

# Nicholas M. Rapidis

## Curriculum Vitae

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## Education

- 2019-present **Stanford University**  
Ph.D. Candidate in Physics. Expected graduation: Spring 2026  
Advisor: *Prof. Kent Irwin*  
M.S. in Physics completed in July 2022
- 2015-2019 **University of California, Berkeley**  
B.A. in Physics. Graduated with High Distinction in General Scholarship and Departmental Honors  
Thesis Title: *Resonant Axion-Photon Scattering and Galactic Searches for Axions*  
Advisor: *Prof. Karl van Bibber*

## Research Experience

- 2020-present **Graduate Research Assistant**, Stanford University  
Advisor: *Prof. Kent Irwin*  
Member of the Dark Matter Radio (DMRadio) collaboration. Lead on the first design and sensitivity estimates of DMRadio- $m^3$ . Lead on DMRadio-50L SQUID readout chain, superconducting sheath design, other hardware components.  
Former lead on SQUID testing for BICEP array
- 2019-2020 **Graduate Research Assistant**, Stanford Institute for Theoretical Physics  
Advisor: *Prof. Savas Dimopoulos*  
Studied phenomenology of dense dark matter axion clumps (oscillons) collisions with neutron stars.  
Set limits on oscillon dark matter abundance.
- 2016-2019 **Undergraduate Research Assistant**, UC Berkeley  
Advisor: *Prof. Karl van Bibber*  
Member of the *Haloscope at Yale Sensitive to Axion Cold Dark Matter (HAYSTAC)* collaboration.  
Co-lead on refurbishment and optimization for cavity used HAYSTAC Phase II. Introduced extensive use of finite element simulation techniques for axion cavity characterization.

## Honors & Awards

- 2022 *Young Scientist Award at Identification of Dark Matter 2022*: One of best three talks (out of 90) given by graduate students and postdocs at the conference.

2019	Phi Beta Kappa
2018-2019	<i>Haas Scholar</i> : Research grant awarded to twenty UC Berkeley undergraduates across all disciplines to conduct research in their senior year.
2017-2018	<i>Berkeley Physics Undergraduate Research Scholar</i>
2016-2019	UC Berkeley <i>Dean's List</i>

## Professional Activities

2023-	Journal Referee: <i>Physical Review Letters</i> , <i>Journal of Low Temperature of Physics</i>
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## Publications & Talks

### Journal Articles

[[INSPIRE PROFILE](#)] [[GOOGLE SCHOLAR PROFILE](#)]

#### PRINCIPAL AUTHOR

- [2] **Electromagnetic modeling and science reach of DMRadio-m<sup>3</sup>**  
A. AlShirawi *et al.* [[arXiv:2302.14084](#)][[INSPIRE](#)]
- [1] **Characterization of the HAYSTAC axion dark matter search cavity using microwave measurement and simulation techniques**  
N.M. Rapidis *et al.* *Review of Scientific Instruments* **90**, 024706 (2019) [[arXiv:1809.02246](#)][[INSPIRE](#)].

#### JOINT PRINCIPAL AUTHOR

- [1] **Resonant Conversion of Dark Matter Oscillons in Pulsar Magnetospheres**  
A. Prabhu and N.M. Rapidis, *JCAP* **10**, (2020) 054 [[arXiv:2005.03700](#)][[INSPIRE](#)].

#### CONTRIBUTING AUTHOR

- [13] **Noise limits for dc SQUID readout of high- $Q$  resonators below 300 MHz**  
V. Ankel *et al.* [[arXiv:2504.20398](#)] [[INSPIRE](#)]
- [12] **Dark Matter Axion Search with HAYSTAC Phase II**  
X. Bai *et al.* *Phys. Rev. Lett.* **134**, 151006 (2025) [[arXiv:2409.08998](#)] [[INSPIRE](#)]
- [11] **Measurements of DC SQUID Damping Effects on Superconducting Resonant Circuits**  
E. C. van Assendelft *et al.* *IEEE Transactions on Applied Superconductivity* **33**, 5, (2023) [[INSPIRE](#)]
- [10] **New Results from HAYSTAC's Phase II Operation with a Squeezed State Receiver**  
M.J. Jewell *et al.* *Phys. Rev. D* **107**, 072007, (2023) [[arXiv:2301.09721](#)][[INSPIRE](#)]
- [9] **Quantum metrology of low frequency electromagnetic modes with frequency upconverters**  
S.E. Kuenstner *et al.* [[arXiv:2210.05576](#)][[INSPIRE](#)]
- [8] **DMRadio-m<sup>3</sup>: A Search for the QCD Axion Below 1  $\mu$ eV**  
L. Brouwer *et al.* *Phys. Rev. D* **106**, 103008, (2022) [[arXiv:2204.13781](#)][[INSPIRE](#)]
- [7] **Introducing DMRadio-GUT, a search for GUT-scale QCD axions**  
L. Brouwer *et al.* *Phys. Rev. D* **106**, 112003, (2022) [[arXiv:2203.11246](#)][[INSPIRE](#)]

