

Nashwan Sabti

✉ nsabti1@jh.edu | Google Scholar | 🏠 nnssa.github.io | 📧 NNSSA | 📺 NNSSA | 🐦 @24NashAvenue

Summary

Postdoctoral researcher with a PhD in physics, passionate about advancing computational and theoretical frameworks for addressing challenging problems. Highly skilled in programming, engineering simulations, and analyzing data. Expert in Python, experienced with JAX, PyTorch, and machine learning, and with an 8+ years track record in high-performance computing.

Key metrics: Authored 16 articles with nearly 600 citations, developed 3 codes, supervised 3 PhD students and 2 MSc students, and presented at 28 occasions.

Employment

Horizon Postdoctoral Research Fellow

Johns Hopkins University, USA

RESEARCH FIELD: COSMOLOGY AND ASTROPHYSICS – ADVISOR: PROF. MARC KAMIONKOWSKI

2022 - present

Deeply immersed in the development of frameworks in cosmology and astrophysics, spanning three main directions: **1)** building a multi-probe high-performance Bayesian analysis pipeline tailored to investigate properties of the young Universe, **2)** leveraging state-of-the-art coding and deep-learning techniques to write GPU-accelerated gravity simulations and optimize signal extraction in noisy astrophysical data, and **3)** studying the potential of atomic quantum systems in fundamental physics searches.

Education

PhD in Physics

King's College London, UK

RESEARCH FIELD: COSMOLOGY AND PARTICLE PHYSICS – ADVISOR: DR. DIEGO BLAS

2018 - 2022

Research in fundamental physics, with an emphasis on utilizing cosmological, astrophysical, and laboratory probes to constrain particle physics and cosmological models. Thesis can be found [here](#).

Master of Science in Theoretical Physics

Leiden University, Netherlands

THESIS: “HEAVY NEUTRAL LEPTONS DURING THE BIG BANG NUCLEOSYNTHESIS EPOCH”

2016 - 2018

GPA: 9.0/10 (Cum Laude)

Double Bachelor of Science in Physics and Astronomy

Leiden University, Netherlands

THESIS: “CONSTRAINING COSMOLOGICAL PARAMETERS USING THE CLASS CODE”

2013 - 2016

GPA: 9.0/10 (Cum Laude) in both degrees

Programming

Languages:

- **Python:** Extensive decade-long expertise in writing analysis pipelines and packages, utilizing key libraries such as NumPy, SciPy, Numba, emcee, Matplotlib, PyTorch, and JAX.
- **Mathematica:** 5+ years proficiency in writing scientific software and crosslinking with Python.
- **C++:** Experience in writing C++ code and wrapping within Python to accelerate simulations.

Software:

- **Developer:** pyBBN (package in Python, C++, and Fortran to model the early Universe), GALLUMI (Bayesian analysis pipeline in Python to model galaxies), Cheetah (GPU-accelerated gravity simulation in JAX)
- **User:** CLASS, CAMB, MontePython, PRIMAT, Resonance-DM, Sterile-DM, CalcHEP

Machine learning: Experience in designing, training, and evaluating tailored neural network architectures for supervised and unsupervised learning on astrophysical data. Architectures include multilayer perceptrons, convolutional neural networks, normalizing flows, autoencoders, generative models, and transformers.

HPC: 8+ years expertise in high-performance computing using both CPU and GPU platforms, including experience with tier-1 supercomputers. Proficient in SLURM workload manager and other HPC-specific software tools.

Professional Experience

Referee for Science Journals

The Astrophysical Journal, Physical Review.

Supervision and Teaching

Supervising PhD and MSc students in their research and teaching undergraduate courses.

Seminars and Colloquiums

Organizer of the joint physics and astronomy seminar series at JHU and committee member for STScI colloquiums.

Extracurricular

Project lead for imaging analysis of the Cosmic Horseshoe lensing system using the Isaac Newton Telescope in La Palma.

Outreach

Mentoring of A-level students in the UK as part of the Realising Opportunities program.

Awards and Certificates

Hendrik Casimir Prize

Awarded by the Casimir Research School for best performance during the Master's program in physics.

Young Talent Encouragement Award

Awarded by the Royal Holland Society of Sciences and Humanities for best performance during the first year of the Bachelor's program in physics.

