candidate 120° antiferromagnetic spin configurations (Γ_1–Γ_4) evaluated by neutron diffraction and DFT; Γ_1 is identified as the bulk ground state (right).

[1] P. Suresh, K. Vijaya Laxmi, A. K. Bera, S. M. Yusuf, B. L. Chittari, J. Jung, P. S. Anil Kumar, "Magnetic ground state of the multiferroic hexagonal $LuFeO_3$," Phys. Rev. B 97, 184419 (2018). https://doi.org/10.1103/PhysRevB.97.184419

2. Ni-Doping Effects on Multiferroic $LuFe_{1-x}Ni_xO_3$

Building on the $LuFeO_3$ platform, I doped Ni^{2+} at the Fe site to engineer room-temperature multiferroicity, a property absent in the undoped compound at 300 K. Phase-pure hexagonal structure ($P6_3cm$) was retained up to x = 0.3, with Rietveld refinement (crystal structure shown below) revealing systematic lattice expansion and an increasing FeO_5 tilt angle with Ni content. This distortion induced a weak ferromagnetic state via Dzyaloshinskii–Moriya interactions, enhancing magnetization across the full 5–400 K range while the ferroelectric polarization increased systematically with Ni content (remnant polarization: 0.078 → 0.232 μC/cm² for x = 0 → 0.3), demonstrating simultaneous enhancement of both magnetic and ferroelectric order parameters through a single dopant.

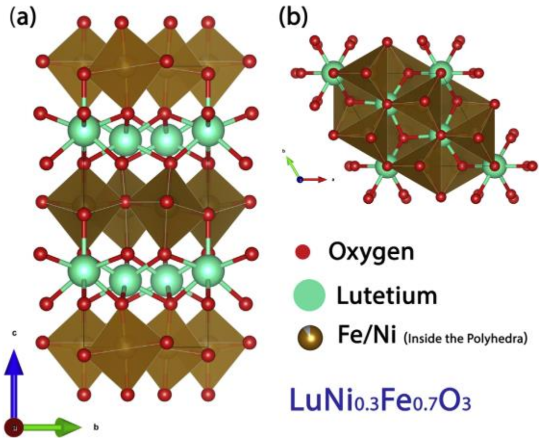

Figure 2. Crystal structure of $LuNi_{0.3}Fe_{0.7}O_3$ viewed along the ab-plane (a) and c-axis (b), showing FeO_5 trigonal bipyramids with Ni substitution and the triangular Lu sublattice.

[2] P. Suresh, K. Vijaya Laxmi, P. S. Anil Kumar, "Enhanced room temperature multiferroic characteristics in hexagonal $LuFe_{1-x}Ni_xO_3$ (x = 0–0.3) nanoparticles," J. Magn. Magn. Mater. 448, 117–122 (2018). https://doi.org/10.1016/j.jmmm.2017.05.052

3. (La, Ho) Co-Substituted $BiFeO_3$

$BiFeO_3$ is the archetypal room-temperature multiferroic but suffers from high leakage current and weak magnetization arising from its spin-cycloid structure. This study combined La (structural stabilizer) and Ho (highest rare-earth magnetic moment, 10.6 μB) as co-substituents. Co-substitution suppressed secondary phases and produced a fivefold increase in dielectric constant (42 → 230 at 1 MHz; panels a–b below) with markedly reduced dielectric loss. M–H measurements revealed an antiferromagnetic-to-ferromagnetic-like transition at low temperature via cycloid annihilation, and a two-sublattice model (Ho ferromagnetic sublattice + canted antiferromagnetic Fe sublattice) quantitatively explained the sharp coercivity peak observed near the magnetic compensation temperature (panel c) — Ho content controlled magnetization enhancement while La content controlled coercivity enhancement.

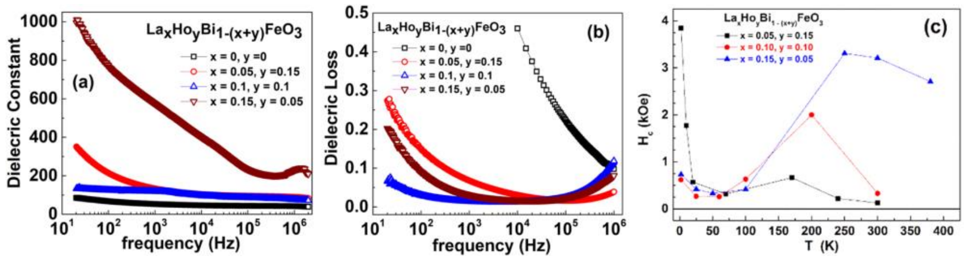

Figure 3. (a, b) Dielectric constant and dielectric loss versus frequency showing a fivefold enhancement with (La, Ho) co-substitution. (c) Coercive field versus temperature showing a sharp peak near the magnetic compensation temperature, consistent with a two-sublattice model.