- [6] **A Model-Independent Radio Telescope Dark Matter Search**  
A. Keller, *et al.* *Astrophys. J.* **927** (2022) 1, 71. [[arXiv:2112.03439](#)][[INSPIRE](#)]
- [5] **A quantum-enhanced search for dark matter axions**  
K.M. Backes *et al.* *Nature* **590**, 238-242 (2021) [[arXiv:2008.01853](#)][[INSPIRE](#)]
- [4] **An improved analysis framework for axion dark matter searches**  
D.A. Palken *et al.* *Phys. Rev. D* **101**, 123011, (2020) [[arXiv:2003.08510](#)][[INSPIRE](#)].
- [3] **Results from Phase 1 of the HAYSTAC microwave cavity axion experiment**  
L. Zhong *et al.* *Phys. Rev. D* **97**, 092001, (2018) [[arXiv:1803.03690](#)][[INSPIRE](#)].
- [2] **Design and Operational Experience of a Microwave Cavity Axion Detector for the 20-100  $\mu\text{eV}$  Range**  
S. Al Kenany *et al.* *Nuclear Instruments and Methods in Physics Research A* **854** (2017) 11–24. [[arXiv:1611.07123](#)] [[INSPIRE](#)].
- [1] **First Results from a Microwave Cavity Axion Search at 24  $\mu\text{eV}$**   
B.M. Brubaker *et al.* *Phys. Rev. Lett.* **118**, 061302 (2017) [[arXiv:1610.02580](#)][[INSPIRE](#)].

## Talks

### INVITED TALKS

- [2] **Searching for low mass dark matter axions with DMRadio**  
Physics Seminar, Boston University, July 24, 2024, Boston, MA
- [1] **Status of the DMRadio Program**  
*YOUNGST@RS - Shoot for the Stars, Aim for the Axions*, October 4-7, 2022, Virtual.

### CONTRIBUTED TALKS

- [9] **Overview of the DMRadio Series of Experiments**  
*APS Global Physics Summit*, March 16-21, 2024, Anaheim, CA
- [8] **Science reach and electromagnetic modeling of DMRadio- $\text{m}^3$**   
*APS April Meeting 2024*, April 3-6, 2024, Sacramento, CA
- [7] **Science reach and electromagnetic modeling of DMRadio- $\text{m}^3$**   
*Topics in Astroparticle and Underground Physics*, Aug 28-Sep 1, 2023, Vienna, Austria
- [6] **Status of DMRadio 50L and  $\text{m}^3$**   
*Identification of Dark Matter*, July 18-22, 2022, Vienna, Austria
- [5] **Modeling and optimizing DMRadio using an equivalent circuit formalism**  
*APS April Meeting 2021*, April 17-20, 2021, Virtual
- [4] **Electromagnetic sensing below the Standard Quantum Limit: 3 kHz to 300 MHz**  
*APS March Meeting 2021*, March 15-19, 2021, Virtual
- [3] **Characterization of the HAYSTAC dark matter detector cavity: microwave measurement and simulation**  
*APS April Meeting 2019*, April 13-16, 2019, Denver, CO
- [2] **Completion of Phase I and Preparation for Phase II of the HAYSTAC Experiment**  
*14th Patras Workshop on Axions, WIMPs, and WISPs*, June 18-22, 2018, DESY, Hamburg, Germany
- [1] **Application of the Bead Perturbation Technique to a Study of a Tunable 5 GHz Annular Cavity**  
*2nd Workshop on Microwave Cavities and Detectors for Axion Research*, January 10-13, 2017, LLNL, Livermore, CA

## Teaching Experience

Head Teaching Assistant, Stanford University

Spr. 2022     Physics 25 – Modern Physics (Instructor: Kent Irwin).

2021-2022     **Mentor**, Polygence  
                   One-on-one mentoring of high school students on research projects in their pre-collegiate schooling. Projects  
                   topics in dark matter physics and cosmology.

**Teaching Assistant**, Stanford University

Fall 2020     Physics 46 – Heat and Optics (Instructor: Giorgio Gratta).

Spr. 2020     Physics 43 – Electricity and Magnetism (Instructor: Mark Kasevich).

Sum. 2017     **Reader (Grader)**, UC Berkeley  
                   Physics 137A – Quantum Mechanics I

## Skills

### Programming & Software

Languages: *Python, Mathematica, Matlab, LabVIEW*  
 Software: *COMSOL (AC/DC, RF, Heat Transfer), Fusion 360, CST Microwave Studio, KiCad, FastHenry*  
 Other: *L<sup>A</sup>T<sub>E</sub>X*, HTML

### Experimental Tools

Dilution refrigerators, Liquid cryogen dips, Network analyzers, Lock-in amplifiers, Wirebonding, Machine shop skills, 3D printing

### Languages

English (native), Greek (native), German (advanced proficiency)