

# Daniel Ariad

Bioinformatics Data Scientist · Physicist

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## Summary

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Experienced Bioinformatics Data Scientist with a strong background in physics, specializing in the analysis of molecular entities in biological fluids. Skilled in applying physics-based methodologies to complex biological problems, with a proven track record in early embryonic development, condensed matter physics, and astrophysics research. Proficient in computer programming and experienced in developing scientific algorithms and machine learning models. Aiming to leverage my interdisciplinary background to advance the development of genetic tests for early disease detection. Holding a Ph.D. from Ben-Gurion University of the Negev, complemented by postdoctoral research at Indiana University Bloomington and Johns Hopkins University.

## Professional Experience

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10/2022 - Present **Bioinformatics Data Scientist**, PrognomiQ Inc, CA, USA

- Formulated a methodology based on fragmentomics and methylation patterns to estimate the proportion of cell-free tumor DNA in liquid biopsies, enhancing early cancer detection capabilities.
- Spearheaded a comprehensive analysis of the company's genomics dataset, assessing the reproducibility of measurements and the detection boundaries of tumor signals.
- Developed an approach to identify tumor related peptides from a library-free data-independent acquisition of proteomics.
- Enhanced predictive models for diagnosing cancer by customizing machine learning algorithms within the scikit-learn framework. The identified cancer biomarkers guide the development of our diagnostic products.

03/2020 - 10/2022 **Postdoctoral Researcher**, Johns Hopkins University, MD, USA

- Identified the basic mechanisms responsible for chromosomal abnormalities in embryonic development and conceived diagnostic tests to detect them.
- Developed machine learning classifiers to distinguish between meiotic and mitotic aneuploidies and to infer sex-specific landscapes of recombination.
- The machine learning classifiers used Bayesian statistical models that I crafted, tailored for extremely low-coverage whole-genome sequencing data from preimplantation genetic testing for aneuploidy.

03/2019 - 03/2020 **Postdoctoral Researcher**, Indiana University Bloomington, IN, USA

- Studied the formation of flat bands in twisted bilayer graphene at low magnetic fields.
- Classified phases of matter and phase transitions in disordered Graphene, using high performance clusters.

10/2013 - 11/2018 **Graduate Researcher**, Ben-Gurion University of the Negev, Beer-Sheva, Israel

- Engaged in cutting-edge research to address fundamental questions in quantum physics, showcasing a capacity for innovative thinking and problem-solving.
- Formulated sophisticated models to study the properties of quantum vortices in topological superconductors, employing path-integral methods and tight-binding models for quantum simulations.
- Demonstrated the ability to articulate complex scientific concepts through high-impact research publications and collaborative projects.

10/2009 - 07/2013 **Masters Graduate Researcher**, Ben-Gurion University of the Negev, Beer-Sheva, Israel

- Conceived numerical methods for studying space plasma dynamics in space, integrating theoretical physics with practical computational applications.
- Built mathematical models and developed algorithms to interpret space observation data from the spacecraft Voyager II, contributing to the understanding of solar wind interactions with the interstellar medium.

## Education

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**PhD in Theoretical Condensed Matter Physics**

Ben-Gurion University of the Negev

10/2013 - 11/2018

Beer-Sheva, Israel

**MSc in Astrophysics**

Ben-Gurion University of the Negev

10/2009 - 07/2013

Beer-Sheva, Israel

## Military Service

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07/2003 - 07/2006 **Sergeant First Class**, Combat Corps, IDF, Israel

- Electro-optic technician. Tested, evaluated, and analyzed EO/IR devices. Performed test planning, day-to-day operation, data analysis, and the preparation of reports.

## Selected publications, Preprints and Patents

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- **Daniel Ariad**, Svetlana Madjunkova, Mitko Madjunkov, Siwei Chen, Rina Abramov, Clifford Librach, Rajiv C. McCoy. “Aberrant landscapes of maternal meiotic crossovers contribute to aneuploidies in human embryos” *Genome Research*. 2024 Jan 1;34(1):70-84, bioRxiv:10.1101/2023.06.07.543910
- **Daniel Ariad**, Rajiv Mccoy, and Manuel Viotti. Patent: “Methods for distinguishing aneuploidies in non-invasive prenatal testing.” Provisional application was filed in the U.S Patent and Trademark Office on 16 December 2022 by Johns Hopkins University.
- **Daniel Ariad**, Rajiv C. McCoy, Manuel Viotti. Patent: “Methods and related aspects for analyzing chromosome number status”. U.S. Patent Application 18/035,811, May 12, 2022
- **Daniel Ariad**, Stephanie M. Yan, Andrea R. Victor, Frank L. Barnes, Christo G. Zouves, Manuel Viotti, Rajiv C. McCoy. “Haplotype-aware inference of human chromosome abnormalities”. *PNAS* November 16, 2021 118 (46), bioRxiv:10.1101/2021.05.18.444721; Appeared on the PNAS cover
- **Daniel Ariad**, Yshai Avishai and Eytan Grosfeld. “How vortex bound states affect the Hall conductivity of a chiral  $p \pm ip$  superconductor”. *Phys. Rev. B* 98, 104511 (2018), arXiv:1603.00840; Appeared on PRB Kaleidoscope
- **Daniel Ariad**, and Eytan Grosfeld. “Signatures of the topological spin of Josephson vortices in topological superconductors”. *Phys. Rev. B* 95, 161401(R) (2017), arXiv:1301.0538
- **Daniel Ariad**, Eytan Grosfeld, and Babak Seradjeh. “On the effective theory of vortices in two-dimensional spinless chiral  $p$ -wave superfluid”. *Phys. Rev. B* 92, 035136 (2015), arXiv:1407.2553
- **Daniel Ariad**, and Michael Gedalin. “The role pickup ions play in the termination shock”. *Journal of Geophysical Research: Space Physics* 118.6 (2013): 2854-2862

## Technical Skills

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**Languages** Python, Julia, Bash, C++, SQL, HTML, CSS, PHP and Assembler.  
**Bioinformatics** cfDNA sequencing, Methylation Sequencing, RNAseq, WGS, WGBS, Single-Cell (10x) and Microarrays.  
**Productivity** Latex, Git, Confluence, Slack, Zoom, JIRA

## Service and Outreach

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2020 - 2024 **Reviewer of manuscripts for Nature Portfolio Journals**, Nature, Nature Communication  
2015 - 2018 **Journal Referee for the American Physical Society**, Physical Review Letters, Physical Review B