

# Thomas Bsaibes, PhD

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## WORK EXPERIENCE

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### Measuring quantum decoherence via gravity using torsional balance

2025 - present

*Postdoctoral Researcher @ NIST with Jon Pratt and Jacob Taylor*

- Characterized two competing pendula designs using optical lever photodiode measurement, analyzed time-series data to determine pendula frequency using FFT signal analysis, then confirmed agreement with theoretical performance model.
- Installed experimental equipment including pendulum in vacuum chamber containing trapped atoms using custom hardware for future tests of quantum decoherence via gravity.
- Demonstrated the viability of torsional balance approach by implementing a real-time operating system that controls the torsional pendulum amplitude using optical feedback and collects the pendulum position data using an optical lever; results to be presented at the 2026 APS Global Summit and a journal publication is under preparation.
- Supported ongoing collaboration between University of Maryland (Jacob Taylor's group), NIST (Jon Pratt's group) and UC Berkeley (Holger Müller's group) through meetings and on-site visits.
- Supervised, trained, and mentored three undergraduate researchers in experimental design, fabrication, and fundamental laboratory skills.

### Established gravity calibration loop

2023 - 2024

*Geodetic Surveyor TS/SCI @ National Geospatial-Intelligence Agency*

- Initiated effort towards a latitude-varying gravity calibration loop to meet the needs of the local survey team and reduce need for travel.
- Identified candidate locations suitable for gravity calibration loop by extending altitude-based calibration sensitivities to a new technical standard for latitude-based methods.
- Coordinated secured site access, placed and geolocated medallions for future calibration expeditions.
- Documented the scientific principles behind absolute gravimetry for geodetic surveyor training purposes.

### Technical support for magnetostriction characterization of novel materials

2022

*Visiting Graduate Researcher @ NHMFL, Los Alamos National Laboratory*

- Conducted magnetostriction experiments using a fiber Bragg grating.
- Cryogenically cooled samples and pulsed with 65 T magnet.
- Supported users during pulsed magnetic field experiments.
- Designed mounting bracket to attach a new camera to a spectrometer.
- Tested new camera by measuring the vibrational modes of an aluminum rod.

### Experimental design to improve sensitivity of short range force measurement

2016 - 2023

*Graduate Experimental Physicist @ Purdue Indianapolis School of Science*

- Designed micro-mechanical oscillator force sensor system.
- Developed lithographic process for manufacturing 20  $\mu\text{m}$  tall fractional cylinder.
- Developed and characterized a capacitive alignment system.
- Simulated the capacitive alignment system to compare with experimental data.
- Mentored undergraduate researchers.

## EDUCATION

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### Ph.D. Physics

Purdue School of Science, Indianapolis IN

Thesis: Short Range Probes to Extensions of the Standard Model

2016 - 2023

### M.S. Physics

DePaul University, Chicago IL

Thesis: A Study of Amorphous and Crystalline Transparent Conducting Oxides' Structures Through Radial-Distribution Functions

2014 - 2016

### B.S. Physics

University of Illinois at Chicago

2010 - 2014

## SKILLS

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Hardware: Optical Feedback Control, Real-Time OS, Lock-in Amplifier, Position Sensitive Detectors, Capacitance Bridge, Scanning Electron Microscope (SEM), Profilometer, FG5-X Gravimeter, Raspberry Pi, Arduino

Fabrication: Greyscale Lithography, Printed Circuit Board (PCB) Design, Milling Machine, Lathe

Software: Toolbox, LabVIEW, COMSOL Multiphysics, MATLAB, CNST Nanolithography, Blender, FreeCAD, EasyEDA, L<sup>A</sup>T<sub>E</sub>X

Languages: Python

## PUBLICATIONS AND PRESENTATIONS

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**T. Bsaibes**, C. Condos, J. Manley, J. Pratt, D. Wilson, and J. Taylor, "Lithographically defined  $\text{Si}_3\text{N}_4$  torsional pendulum", Manuscript Under Preparation.

G. B. González, C. J. Benmore, J. E. Medvedeva, J. S. Okasinski, C. Riegger, O. Medina, M. M. Stulajter, **T. Bsaibes**, G. Cardenas, S. Cone, K. Edlund, M. Osorio, T. Holmes, I. Zhuravlev, B. Bhattarai, D. B. Buchholz, and R. P. H. Chang, "Local structure of zinc-indium-tin oxide films via grazing-incidence x-ray pair-distribution functions and theoretical methods", [Journal of Applied Physics](#) **137**, 115104 (2025).

A. S. Dale, M. Qiu, F. B. Che, **T. Bsaibes**, L. Christopher, and P. Salama, "Towards predicting the success of transfer-based attacks by quantifying shared feature representations", [arXiv:2412.05351](#) (2024).

**T. Bsaibes**, *Absolute gravimetry*, Applied Research Laboratory, 2024.

**T. Bsaibes** and R. Decca, "Analyzing power law extensions of newtonian gravity using differential force measurements", [Metrology](#) **4**, 227–239 (2024).

S. Yazdani, J. Phillips, A. Mosey, **T. Bsaibes**, R. Decca, and R. Cheng, "Study of the long-range exchange coupling in nd-fe-b/ti/fe multilayered structure", [Crystals](#) **14**, 119 (2024).

**T. Bsaibes**, "Short range probes to extensions of the standard model", PhD thesis (Purdue University, 2023).

**T. Bsaibes**, L. Pires, and R. S. Decca, *Macroscopic approach for improving yukawa-like interaction limits*, American Physics Society April Meeting, 2021.

**T. Bsaibes**, L. Pires, D. Czaplewski, D. López, and R. S. Decca, "Toward a better system for short range precision force measurements", [Modern Physics Letters A](#) **35**, 10.1142/S0217732320400027 (2020).

**T. Bsaibes**, L. Pires, A. Modey, S. Yazdani, D. Czaplewski, D. López, and R. S. Decca, *Setting stronger dark sector limits on monopole-monopole and monopole-dipole interactions using cylinders*, GR22/Amaldi 13 Conference, 2019.

**T. Bsaibes**, L. Pires, D. Czaplewski, D. López, and R. S. Decca, *Improving short range gravity limits with cylinders*, American Physics Society April Meeting, 2019.

**T. Bsaibes**, L. Pires, D. Czaplewski, D. López, and R. S. Decca, *Improving short range gravitation limits using cylinders*, Indiana Academy of Science Annual Meeting, 2019.

**T. Bsaibes** and G. B. G. Aviles, *Using radial distribution function to analyze the structure of indium oxide*, Denver X-ray Conference, 2016.

A. W. Schuman, **T. S. Bsaibes**, and M. L. Schlossman, "Microphase formation at a 2d solid-gas phase transition", [Soft Matter](#) **10**, 7353–7360 (2014).

## AWARDS & HONORS

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**School of Science Outstanding Graduate Student Award**

2023

*Awarded*

**SMART Scholarship**

2022

*Awarded*

**Google PhD. Fellowship**

2021

*Nominated*