

# Yash Anand

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## EDUCATION

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**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

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### 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

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### 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  $\text{Fe}_3\text{Sn}_2$  single crystal recipe using Sn flux. Studying skyrmionic bubbles in  $\text{Fe}_3\text{Sn}_2$  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

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### 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: $\text{Fe}_3\text{Sn}_2$ : 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
<b>PARADIM Hosted by Cornell and Johns Hopkins</b>	August 2022
• Poster Presentation: Synthesis and Characterization of Dirac Semimetal $\text{Fe}_3\text{Sn}_2$	
<b>Physics Undergraduate Research Showcase Hosted by University of Maryland</b>	May 2022
• Poster Presentation: Developing a Toy Model for Quantum Chaos Theory: Entanglement Entropy of Bipartite Systems Under Random Real Hamiltonians	

## PUBLISHED PAPERS

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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

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<b>Barry Goldwater Scholar</b>	2024
<b>Dean's List</b>	Fall 2021, Spring 2022, Fall 2022, Fall 2023, Spring 2024
<b>Accelnet Quantum Materials Exchange Award</b>	2023
<b>University of Maryland Physics Department Bardasis Scholarship</b>	Spring 2024, Fall 2023, Spring 2023
<b>The Admitted Physics Major Scholarship (University of Maryland)</b>	2021
<b>Regeneron Science Talent Search Scholar</b>	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

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<b>Mental Health Committee-Physics Undergraduate Committee</b>	Fall 2024 – Present
<i>Physics Department, University of Maryland</i>	
• 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.	
<b>Treasurer-Society of Physics Students (SPS), UMD Chapter</b>	Fall 2023 – Spring 2024
<i>Physics Department, University of Maryland</i>	
• 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 <sup>2</sup> MiP).	

## TEACHING

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<b>PHYS260: Electricity, Magnetism and Thermodynamics</b>	Fall Semester 2022
<i>Physics Department, University of Maryland</i>	
• 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.	
<b>PHYS402: Quantum Mechanics 2</b>	Spring Semester 2023
<i>Physics Department, University of Maryland</i>	
• 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

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### 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<sup>2</sup>MiP)    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.