

# Nicholas M. Rapidis

## Curriculum Vitae

---

Email: rapidis@stanford.edu  
Website: nicholas-rapidis.github.io

Phone: +1 (510) 847-1414  
Nationalities: USA & EU (Greek)

## Education

- 2019– **Stanford University**  
Ph.D. in Physics  
Member of *DM Radio* collaboration – Adviser: *Prof. Kent Irwin*
- 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* – Adviser: *Prof. Karl van Bibber*
- 2018 **Institute for Quantum Computing, University of Waterloo**  
Attended *Undergraduate School on Experimental Quantum Information Processing* in Summer 2018
- 2011-2015 **Psychiko College High School, Athens, Greece**  
Completed International Baccalaureate Diploma Program in May 2015

## Research Experience

- 2020– **Graduate Research Assistant**, Stanford University  
Advisor: *Prof. Kent Irwin*  
Member of *DM Radio* collaboration. Designing and understanding limitations of *DM Radio*  $m^3$ , the third generation of the experiment with anticipated sensitivity to DFSZ axions.
- 2019-2020 **Graduate Research Assistant**, Stanford Institute for Theoretical Physics  
Advisor: *Prof. Savas Dimopoulos*  
Studied the physics and phenomenology of dense dark matter axion clumps (oscillons) in the context of oscillon-neutron star collisions. Using current sensitivity of radio telescopes, set limits on the abundance of oscillons in galactic dark matter halos in terms of the axion mass and symmetry breaking scale.
- 2016-2019 **Undergraduate Research Assistant**, UC Berkeley  
Advisor: *Prof. Karl van Bibber*  
Member of *Haloscope at Yale Sensitive to Axion Cold Dark Matter (HAYSTAC)* collaboration. Designed and refurbished microwave cavities used in experimental runs. Co-lead on refurbishment and optimization for cavity used in first fundamental physics result to evade the standard quantum limit. Introduced extensive use of finite element simulation techniques for characterization of axion haloscopes.

## Teaching Experience

- 2021 **Mentor**, Polygence  
Mentoring high school students on independent research projects in fields related to dark matter physics and my personal research.
- 2020 **Teaching Assistant**, Stanford University  
Taught two discussion sections for Electricity and Magnetism (Physics 43 – Spring 2020) and two lab sections for Heat and Optics (Physics 46 – Fall 2020).
- Summer 2017 **Reader**, UC Berkeley  
Graded weekly problem sets for Quantum Mechanics I (Physics 137A).

## Honors & Awards

- 2019 Member of  $\Phi\text{BK}$
- 2018-2019 *Haas Scholar*
- 2017-2018 *Berkeley Physics Undergraduate Research Scholar*
- 2016-2019 UC Berkeley *Dean's List*
- 2014 Member of the Greek National Linguistics Team: Attended 12th International Linguistics Olympiad in Beijing, China.

## Publications, Talks, & Conferences

### Peer-Reviewed Journal Articles

#### A quantum-enhanced search for dark matter axions

K.M. Backes, D.A. Palken, S. Al Kenany, B.M. Brubaker, S.B. Cahn, A. Droster, G.C. Hilton, S. Ghosh, H. Jackson, S. K. Lamoreaux, A.F. Leder, K.W. Lehnert, S.M. Lewis, M. Malnou, R.H. Maruyama, N.M. Rapidis, M. Simanovskaia, S. Singh, D.H. Speller, I. Urdinaran, L.R. Vale, E.C. van Assendelft, K. van Bibber, and H. Wang, *Nature* **590**, 238-242 (2021) [[arXiv:2008.01853](#)] [[INSPIRE](#)]

#### Resonant Conversion of Dark Matter Oscillons in Pulsar Magnetospheres

A. Prabhu and N.M. Rapidis, *JCAP* **10**, (2020) 054 [[arXiv:2005.03700](#)] [[INSPIRE](#)].

#### An improved analysis framework for axion dark matter searches

D.A. Palken, B.M. Brubaker, M. Malnou, S. Al Kenany, K.M. Backes, S.B. Cahn, Y.V. Gurevich, S.K. Lamoreaux, S.M. Lewis, R.H. Maruyama, N.M. Rapidis, J.R. Root, M. Simanovskaia, T.M. Shokair, S. Singh, D.H. Speller, I. Urdinaran, K. van Bibber, L. Zhong, K.W. Lehnert, *Phys. Rev. D* **101**, 123011, (2020) [[arXiv:2003.08510](#)] [[INSPIRE](#)].

