Yash Anand

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Education

University of Maryland - Honors College College Park, MD
B.S. in Physics and B.S. in Math *2021 – Present*

Related Coursework

Physics

Graduate Courses

- Quantum Many-body II (PHYS626)
- Introduction to the Phenomenology and Theory of Superconductivity (PHYS798C)
- Quantum Many-Body I (PHYS625)
- Advanced Quantum Mechanics (PHYS624)
- Introduction to Relativity, Gravitation and Cosmology (PHYS675)
- Quantum and Statistical Physics 1 and 2 (PHYS612/613)
- Special Topics in Experimental Solid State Physics; Center for Nanophysics and Advanced Materials Seminar (PHYS838C)
- Seminar in Experimental Solid State Physics; Quantum Mechanical Many-Body Problems (PHYS738)

Undergraduate Courses

- Quantum Mechanics 1 and 2 (PHYS401/402)
- Introduction to Thermodynamics and Statistical Mechanics (PHYS404)
- Classical Mechanics (PHYS410)
- Solid State Physics (PHYS431)
- Introduction to Nuclear and Particle Physics (PHYS441)

Mathematics

- Differential Geometry of Curves and Surfaces I (MATH436)
- Introduction to Probability Theory (STAT410)
- Complex Analysis (MATH463)
- Linear Algebra (MATH405)
- Transform Methods (MATH464)
- Advanced Calculus 1 (MATH410)
- Advanced Calculus 2 (MATH411)
- Partial Differential Equation (MATH462)
- Calculus 3 (MATH241)

Skills

Technical Skills

- **Programming Languages**: Python, Matlab, Java, HTML, CSS, STELLA, ROOT, Dr. Racket, LaTeX
- **Applications**: Anaconda, Visual Code, Autodesk Inventor, Minitab, Eclipse, Overleaf, MS Office (Word, Excel, Powerpoint), GitHub

Interpersonal Skills

- **Project Management**: Time management, scheduling events, event organization
- **Science Communication**: Presentations, outreach, demonstrations
- **Teaching**: Curriculum development, tutoring, leading discussions

Research Experience

Independent Research under Dr. Johnpierre Paglione November 2021 – Present

Quantum Materials Center, UMD Physics Department

- Exploring different synthesis processes: Chemical Vapor Transport (CVT), Flux Growth, arc-melting.
- Perfected Fe_3Sn_2 single crystal recipe using Sn flux. Studying skyrmionic bubbles in Fe_3Sn_2 using muon spin relaxation.
- Exploring magnetic and electrical properties of novel rare earth quantum materials, the 122, 213, and 111 rare-earth materials.
- Perfecting the doping of iron-pnictide $Ba(Fe)_2As_2$ with other transition metals at the Fe site to create high-entropy alloys.
- Synthesizing and analyzing platinum-aluminum compounds to study physical and magnetic properties of novel materials, such as resistivity, magnetoresistance, magnetization.

Independent Research with Dr. Zohreh Davoudi March 2023 – Present

Joint Center for Quantum Information and Computer Science, UMD Physics Department & NIST

- Developed tighter Lieb Robinson bounds to determine the speed limits of information propagation in a quantum system, specifically the Z_2 lattice gauge theory. Lieb Robbinson bounds put a limit on how fast information is saturated in a system.
- Writing manuscript to submit to a peer review journal.

Independent Research with Dr. Jay Deep Sau November 2023 – Present

Condensed Matter Theory Center, UMD Physics Department

- Creating a model of self-interaction in phonons to study non-linear quantum mechanics, using two-sublattices.
- Conducting literature review to design experiments using existing experimental set ups to validate model.

