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Nicholas M. Rapidis

Curriculum Vitae

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Education

2019-present **Stanford University**
Ph.D. Candidate in Physics
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 readout chain, superconducting sheath design, 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 *Haas Scholar*: Research grant awarded to twenty UC Berkeley undergraduates across all disciplines to conduct research in their senior year.

2017-2018 *Berkeley Physics Undergraduate Research Scholar*

2016-2019 UC Berkeley *Dean's List*

Professional Activities

2023- Journal Referee: *Physical Review Letters*, *Journal of Low Temperature of Physics*

Publications & Talks

Journal Articles

[INSPIRE PROFILE] [GOOGLE SCHOLAR PROFILE]

* (**) indicates principal (equal contribution principal) author paper

[15] **Dark Matter Axion Search with HAYSTAC Phase II**
X. Bai *et al.* [arXiv:2409.08998] [INSPIRE]

[14] **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]

[13]* **Electromagnetic modeling and science reach of DMRadio-m^3**
A. AlShirawi *et al.* [arXiv:2302.14084][INSPIRE]

[12] **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]

[11] **Quantum metrology of low frequency electromagnetic modes with frequency upconverters**
S.E. Kuenstner *et al.* [arXiv:2210.05576][INSPIRE]

[10] **DMRadio-m^3: A Search for the QCD Axion Below 1 μeV**
L. Brouwer *et al.* *Phys. Rev. D* **106**, 103008, (2022) [arXiv:2204.13781][INSPIRE]

[9] **Introducing DMRadio-GUT, a search for GUT-scale QCD axions**
L. Brouwer *et al.* *Phys. Rev. D* **106**, 112003, (2022) [arXiv:2203.11246][INSPIRE]

[8] **A Model-Independent Radio Telescope Dark Matter Search**
A. Keller, *et al.* *Astrophys. J.* **927** (2022) 1, 71. [arXiv:2112.03439][INSPIRE]

[7] **A quantum-enhanced search for dark matter axions**
K.M. Backes *et al.* *Nature* **590**, 238-242 (2021) [arXiv:2008.01853][INSPIRE]

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

[5] **An improved analysis framework for axion dark matter searches**
D.A. Palken *et al.* *Phys. Rev. D* **101**, 123011, (2020) [arXiv:2003.08510][INSPIRE].

[4]* **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].

[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 μeV 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 μeV**
B.M. Brubaker *et al.* *Phys. Rev. Lett.* **118**, 061302 (2017) [arXiv:1610.02580][INSPIRE].

Talks

* indicates invited talk

[10]* **Searching for low mass dark matter axions with DMRadio**
Physics Seminar, Boston University. July 24, 2024, Boston, MA

[9] **Science reach and electromagnetic modeling of DMRadio-m^3**
APS April Meeting 2024, April 3-6, 2024, Sacramento, CA

[8] **Science reach and electromagnetic modeling of DMRadio-m^3**
Topics in Astroparticle and Underground Physics, Aug 28-Sep 1, 2023, Vienna, Austria

[7]* **Status of the DMRadio Program**
YOUNGST@RS - Shoot for the Stars, Aim for the Axions, October 4-7, 2022, Virtual.

[6] **Status of DMRadio 50L and 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

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.

Head Teaching Assistant, Stanford University
Spr. 2022 Physics 25 – Modern Physics (Instructor: Kent Irwin).

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: LaTeX, HTML

Experimental Tools

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

Languages

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