KARTHIK RAO

ksr5@rice.edu ◇ karthiksrao03@gmail.com
Website: tx.ag/karthik ◇ Github: k-rao

RESEARCH INTERESTS

Design and synthesis of novel materials, crystal growth, strongly correlated electron systems, quantum spin liquids, high pressure floating zone

EDUCATION

Rice University, Houston, TX August 2021 - Present
Ph.D. in Physics
Thesis Advisor: Prof. Emilia Morosan

Texas A&M University, College Station, TX August 2017 - May 2021
B.S. in Physics, B.S. in Computer Science
Honors Minor in Mathematics, Minor in Cybersecurity
Cumulative GPA - 3.814
Magna Cum Laude, Undergraduate Research Scholar
University Honors Fellows, Honors in Physics
Thesis:*Particle Detector for Low-Energy Heavy Ions*
Thesis Advisor: Prof. Grigory Rogachev

RELEVANT RESEARCH EXPERIENCE

Quantum Materials - Rice University August 2021 - Present
Graduate Research Assistant
Designed, synthesised, and characterized novel quantum materials with unconventional electronic and magnetic ground states, constructed the high pressure floating zone laser furnace at Rice University, maintained several of the lab's instruments including the Quantum Design PPMS DynaCool (with DR), Quantum Design MPMS3 (with iQHe3), and Bruker D8 Advance, and mentored undergraduate research assistants in the lab

Atomic Force Microscopy - National Institute of Standards and Technology May 2021 - July 2021
Research Intern
Performed COMSOL simulations on AFM probes to build a dataset of results using different probe shapes and to determine unknown probe shape from scanning results

OTHER RESEARCH EXPERIENCE

Nuclear Astrophysics - Texas A&M University May 2019 - July 2021
Deep Learning - Texas A&M University August 2020 - May 2021
Quantum Light-Matter Interaction - Texas A&M University August 2019 - May 2021
Superconducting Magnets - Texas A&M University May 2018 - January 2019
Molecular Gyroscopes - Texas A&M University January 2018 - May 2018

SKILLS

Proficient in **material synthesis** techniques such as single crystal flux growths, chemical and physical vapor transport, high pressure laser floating zone, and polycrystalline arc-melting
Proficient in **material characterization** techniques such as crystallography, powder x-ray diffraction, Laue diffraction, elemental analysis, scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), magnetization and specific heat measurements, electrical transport

Proficient in LaTeX, C, C++, Java, MATLAB, OriginPro, Python, HTML, CSS, JavaScript
Experience with R, Prolog, Assembly, Inventor, Verilog, VHDL, ROOT, LISE++, COMSOL
Familiar with workshop machines such as mills, band-saws, lathes etc.
Website Architect: Personal Website

PUBLICATIONS

2. K.Rao et. al, "Topological Hall in Gd_5Pb_3 Ferromagnet" (in preparation)

1. W. Yao, S. Liu, H. Kikuchi, H. Ishikawa, Ø. S. Fjellvag, D. W. Tam, F. Ye, D. L. Abernathy, G. D. A. Wood, D. Adroja, C.-M. Wu, C.-L. Huang, B. Gao, Y. Xie, Y. Gao, **K. Rao**, E. Morosan, K. Kindo, T. Masuda, K. Kindo, T. Masuda, K. Hashimoto, T. Shibauchi, and P. Dai. "Anomalous Electrical Transport in the Kagome Metal $YbFe_6Ge_6$", *Phys. Rev. Lett.*, **134**, 186501 (2025) doi: 10.1103/PhysRevLett.134.186501 (arXiv: 2504.12454)

Acknowledged for contributions in **2** publications

TECHNICAL REPORTS

3. E. Harris, G. V. Rogachev, G. Chubaryan, H. Jayatissa, E. Koshchiy, and **K. Rao**, "Parallel-plate avalanche counter (PPAC) detector commissioned for the MDM focal plane", *Texas A&M University Cyclotron Institute Progress in Research*, 2021-2022 (Link)

2. E. Harris, G. V. Rogachev, G. Chubaryan, C. Hunt, E. Koshchiy, Z. Luo, C.E. Parker, **K. Rao**, M. Roosa, A. Saastamoinen, and D.P. Scriven, "Determining ANCs relevant for the $^{12}C(\alpha,\gamma)^{16}O$ reacton", *Texas A&M University Cyclotron Institute Progress in Research*, 2021-2022 (Link)

1. K. Rao, "Particle Detector For Low-Energy Heavy Ions", *Explorations: The Texas A&M Undergraduate Journal*, vol. 12, pp. 74-78, Nov 2020 (Link)

PRESENTATIONS AND POSTERS(*)