Independent Research with Michael H. Winer May 2020 – June 2023

Joint Quantum Institute, UMD Physics Department & NIST

- Developed a model to compute the amount of information shared between two-subsystems. Used Random Matrix Theory (RMT) and proved that Wishart Ensemble (a family of random matrices) could be used to approximate the information shared between subsystems.
- Presented the project titled, *Developing a Toy Model for Quantum Chaos Theory: Entanglement Entropy of Bipartite Systems Under Random Real Hamiltonians.*

Presentations

PHYS838C: Superconductivity, Quantum Materials and Nanoscience Seminar September 2024

- Speaker Talk: High Entropy Alloys: Transition Metal Doping of $Ba(Fe)_2As_2$ at Fe sites

Conference for Undergraduate Underrepresented Minorities in Physics April 2024

- Poster Presentation: Large Anisotropic Magnetoresistance and Magnetic properties of Single Crystalline, $Tb_2Al_3Si_2$

American Physical Society (APS) March Meeting March 2024

- Speaker Talk: Large Anisotropic Magnetoresistance and Magnetic properties of Single Crystalline, $Tb_2Al_3Si_2$

Quantum World Congress September 2023, September 2024

- Demonstration of the Meissner Effect in Superconductors

University Of Maryland PUC Undergraduate Colloquium

Colloquium Talk: High Entropy Alloys: Transition Metal Doping of $Ba(Fe)_2As_2$ at Fe sites September 2024

Colloquium Talk: Review of Lieb Robinson Bounds March 2024

Colloquium Talk: Fe_3Sn_2: Frustrated Kagome Magnet March 2023

Colloquium Talk: Developing a Toy Model for Quantum Chaos Theory:
Entanglement Entropy of Bipartite Systems Under Random Real Hamiltonians March 2022

PARADIM Hosted by Cornell and Johns Hopkins August 2022

- Poster Presentation: Synthesis and Characterization of Dirac Semimetal Fe_3Sn_2

Physics Undergraduate Research Showcase Hosted by University of Maryland May 2022

- Poster Presentation: Developing a Toy Model for Quantum Chaos Theory: Entanglement Entropy of Bipartite Systems Under Random Real Hamiltonians

Published Papers

1. Wang, L., Hu, R., **Anand, Y.**, Saha, S. R., Jeffries, J. R., and Paglione, J. (2024). Pressure-Induced Exciton Formation and Superconductivity in Platinum-Based Mineral Sperrylite. Materials, 17(14), 3476. https://doi.org/10.3390/ma17143476

Awards

Barry Goldwater Scholar 2024

Dean's List Fall 2021, Spring 2022, Fall 2022, Fall 2023, Spring 2024

Accelnet Quantum Materials Exchange Award 2023

University of Maryland Physics Department Bardasis Scholarship Spring 2024, Fall 2023, Spring 2023

The Admitted Physics Major Scholarship (University of Maryland) 2021

Regeneron Science Talent Search Scholar 2021

- Named as a Top 300 Scholar in the Regeneron Science Talent Search for *"Developing a Toy Model for Quantum Chaos Theory: Entanglement Entropy of Bipartite Systems Under Random Real Hamiltonian"*

Leadership Experience

Mental Health Committee-Physics Undergraduate Committee Fall 2024 – Present

Physics Department, University of Maryland

- Leading mental health programs and organizing events to promote community well-being.
- Collaborated with fellow officers to host bi-weekly colloquia for undergraduates to showcase their research.
- Assisted with the annual newsletter to highlight the achievements of undergraduate students.

Treasurer-Society of Physics Students (SPS), UMD Chapter Fall 2023 – Spring 2024

Physics Department, University of Maryland

- Coordinated and led weekly general members meetings.
- Organized a SPS social event to foster community building and peer connections at the Conference for Undergraduate Underrepresented Minorities in Physics (CU^2MiP).

Teaching

PHYS260: Electricity, Magnetism and Thermodynamics Fall Semester 2022

Physics Department, University of Maryland

- Served as a graduate TA for two sections of the undergraduate engineering course on electricity, magnetism and thermodynamics.
- Led two weekly discussion sections, reviewing homework, answering coursework questions, and administering quizzes.
- Proctored and graded exams and finals.