[3] P. Suresh, B. K. Hazra, B. Ravi Kumar, T. Chakraborty, P. D. Babu, S. Srinath, "Lattice effects on the multiferroic characteristics of (La, Ho) co-substituted $BiFeO_3$," J. Alloys Compd. 863, 158719 (2021). https://doi.org/10.1016/j.jallcom.2021.158719

4. Ho-Substituted $BiFeO_3$

This earlier, foundational study first demonstrated that Ho doping breaks the $BiFeO_3$ spin cycloid, inducing ferromagnetic-like order at low temperature. Magnetization at 9 T increased systematically from 5.62 to 17.9 emu/g as x increased from 0.05 to 0.2 (right), with the M–H loops becoming progressively more curved and approaching saturation at low temperature as Ho content increased. This work introduced the two-sublattice framework — later extended in the co-substitution study above — to explain the counterintuitive increase of coercivity with temperature up to the magnetic compensation point.

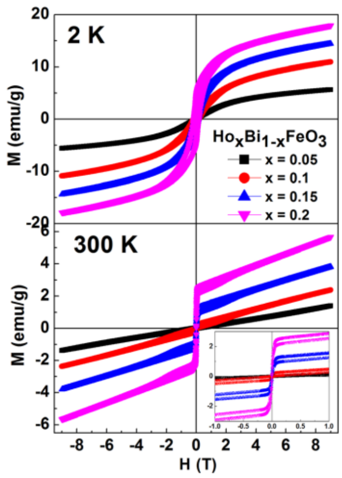

Figure 4. M–H loops of $Ho_xBi_{1-x}FeO_3$ (x = 0.05–0.2) at 2 K (top) and 300 K (bottom).

[4] P. Suresh, P. D. Babu, S. Srinath, “Effect of Ho substitution on structure and magnetic properties of $BiFeO_3$,” J. Appl. Phys. 115, 17D905 (2014). https://doi.org/10.1063/1.4863944

5. N-Doped Graphene/CNT Hybrids for Flexible Supercapacitors

Moving into energy storage, this collaborative work developed a single-step, carbon-precursor-gas-free CVD method to grow nitrogen-doped graphene leaves directly on bamboo-shaped carbon nanotubes (N-glbNT; synthesis schematic below, top), avoiding the multi-step, expensive plasma-based routes used previously. N-glbNT-850 achieved 528 F/g specific capacitance at 2 A/g with 80.6% retention at 40 A/g, while a companion 3D “blooming-flower” $NiMn_2O_4$-graphene composite delivered 1632 C/g specific capacity. A novel ionogel electrolyte (96 wt% ionic liquid in 4 wt% methylcellulose) enabled a flexible, solid-state asymmetric supercapacitor achieving 156.8 Wh/kg energy density and 97.1% capacitance retention after 10,000 cycles (below, bottom), remaining stable under repeated bending and successfully powering an LED — demonstrating viability for wearable electronics.

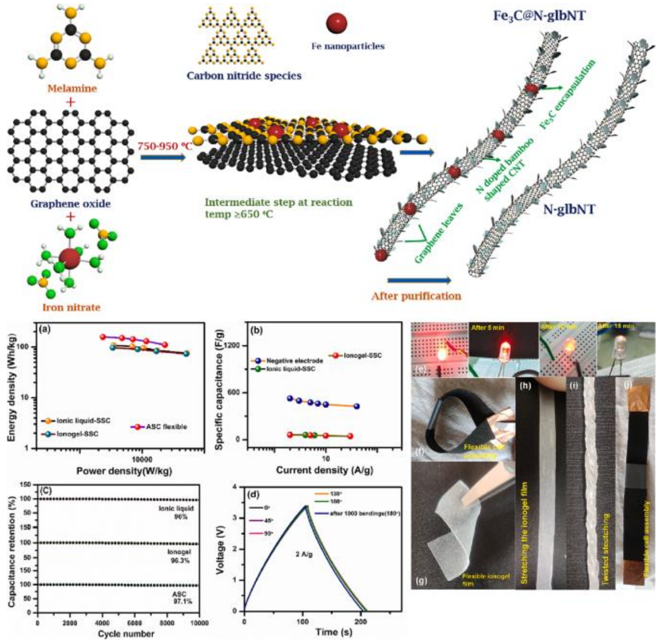

Figure 5. Top: schematic of the single-step CVD synthesis of N-doped graphene leaves on bamboo-shaped carbon nanotubes (N-glbNT). Bottom: (a) Ragone plot, (b) rate capability, (c) 10,000-cycle stability, (d) bending-angle stability, and (e–j) flexibility demonstration and LED-powered by the flexible ionogel-based supercapacitor.

