

KARTHIK RAO

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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

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 based on designs used by collaborators at University of California at Santa Barbara, maintained several of the lab's instruments including the Quantum Design PPMS DynaCool, Quantum Design MPMS3, and Bruker D8 Advance, and mentored undergraduate research assistants working 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

Nuclear Astrophysics - Texas A&M University

May 2019 - July 2021

Undergraduate Research Assistant

Developed a parallel plate avalanche counter (PPAC) particle detector for low-energy heavy ions which will be used in experiments in nuclear astrophysics using indirect methods at the Cyclotron at Texas A&M

Deep Learning - Texas A&M University

August 2020 - May 2021

Trained and applied a good model that can detect the target action/emotion, using (existing) datasets, to YouTube videos to find "moments" that contain the target action/emotion, and build a large and accurate dataset of such "moments"

Quantum Light-Matter Interaction - Texas A&M University

August 2019 - May 2021

Performed an independent study in quantum information considering interactions between qubits and

quantum fields, entangled systems, dissipation and decoherence, non-trivial topological materials, topological superconductivity, and interaction of light with condensed matter systems as well as designed a theoretical cavity using magnetized graphene to create a qubit with discreet energy levels

Superconducting Magnets - Texas A&M University

May 2018 - January 2019

Undergraduate Research Assistant

Collaborated to create a device that was used to align magnetic fields precisely in a Tokamak and participated in USPAS “Fundamentals of Accelerator Physics and Technology” summer 2018 session with full financial support

Molecular Gyroscopes - Texas A&M University

January 2018 - May 2018

Undergraduate Research Assistant

Worked with the Gladysz research group and performed team-led research focusing on computational investigations of molecular gyroscopes using mainly atomistic simulations on supercomputers

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.

PUBLICATIONS

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

PRESENTATIONS AND POSTERS

1. Mar 13, 2023: *Workshop on Design Principles for Topological Quantum Materials*, Santa Barbara, California, “TmAgTe₂ and TmCuTe₂: Quantum Spin Liquid Candidates”
2. Aug 06, 2021: *The 2021 Virtual SPS Intern Symposium*, “Profiling the Shape of Electrostatic Force Microscopy Probes Using Finite Element Simulations”
3. Apr 18, 2020: *1st APS Virtual April Meeting (Q2C, 2020 Vision: Frontiers in Physics)*, “Delay line PPAC for low-energy, heavy ions”
4. Feb 26, 2020: *3rd Undergraduate Research Scholars Symposium*, College Station, Texas, “Delay line PPAC for low-energy, heavy ions”
5. Mar 22, 2018: *21st 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

WORK EXPERIENCE

Teaching Assistant

January 2022 - Present

TA for Elementary Physics Lab 2, Mechanics (with Lab)

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

LEADERSHIP EXPERIENCE

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

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

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 multi-disciplinary 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