1. Mar 18, 2025: *APS Global Summit*, Anaheim, California, "Complex Magnetism in Gd_5Pb_3"
2. *Apr 10, 2024: *2024 Rice Workshop on Quantum Materials Synthesis*, Houston, Texas, "Complex Magnetic Order and Room Temperature Ferromagnetism in Rare Earth Intermetallic"
3. Mar 22, 2024: *Houston APS: Space City Symposium*, Houston, Texas "Quantum Spin Liquids"
4. Mar 07, 2024: *APS March Meeting*, Minneapolis, Minnesota, "New Quantum Spin Liquid Candidates Based on a Tm triangular lattice"
5. Feb 09, 2024: *PAGSA Journal Club*, Houston, Texas, "Review of Synthesis Techniques"
6. *Jan 15, 2024: 7^{th} *Fundamentals of Quantum Materials Winter School*, College Park, Maryland, "Complex Magnetic Order and Room Temperature Ferromagnetism in Rare Earth Intermetallic"
7. Nov 3, 2023: *Science in a Flash*, Houston, Texas, "Design and Synthesis of Novel Quantum Materials"
8. Sept 29, 2023: *PAGSA Journal Club*, Houston, Texas, "Unconventional Magnetism in Triangular Lattice Rare Earth Compounds"
9. *Aug 04, 2023: *2023 Smalley-Curl Institute Summer Research Colloquium*, Houston, Texas, "Complex Magnetic Order and Room Temperature Ferromagnetism in Gd_5Pb_3"
10. *Mar 13, 2023: *Workshop on Design Principles for Topological Quantum Materials*, Santa Barbara, California, "$TmAgTe_2$ and $TmCuTe_2$: Quantum Spin Liquid Candidates"

11. Aug 06, 2021: *The 2021 Virtual SPS Intern Symposium*, "Profiling the Shape of Electrostatic Force Microscopy Probes Using Finite Element Simulations"
12. *Apr 18, 2020: 1^{st} *APS Virtual April Meeting (Q2C, 2020 Vision: Frontiers in Physics)*, "Delay line PPAC for low-energy, heavy ions"
13. *Feb 26, 2020: 3^{rd} *Undergraduate Research Scholars Symposium*, College Station, Texas, "Delay line PPAC for low-energy, heavy ions"
14. *Mar 22, 2018: 21^{st} *Student Research Week (Bridging Disciplines, Engaging with Others)*, College Station, Texas, "Simulations of Rotational Barriers in Molecular Gyroscopes", presented by J. Joung, **K. S. Rao**, C. Woodall

PROPOSALS

1. 2024: User proposal - "Spinon excitation in a Tm-based triangular lattice QSL candidate", Oak Ridge National Laboratory
2. 2024: User proposal - "High Field Susceptibility, Magnetization and Resistivity Measurements in Gd_5Pb_3", National High Magnetic Field Laboratory-Pulsed Field Facility
3. 2023: Rapid proposal - "Crystal Electric Field (CEF) Effect in $TmCuTe_2$", ISIS Neutron and Muon Source

SCHOOLS ORGANIZED

1. 2024 Rice Center for Quantum Materials (RCQM) Winter School on Quantum Materials Synthesis (Link)

PRESS COVERAGE

1. "Rice hosts workshop and winter school to advance quantum materials research", *Rice University News and Media Relations* (Link)
2. "Trust Your Gut", *the SPS Observer*, 57(2), pp. 20, Fall 2023 (Link)

WORK EXPERIENCE

Teaching Assistant January 2022 - December 2023
TA for Elementary Physics Lab 2, Mechanics (with Lab), Undergraduate Quantum Mechanics
Grader August 2019 - May 2021
Graded for physics classes such as Optics and Thermodynamics (Fall 2019), Quantum Mechanics 1 (Spring 2020, 2021), Quantum Mechanics 2 (Fall 2020)
Peer Mentor August 2018 - December 2018
Mentored incoming freshmen in College of Science through one-on-one weekly interactions and served as a sincere and positive source of support to help first-year physics students
Student Technician August 2017 - December 2017
Assisted the TA for a freshman-level Physics class

SUPERVISION/MENTORING

Undergraduate Students - Megan Schultze (2021-2022), Emma Codianne (2023), Lulu Shih (2023), Raven Shamoo (2023-Present)
Summer Interns - Han Wang (REU 2024), Zhiyi Shi (REU 2024), Constantino Andrade (REU 2025), Ritu Gandhi (RET Summer Teacher, 2023)

LEADERSHIP EXPERIENCE

junior Rice Center for Quantum Materials (jRCQM) August 2023 - August 2024
jRCQM Organizer
Led and managed a subcommittee of postdoctoral researchers and graduate students, bridging communication between the faculty committee and students' needs relevant to the Rice Center for Quantum Materials, fostered a collaborative environment through the organization of weekly happy hour events with the theme of research progress discussions and organized the inaugural RCQM Winter School on Quantum Materials Synthesis (2024), featuring 5 lectures, 6 practical sessions, and 30 participants from various universities.