PHYS402: Quantum Mechanics 2 Spring Semester 2023

Physics Department, University of Maryland

- Advanced core physics course covering bosons and fermions, angular spin addition, and perturbation theory.
- Assisted in running weekly discussion sections, addressing specific questions and reinforcing key concepts.
- Graded weekly homework assignments.

PHYS431: Solid State Physics Fall Semester 2023, Spring Semester 2024

Physics Department, University of Maryland

- Advanced physics elective cross-listed with Materials Engineering Department, covering solid-state physics fundamentals: lattice structures, Drude model, Einstein model, superconductivity, and band structures.
- Served as a TA for Prof. Paglione (Fall 2023) and Prof. Takeuchi (Spring 2024).
- Held hour-long office hours, addressing homework questions, conducting review sessions for exams. Created review materials for the review sessions.
- Graded homework, exams and finals.

PHYS441: Introduction to Sub Atomic Particles Spring Semester 2024

Physics Department, University of Maryland

- Advanced physics elective covering special and general relativity, introductory quantum field theory through Feynman diagrams, and high-energy particle detection.
- Converted homework to LaTeX and prepared homework solutions.
- Led discussion sections, reviewing class materials and readings.
- Held one-on-one tutoring sessions with students to answer questions and assist with homework.

Outreach

SPS Tutor August 2022-Present

Physics Department, University of Maryland

- Provided walk-in tutoring for classical mechanics, electricity and magnetism, thermodynamics, quantum mechanics, solid-state physics, and physics lab courses for majors and non-majors.
- Tutored UMD students from various majors, including biology, engineering, and physics.

Physics is Phun Shows Spring 2023 – Present

Physics Department, University of Maryland

- Organized and conducted free public physics outreach shows aimed at K-12 students to enhance their understanding of physics in an engaging way. Show themes included: Pressure, Waves, Spooky physics, Physics in motion.
- Led demonstrations on various physical phenomena, including heat, pressure, sound, and waves using UMD's Lecture Demonstration department resources.

Discovery Days Fall 2024 – Present

Physics Department, University of Maryland

- Hosted interactive programs for elementary school students as part of a free event by UMD's Physics Department, helping them learn physics through hands-on workshops.
- Projects and workshops included: Air cannons, oobleck, motion of hot air using paper snakes.

Fundamentals of Quantum Materials (FQM) School Summer 2022, Winter 2022, Winter 2023, Winter 2024

Quantum Materials Center, University of Maryland

- Participated as a freshman in the QMC hosted winter and summer school for graduate students to learn about crystal synthesis and characterization.
- Organizing the flux growth workshop at the school since Winter 2022.

Undergraduate Immersion Day August 2024

Physics Department, University of Maryland

- Developed an agenda collaboratively with student leaders and staff for new undergraduate students aimed to foster community.
- Ran a physics demonstration show.
- Conducted lab tour of the Quantum Materials Center.
- Participated in a student panel discussing life and success as a physics student.

Laboratory of Physical Sciences (LPS) Summer school Summer 2024

Laboratory of Physical Sciences, University of Maryland

- Organized the summer school co-hosted by LPS and QMC for undergraduate students.
- Organized a python workshop with a graduate student from LPS.
- Hosted a workshop on using x-ray diffraction to study crystal structures. Taught powder x-ray diffraction and x-ray fluorescence techniques.

Maryland Day Spring 2023, Spring 2024

Physics Department, University of Maryland

- Participated in and organized shows for Maryland Day, an University Open House with events from each department showcasing work to the public in a fun and engaging way.
- Conducted shows and table-top demonstrations to explain engaging physics concepts, such as air cannons, lead brick and hammer, physics trivia.

Conference for Undergraduate Underrepresented Minorities in Physics (CU^2MiP) Spring 2024

Physics Department, University of Maryland

- Volunteered to host a regional conference co-hosted by UMD and NIST to support equity and access for underrepresented students in physics.
- Organized an SPS social event.
- Presented research on anisotropic magnetoresistance in $Tb_2Al_3Si_2$ at the poster session.