Languages

Fluent: English, Dutch

Intermediate: Arabic

Basic: Russian

References

- **Prof. Marc Kamionkowski** – Bloomberg Center for Physics and Astronomy, Johns Hopkins University, Baltimore, Maryland, USA, kamion@jhu.edu
- **Prof. Julian B. Muñoz** – Department of Astronomy, The University of Texas at Austin, Austin, Texas, USA, julianbmunoz@utexas.edu

Publications

Published

1. S. C. Hotinli, N. Sabti, J. North, and M. Kamionkowski, *Unveiling Neutrino Halos with CMB Lensing*, **Phys. Rev. D** **108**, 103504 [2306.15715].
2. J. B. Muñoz, J. Mirocha, S. Furlanetto, and N. Sabti, *Breaking degeneracies in the first galaxies with clustering*, **MNRAS L. Vol. 526 Iss. 1** pp L47-L55 [2306.09403].
3. N. Sabti, J. B. Muñoz and D. Blas, *New Roads to the Small-Scale Universe: Measurements of the Clustering of Matter with the High-Redshift UV Galaxy Luminosity Function*, **ApJL** **928 L20** [2110.13161].
4. J. Alvey, M. Escudero and N. Sabti, *What can CMB observations tell us about the neutrino distribution function?*, **JCAP** **02 (2022) 037** [2111.12726].

5. J. Alvey, M. Escudero, [N. Sabti](#) and T. Schwetz, *Cosmic Neutrino Background Detection In Large-Neutrino-Mass Cosmologies*, [Phys. Rev. D 105, 063501 \[2111.14870\]](#).
6. [N. Sabti](#), J. B. Muñoz and D. Blas, *GALLUMI: A Galaxy Luminosity Function Pipeline for Cosmology and Astrophysics*, [Phys. Rev. D 105, 043518 \[2110.13168\]](#).
7. [N. Sabti](#), J. Alvey, M. Escudero, M. Fairbairn and D. Blas, *Implications of LUNA for BBN and CMB constraints on MeV-scale Thermal Dark Sectors*, [JCAP 08 \(2021\) A01 \[2107.11232\]](#).
8. A. Boyarsky, M. Ovchinnikov, [N. Sabti](#) and V. Syvolap, *When FIMPs Decay into Neutrinos: The N_{eff} Story*, [Phys. Rev. D 104, 035006 \[2103.09831\]](#).
9. J. Alvey, [N. Sabti](#), V. Tiki, D. Blas, K. Bondarenko, A. Boyarsky, M. Escudero, M. Fairbairn, M. Orkney and J. I. Read, *New Constraints on the Mass of Fermionic Dark Matter from Dwarf Spheroidal Galaxies*, [MNRAS 501 \(2021\) 1, pp. 1188-1201 \[2010.03572\]](#).
10. [N. Sabti](#), J. B. Muñoz and D. Blas, *First Constraints on Small-Scale Non-Gaussianity from UV Galaxy Luminosity Functions*, [JCAP 01 \(2021\) 010 \[2009.01245\]](#).
11. [N. Sabti](#), A. Magalich and A. Filimonova, *An Extended Analysis of Heavy Neutral Leptons during Big Bang Nucleosynthesis*, [JCAP 11 \(2020\) 056 \[2006.07387\]](#).
12. J. Alvey, [N. Sabti](#), M. Escudero and M. Fairbairn, *Improved BBN Constraints on the Variation of the Gravitational Constant*, [Eur. Phys. J.C80.2 \(2020\), p. 148 \[1910.10730\]](#).
13. [N. Sabti](#), J. Alvey, M. Escudero, M. Fairbairn and D. Blas, *Refined Bounds on MeV-scale Thermal Dark Sectors from BBN and the CMB*, [JCAP 01 \(2020\) 004 \[1910.01649\]](#).

Submitted to journal

14. [N. Sabti](#), J. B. Muñoz, and M. Kamionkowski, *Insights from HST into Ultra-Massive Galaxies and Early-Universe Cosmology*, [[2305.07049](#)] (accepted for publication in Physical Review Letters).

White papers

15. *EuCAPT White Paper: Opportunities and Challenges for Theoretical Astroparticle Physics in the Next Decade*, [[2110.10074](#)]. Contributed to the section ‘Astroparticle observables for dark matter’.
16. *Snowmass2021 Cosmic Frontier White Paper: Dark Matter Physics from Halo Measurements*, [[2203.07354](#)]. Contributed to the section ‘Ultraviolet luminosity function probes of dark matter’.