Physics and Astronomy Graduate Student Association (PAGSA) August 2023 - May 2024
Physics and Astronomy Department Graduate Program Committee Representative
Represent graduate students on the departmental Graduate Program Committee, along with organizing social and professional development events, working with administrators to plan events for prospective and incoming graduate students, and coordinate with other graduate student associations across Rice University and other universities to organize joint social events

Nanotechnology NSF Research Experience for Teachers (RET) June 2023 - July 2023
RET Mentor
Mentored an elementary school teacher for six weeks and created a research project that aligned with their expectations and experience, and helped them create a scientific poster that they presented at the RET Symposium

Physics and Astronomy Graduate Student Association (PAGSA) August 2022 - May 2023
Diversity, Equity and Inclusion (DEI) Representative
Represent graduate student voices on the Physics & Astronomy Department DEI Committee, report back on DEI committee progress and initiatives, and work with PAGSA and graduate students to implement graduate student level initiatives to improve the physics graduate community culture

Society of Physics Students August 2018 - May 2021
Treasurer
Create and manage a budget of $1000, analyze budgets and financial reports regularly, ensure the organizations funding activities is in compliance with the standards set by the University, develop ideas for fundraising and aid in Department of Physics and Astronomy outreach events

Discover, Explore and Enjoy Physics (DEEP) August 2017 - May 2021
Member
Built demonstrations such as the plasma cutter, drawdio pencils, thermoelectric generator, fluid instability demonstration and so on, worked side-by-side with their peers and professors on research, concept, design, and fabrication of science demonstration experiments and presented these exhibits during the Festival, Shows, and other outreach program in teams of several students and faculty members

Corps of Cadets August 2017 - May 2021
Operations/Logistics Officer
Train freshmen, sophomore and junior cadets on class structure, ensuring knowledge of rules, responsibilities, and duties expected of them as well as organize outfit events such as the annual Christmas party, family weekend events and more

O. R. Simpson Honor Society August 2018 - May 2020
Test Bank Sergeant
Offer free one-on-one tutoring for any cadet in need, take accountability at all mandatory tutoring

events for the Corps of Cadets as well as update and maintain the test bank

OUTREACH, VOLUNTEERING AND COMMUNITY SERVICE

Valhalla (2024), Houston Humane Society (2022), Big Event (2018, 2019, 2021), March to the Brazos (2018, 2019), Various community service events with the Corps of Cadets, Assisted department in New Student Conferences, Physics Festival (2018, 2019, 2021), DEEP Showcase (2018-2020), Various department outreach events over the academic year and summer breaks

AWARDS

QuantEmX Scientist Exchange Award - Institute for Complex Adaptive Matter August 2024
Travel grant to visit and conduct experiments at the Pulsed Field Facility, Los Alamos National Lab

Robert L. Chuoke Award - Dept. of Physics and Astronomy, Rice University 2022 - 2023
Recognize second and third year graduate students who show the greatest promise in physics as evidenced by performance in course work and speedy progress in research

John B. Beckham Award - College of Science, Texas A&M University 2020 - 2021
Highest award in Texas A&M's College of Science with selection based upon achievement, integrity, and academic and extracurricular leadership

Phi Kappa Phi Deans Excellence Award - College of Science, Texas A&M University 2017 - 2018
Recognize top first-year and sophomore students for their achievements and to help identify these students as potential candidates for future recognition in both campus award programs as well as for nomination to nationally-competitive awards

Aggie Research Scholar - Texas A&M University Spring 2018
Fulfilled all requirements to be certified as an Aggie Research Scholar by working in a cross multidisciplinary research team

Dean's Honor Roll - College of Science, Texas A&M University Fall 2017, Spring 2018, Spring 2020
Distinction awarded to top 10% of students based on a grade point average of 3.75 to 4.00 and completion of 15 graded hours

Outstanding Academic Freshman - Corps of Cadets, Texas A&M University 2017 - 2018
Awarded to one freshman cadet in the Corps of Cadets based on academic performance

Academic Scholarships - Texas A&M University 2017 - 2021
Various academic scholarships from student organizations, departments, colleges and the University of varying amounts based upon academic achievement and extracurricular leadership

Non-Resident Tuition Waiver - Texas A&M University 2017 - 2021
Awarded to eligible non-resident students who hold competitive scholarships of atleast $4000 for the academic year for which they are enrolled, making them eligible to pay the fees and charges required of Texas residents without regard to the length of time the students have resided in Texas