

Yash Anand

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EDUCATION

University of Maryland - Honors College

B.S. in Physics and B.S. in Math

College Park, MD

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

- **Experimental Condensed Matter Techniques:** Powder X-ray diffraction, X-ray florescence, Laue measurements, energy-dispersive X-ray spectroscopy, magnetization measurement, magnetic susceptibility measurement, four-contact transport measurement, four-contact rotator measurement, four-contact magnetoresistance measurement, Raman spectroscopy, Hall measurement, muon spin relaxation
- **Experimental Devices:** Rigaku Miniflex XRD, Quantum Design Dynacool 14 T PPMS, Quantum Design SQUID Magnetometer MPMS, hydrogen torch quartz table
- **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 $\text{Ba}(\text{Fe})_2\text{As}_2$ 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 \mathbb{Z}_2 lattice gauge theory. Lieb Robinson 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 $\text{Ba}(\text{Fe})_2\text{As}_2$ at Fe sites

Conference for Undergraduate Underrepresented Minorities in Physics

April 2024

- Poster Presentation: Large Anisotropic Magnetoresistance and Magnetic properties of Single Crystalline, $\text{Tb}_2\text{Al}_3\text{Si}_2$

American Physical Society (APS) March Meeting

March 2024

- Speaker Talk: Large Anisotropic Magnetoresistance and Magnetic properties of Single Crystalline, $\text{Tb}_2\text{Al}_3\text{Si}_2$

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 $\text{Ba}(\text{Fe})_2\text{As}_2$ 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
Sigma Pi Sigma Honors Society	Spring 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 " <i>Developing a Toy Model for Quantum Chaos Theory: Entanglement Entropy of Bipartite Systems Under Random Real Hamiltonian</i> "	

LEADERSHIP EXPERIENCE

Mental Health Committee-Physics Undergraduate Committee	Fall 2024 – Present
<i>Physics Department, University of Maryland</i>	
<ul style="list-style-type: none"> • 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
<i>Physics Department, University of Maryland</i>	
<ul style="list-style-type: none"> • 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 (CU²MiP). 	

TEACHING

PHYS260: Electricity, Magnetism and Thermodynamics	Fall Semester 2022
<i>Physics Department, University of Maryland</i>	
<ul style="list-style-type: none"> • 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
<i>Physics Department, University of Maryland</i>	
<ul style="list-style-type: none"> • 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 (CU²MiP) 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 $\text{Tb}_2\text{Al}_3\text{Si}_2$ at the poster session.