

Samuel Degen

PAB 2-429, Department of Physics, UCLA, Los Angeles, CA 90024, USA
degen@ucla.edu – updated 7/21/2025

| | | |
|-----------|---|--------------------|
| Education | University of California Los Angeles (UCLA) <i>B.S. Physics, Mathematics</i> GPA: 3.984 (overall); 4.0 (major) | 9 / 2023 - present |
| | University of Colorado Boulder <i>High School Concurrent Enrollment</i> GPA: 4.0 (overall) | 2021 - 2023 |

| | | |
|--------|--|---------------------|
| Honors | Mani L. Bhaumik Institute for Theoretical Physics Summer Research Fellowship <i>Mani L. Bhaumik Institute for Theoretical Physics, UCLA; Los Angeles, CA, USA</i> Advisors: Zvi Bern & Mikhail Solon (Scattering Amplitudes) <ul style="list-style-type: none">First undergraduate offered a summer research fellowship at UCLA's Bhaumik Institute for Theoretical Physics | 8 - 9 / 2025 |
| | University of Tokyo Research Internship Program (UTRIP) <i>Dept. of Physics, The University of Tokyo (東京大学); Tokyo, Japan</i> Advisor: Haozhao Liang (Nuclear Theory) <ul style="list-style-type: none">1 of 14 students selected from 1,149 applicants for in-person, fully funded 6-week research and culture program in Tokyo<i>Friends of UTokyo, Inc. (FUTI) Global Leadership Award</i> – prestigious funding award for USA students to research in Japan (1 of 2 UTRIP students) | 6 - 7 / 2025 |
| | Perimeter Institute's PSI START Satellite Program (Perimeter Scholars International Students' Training Accelerator for Research in Theory) <i>Bishop's University; Sherbrooke, Quebec, Canada</i> <ul style="list-style-type: none">1 of 3 international students selected for in-person, fully funded 2-week intensive theoretical physics coursework in Quebec, Canada | 5 / 2025 |
| | UCLA Summer Undergraduate Research Fellowship <i>Dept. of Physics & Astronomy, UCLA; Los Angeles, CA, USA</i> Advisor: E. Paulo Alves (Plasma Theory) <ul style="list-style-type: none">1 of 2 first-year undergraduates selected for competitive paid 10-week research fellowship | Summer 2024 |
| | Member of Colorado Math Team (ARML) 2nd in State of Colorado for Core Value Debate | Summer 2023 2021 |

| | | |
|-------------------------|--|-------------------|
| Presenting and Talks | Research | |
| | <i>Benchmarking FRG-DFT with the One-Dimensional Fermi Gas – Towards a Nonperturbative Many-Body Nuclear Theory</i> | |
| | UTRIP Final Presentation, The University of Tokyo | August 5, 2025 |
| | Department of Physics Summer 2025 Research Talks, UCLA | August 22??, 2025 |
| | <i>Data-driven statistical model of nonthermal particle acceleration by the kink instability in relativistic jets</i> | |
| | Department of Physics Summer 2024 Research Talks, UCLA | August 22, 2024 |
| | Plasma Astrophysics Oral Contributions (NO05.00014) , 66th Annual Meeting of the APS Division of Plasma Physics; Atlanta, Georgia | October 9, 2024 |
| | Pedagogy | |
| | <i>From Finite Groups to Lie Algebras: Symmetries and Representations in Physics</i> | |
| | Perimeter Institute’s PSI START Satellite Program, Bishop’s University; Quebec, Canada | May 29, 2025 |
| | <i>Convex Compactness and its Applications</i> | |
| | APPM 6560 Final Presentation, CU Boulder | May 1, 2023 |
| <hr/> | | |
| Pedagogical | Unpublished | |
| Articles | S. Degen, An Introduction to 3D Gravity from TQFTs | 6 / 2025 |
| | (UCLA PHYS 242C Final Project) | |
| | S. Degen, Tensor Products of Representations of Lie groups | 10 / 2024 |
| | (UCLA MATH 229A Final Project) | |
| <hr/> | | |
| Meetings Attended | California Amplitudes Meeting 2025 (LA) ; Mani L. Bhaumik Institute for Theoretical Physics, UCLA | 11 / 2025 |
| | California Amplitudes Meeting 2025 (Davis) ; Center for Quantum Mathematics and Physics (QMAP), UC Davis | 5 / 2025 |
| | 66th Annual Meeting of the APS Division of Plasma Physics ; Atlanta, Georgia | 10 / 2024 |
| <hr/> | | |
| Research | The University of Tokyo (東京大学) Undergraduate Researcher | 5/2025 - present |
| | <i>H. Liang Nuclear Theory Group</i> | 5/2025 - present |
| | How humans can make a safe and efficient use of nuclei – such as through fission and fusion processes – is a difficult question, requiring a deep microscopic understanding of quantum many-body theories. The treatment of long-lived fission products by nuclear power plants depends strongly on the specifics of quantum many-body tunneling, a long-standing problem that requires a first principles (<i>ab initio</i>) theory of properties of nuclei. While there are many established microscopic nuclear theories, the only approach applicable to almost the whole nuclear chart is Density Functional Theory (DFT). Our work uses modern theoretical tools such as Effective Field Theory (EFT) and Renormalization Group (RG) Flow to construct such an <i>ab initio</i> nuclear DFT. | |

Supported by UTRIP 2025 and FUTI Global Leadership Award.