#### Characterization of the HAYSTAC axion dark matter search cavity using microwave measurement and simulation techniques

N.M. Rapidis, S.M. Lewis, K.A. van Bibber, *Review of Scientific Instruments* **90**, 024706 (2019) [[arXiv:1809.02246](#)] [[INSPIRE](#)].

#### Results from Phase 1 of the HAYSTAC microwave cavity axion experiment

L. Zhong, S. Al Kenany, K.M. Backes, B.M. Brubaker, S.B. Cahn, G. Carosi, Y.V. Gurevich, W.F. Kindel, S.K. Lamoreaux, K.W. Lehnert, S.M. Lewis, M. Malnou, R.H. Maruyama, D.A.

Palken, N.M. Rapidis, J.R. Root, M. Simanovskaia, T.M. Shokair, D.H. Speller, I. Urdinaran, K.A. van Bibber, *Phys. Rev. D* **97**, 092001, (2018) [[arXiv:1803.03690](#)][[INSPIRE](#)].

**Design and Operational Experience of a Microwave Cavity Axion Detector for the 20-100  $\mu\text{eV}$  Range**

S. Al Kenany, M.A. Anil, K.M. Backes, B.M. Brubaker, S.B. Cahn, G. Carosi, Y.V. Gurevich, W.F. Kindel, S.K. Lamoreaux, K.W. Lehnert, S.M. Lewis, M. Malnou, D.A. Palken, N.M. Rapidis, J.R. Root, M. Simanovskaia, T.M. Shokair, I. Urdinaran, K.A. van Bibber, L. Zhong. *Nuclear Instruments and Methods in Physics Research A* **854** (2017) 11–24. [[arXiv:1611.07123](#)] [[INSPIRE](#)].

**First Results from a Microwave Cavity Axion Search at 24  $\mu\text{eV}$**

B.M. Brubaker, L. Zhong, Y.V. Gurevich, S.B. Cahn, S.K. Lamoreaux, M. Simanovskaia, J.R. Root, S.M. Lewis, S. Al Kenany, K.M. Backes, I. Urdinaran, N.M. Rapidis, T.M. Shokair, K.A. van Bibber, D.A. Palken, M. Malnou, W.F. Kindel, M.A. Anil, K.W. Lehnert, G. Carosi, *Phys. Rev. Lett.* **118**, 061302 (2017) [[arXiv:1610.02580](#)][[INSPIRE](#)].

**Conference Proceedings**

**Completion of Phase I and Preparation for Phase II of the HAYSTAC Experiment**

N.M. Rapidis, Contributed to the 14th Patras Workshop on Axions, WIMPs and WISPs, DESY in Hamburg, June 18 to 22, 2018. [[arXiv:1809.05913](#)][[INSPIRE](#)]

**Application of the Bead Perturbation Technique to a Study of a Tuneable 5 GHz Annular Cavity**

N.M. Rapidis (2018), In: Carosi G., Rybka G., van Bibber K. (eds) Microwave Cavities and Detectors for Axion Research. *Springer Proceedings in Physics*, vol 211. Springer, Cham [[arXiv:1708.04276](#)][[INSPIRE](#)].

**Talks**

**Modeling and optimizing DMRadio using an effective circuit formalism**

Abstract submitted for *APS April Meeting 2021*, April 17-20, 2021, Virtual

**Electromagnetic sensing below the Standard Quantum Limit: 3 kHz to 300 MHz**

Abstract accepted for *APS March Meeting 2021*, March 15-19, 2021, Virtual

**Characterization of the HAYSTAC dark matter detector cavity: microwave measurement and simulation**

*APS April Meeting 2019*, April 13-16, 2019, Denver, CO

**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

**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

## **Skills**

### **Programming & Software**

Advanced: *Mathematica*, *CST Microwave Studio*, *L<sup>A</sup>T<sub>E</sub>X*

Intermediate: *Python*, *COMSOL*, *LabVIEW*, *Matlab*

Basic: *HTML*

### **Languages**

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

### **Experimental Tools**

Basic Machine Shop Skills (operating mills, lathes, and drill presses for work on metallic parts),  
Operating and calibrating network analyzers for studies of electromagnetic devices.