Mohammad Javadi Balakan

Experimental Physicist · Quantum Devices · Nanofabrication

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SUMMARY

Experimental physicist with more than a decade of hands-on work taking quantum and semiconductor devices from design and cleanroom fabrication to low-noise cryogenic measurement. Recent work on topological superconductivity in Fe(Te,Se) nanoscale ring devices for fault-tolerant quantum computing. Earlier, CMOS-compatible 2D-material and hybrid organic–silicon optoelectronic devices. Now combining this experience with AI for science and technology.

CORE SKILLS

Device fabrication and structural characterization: cleanroom nanofabrication, process development, electron-beam lithography (EBL), focused ion beam (FIB), scanning electron microscopy (SEM), atomic force microscopy (AFM), reactive ion etching (RIE), Raman and optical spectroscopy, thin film deposition (PVD, e-beam evaporation, CVD, PECVD), 2D materials, wide bandgap oxides, organic semiconductors, topological insulators, and topological superconductors.

Electrical characterization: DC/AC semiconductor parameter analysis (SMU, LCR, etc.), optoelectronic characterization tests (photovoltaic cells, optical detectors/sensors), low-noise/precision measurements (lock-in amplifiers, Atto-sense modules, low-temperature LPFs), cryogenic systems, quantum transport, phase-sensitive magnetic/flux measurements.

Computation, data analysis, and automation: Python, Mathematica, LabVIEW, KLayout (layout/mask design), statistical analysis, instrument automation.

EXPERIENCE

Research Scientist; Postdoctoral Fellow · CNSE, SUNY Albany · Prof. Ji Ung Lee 2022 – 2026

- Built an end-to-end fabrication process for hBN-encapsulated, nanoscale superconducting ring devices (EBL, FIB, RIE, thin-film deposition).
- Upgraded a closed-cycle cryostat and designed cryogenic low-pass filters; automated low-noise, phase-sensitive measurements in Python.
- Demonstrated half-integer flux quantization, coherent edge transport and intrinsic magnetization of the condensate in Fe(Te,Se); 4 first-author papers and preprints.
- Collaborated with Brookhaven National Laboratory, Stony Brook University and NY Creates; invited talks at LPS and the Gordon Research Conference.

Postdoctoral Associate · Department of Physics, University of Tehran 2019 – 2021

- First chemical-vapor-deposition growth of borophene, a one-atom-thick metal for 2D interconnects (ACS AMI, 100+ citations).
- Measured carrier transfer across graphene–silicon junctions (10^6× slower than Au–Si) and derived the 25.5% efficiency limit of graphene/Si solar cells.
- Developed position-sensitive detectors and self-powered photodiodes on PEDOT:PSS/silicon (APL Editor's Pick; 10^6 V/W responsivity).

Visiting Researcher · Sapienza Università di Roma · Prof. Giorgio Parisi (2021 Nobel Laureate in Physics) 2018

Graduate Researcher · University of Tehran; Tarbiat Modares University 2012 – 2019

- Nanostructured solar cells and photodetectors; Monte Carlo and COMSOL modeling of charge transport and plasma growth.

SELECTED PUBLICATIONS

- **M. J. Balakan**, et al., "Intrinsic magnetization of the superconducting condensate in Fe(Te,Se)," *Physical Review B* (Letter), accepted 2026. **EDITORS' SUGGESTION**
- **M. J. Balakan**, et al., "Half-integer winding of order parameter in an iron-based superconductor," submitted (2026).
- **M. J. Balakan**, et al., "Aharonov–Bohm interference from coherent spin-polarized edge transport in Fe(Te,Se) superconducting rings," submitted (2025), arXiv:2508.05030.
- A. Mazaheri, **M. Javadi**, Y. Abdi, "Chemical vapor deposition of two-dimensional boron sheets by thermal decomposition of diborane," *ACS Applied Materials & Interfaces* 13(7) (2021).
- **M. Javadi**, AA. Noroozi, Y. Abdi, "Kinetics of charge carriers across a graphene–silicon Schottky junction," *Physical Review Applied* 14 (2020).
- **M. Javadi**, M. Gholami, H. Torbatiyan, Y. Abdi, "Hybrid organic/inorganic position-sensitive detectors based on PEDOT:PSS/n-Si," *Applied Physics Letters* 112 (2018). **EDITOR'S PICK**

23 publications and preprints · 437 citations · h-index 13 (Google Scholar). Full list at www.mjbalakan.com. Earlier papers under M. Javadi.

EDUCATION

PhD in Solid-State Physics, University of Tehran, Iran	2019
MSc in Nanoscience and Nanotechnology, University of Tehran, Iran	2014
BSc in Physics, Urmia University, Iran	2012

HONORS

Chamran Postdoctoral Fellowship	2020
Outstanding PhD Thesis in Physics (nationwide)	2019
Outstanding PhD Dissertation in Physical Sciences	2019
INEF Graduate Scholarship	2016–2018

TALKS AND SERVICE

Invited talk, Gordon Research Conference (Correlated Electron Systems)	2026
Talk, APS Global Physics Summit	2026
Invited talk, Laboratory for Physical Sciences, College Park, MD	2025

Referee for Physical Review Letters, Applied Physics Letters, 2D Materials, Nanotechnology