UCLA Undergraduate Researcher

1/2024 - present

Z. Bern & M. Solon Scattering Amplitudes Group

8/2025 - present

Project TBD.

*Supported by Mani L. Bhaumik Institute for Theoretical Physics Summer 2025
Research Fellowship.*

E.P. Alves Plasma Theory Group

4/2024 - 1/2025

Developed novel ML-based methods for studying time-dependent particle acceleration in relativistic astrophysical jets. My work resolves longstanding limitations of standard models by combining analytic theory and machine learning to uniquely solve ill-posed problems for the first time. Demonstrated that simple energy-dependent models are insufficient to explain the observed nonthermal particle spectrum and that these novel ML methods can be generalized to solve a large class of ill-posed problems—uniquely identifying physical solutions from an infinite family of solutions that perfectly reconstruct the data. Presented results at an international plasma physics conference, where my contributed oral talk initiated discussions toward new collaborations and research directions.

Supported by UCLA Physics Summer 2024 Research Fellowship.

B.C. Regan Condensed Matter Group

1/2024 - 3/2024

Pedagogical contributions in proving the Feynman Checkerboard at a level suitable for undergraduates, illuminating an accessible way to teach propagators.

| | | | | |
|---------------------|------|-----------|------------------------|-----------------------------------|
| Relevant Coursework | UCLA | Graduate | PHYS 215A | Statistical Physics |
| | | | PHYS 221A | Quantum Mechanics |
| | | | PHYS 221B | Quantum Mechanics |
| | | | PHYS 226B | Particle Physics (Standard Model) |
| | | | PHYS 226C | Particle Physics (QCD and Higgs) |
| | | | PHYS 226D* | Beyond the Standard Model |
| | | | PHYS 230A | Quantum Field Theory |
| | | | PHYS 230B | Quantum Field Theory |
| | | | PHYS 230C | Quantum Field Theory |
| | | | PHYS 231B | Mathematical Physics (Lie Theory) |
| | | | PHYS 242C [†] | Topological Quantum Field Theory |
| | | | PHYS 291 | String Theory Journal Club |
| | | | MATH 229A [†] | Lie Groups and Lie Algebras |
| | | Undergrad | PHYS 140A | Solid State |
| | | | PHYS 199 | Directed Research |
| | | | CSCI 174A | Computer Graphics (JavaScript) |
| | | | JAPAN 1-3 | Elementary Modern Japanese |
| | | | | |

| | | | |
|------------|-----------|-----------|-------------------------------|
| CU Boulder | Graduate | PHYS 5770 | Gravitational Theory |
| | | APPM 6560 | Measure-Theoretic Probability |
| | Undergrad | CSCI 3104 | Algorithms (C++) |
| | | CSCI 4622 | Machine Learning (Python) |

Service & Outreach

Interviews & Press

| | |
|--|----------|
| FUTI Global Leadership Award (announcement TBA) (report TBA) | 8 / 2025 |
| University of Tokyo Research Internship Program (announcement TBA, archive exp. 12/25) | 6 / 2025 |
| Perimeter Institute's PSI START Satellite (announcement) (interview) | 5 / 2025 |

Professional Events Chair, Society of Physics Students, UCLA 5 / 2025 - present

- Organized quarterly talks by faculty, graduate students, and undergraduate student Gong Shows
- Developed extensive resources for summer research opportunities and course planning

Teaching Assistant, UCLA Department of Physics Fall 2024

- Only undergraduate student trained as a Teaching Assistant in UCLA Department of Physics & Astronomy
- TA appointments beginning in 2025

Journal Clubs

Amplitudes Journal Club, UCLA Department of Physics 1 / 2025 - present

- First undergraduate member of this journal club

String Theory Journal Club, UCLA Department of Physics 1 / 2025 - present

- First undergraduate member of this journal club

Plasma Theory Journal Club, UCLA Department of Physics 4 / 2024 - 1 / 2025

- Multiple presentations and analyses of recent high-impact papers to theoretical plasma PhD students and faculty
- Discussed theory and application of novel analytic and machine learning methods presented in the club to current projects in the UCLA Plasma Theory group
- First undergraduate to present in this journal club