[5] S. R. Mangishetti, D. Jang, J. Choi, G. Rajeshkhanna, S. Pittala, S. K. Kang, J. Ji, M. Kim, S. G. Jung, J. Ha, J. Kim, J. Maeng, G. H. Park, J. Bae, W. B. Kim, “N-doped graphene leaves on carbon nanotubes and $NiMn_2O_4$-graphene hybrid nanocomposites with ionogel film for flexible symmetric and asymmetric supercapacitors,” Chem. Eng. J. 472, 144863 (2023). https://doi.org/10.1016/j.cej.2023.144863

Common thread: across both material families, this work emphasizes structure–property correlation — using diffraction, spectroscopy, and first-principles calculations to establish why a material behaves as observed, then applying that understanding to rationally engineer improved functional performance, whether multiferroic coupling strength or electrochemical energy-storage capacity.

Collaborations

1. Uppsala University, Sweden
2. KAUST, Saudi
3. IISc

	4. IIT Guwahati 5. University of Hyderabad **6.** MNIT Jaipur
Invited Talks	1. **2025 – Session Speaker** Two-Day National Conference on **“Advancing Quantum Frontiers: Optoelectronic Smart Materials for Next-Gen Technologies”**, organized by the Department of Physics, Andhra Loyola College, Vijayawada, Andhra Pradesh, held on **24–25 February 2025**. 2. **2023 – Session Speaker** Two-Day National Conference on **“Recent Advances in Functional Materials”**, organized by Vignan's Foundation for Science, Technology & Research, Guntur, Andhra Pradesh, held on **24–25 March 2023**. 3. **2019 – Guest of Honour** Two-Day Conference **“Technophilia – 2K19”**, organized by KLR College of Engineering and Technology, Palwancha, Telangana, held on **30 September–1 October 2019**. 4. **2019 – Session Speaker** National Workshop on **“Hands-on Training in Latest Trends in Fabrication, Characterisation & Analysis of Composite Materials”**, organized by the Department of Mechanical Engineering, St. Peter’s College of Engineering Technology, Chennai, held on **29–30 August 2019**. 5. **2018 – Session Speaker** National Workshop on **“Recent Trends in Fabrication & Characterization of Nanocomposites”**, organized by the Department of Mechanical Engineering, S. A. Engineering College, Chennai, held on **5–6 July 2018**. 6. **2018 – Resource Person** In-house Faculty Development Programme on **“Advanced Materials for Engineering and Environmental Applications”**, organized by Siddaganga Institute of Technology, Tumakuru, Karnataka, held on **21–26 April 2018**. 7. **2018 – Session Speaker** National Workshop on **“Latest Trends in Fabrication, Characterization & Analysis of Composite Materials”**, organized by the Department of Mechanical Engineering, S. A. Engineering College, Chennai, held on **30–31 January 2018**. 8. **2017 – Video Presentation** International Conference on **“Magnetism and Magnetic Materials”**, held in **London, UK**, on **9–10 October 2017**. 9. **2017 – Keynote Address** International Conference on **“Functional Materials, Characterization, Solid State Physics, Power, Thermal & Combustion Energy (FCSPTC)”**, organized by Ramachandra College of Engineering, Eluru, Andhra Pradesh, held on **7–8 April 2017**.

Group Members (PhD Students and Projects) Open Positions: If any	PhD Scholars
	
	1. **Mr. Harihara Bhoi**
	    o **Registered:** 2023
	    o **Research Interest:** Magnetoelectric Materials
	2. **Ms. Roshini G**
	    o **Registered:** 2024
	    o **Research Interests:** Heusler Alloys, High Entropy Oxides
	3. **Ms. Vandana M**
	    o **Registered:** 2024
	    o **Research Interest:** Double Perovskites
	4. **Ms. Saroj Vijayalaxmi**
	    o **Registered:** 2025
	    o **Research Interest:** Thermoelectrics
	5. **Ms. Mamatha T C**
	    o **Registered:** 2026
	    o **Research Interest:** Thermoelectrics
	
	OPEN POSITIONS: 3 PhD Positions open in the Area of Quantum Materials, Nanomaterials, Spintronics and Magnetism