

Raed Diab

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PROFESSIONAL SUMMARY

Wavefront Sensing (WFS) and Control expert with a Ph.D. in Physics from the University of Florida, specializing in high precision optical alignment for the LIGO gravitational wave detector. Demonstrated a new optical alignment sensing scheme that achieves over 10× noise improvement under 30Hz compared to traditional wavefront sensing. Built and aligned a telescope system to capture images from an electro-optic beam deflector, then characterized, calibrated, and mathematically modeled its response for precision alignment tasks. Developed performance budgets and verification methods, contributing to the development of purpose-built optical subsystems. Proficient in Python and LabVIEW for automated instrument control, data acquisition, and analysis to define calibration and verification procedures and support end-to-end performance assessment of optical instruments and subsystems.

SKILLS

Optics & Photonics: Optical instruments, budgeting and analysis, trade-off analyses, AIT and AIV, imaging systems, telescopes, focal plane subsystems

Programming & Automation: Python, MATLAB, Git, LabVIEW, Zemax FINESSE

Electronics & Hardware: Detector electronics, Alignment control loops, detectors, precision mechanics

Procedures & Documentation: Cleanroom assembly and testing procedures, data reporting, technical presentations

WORK AND PROFESSIONAL RESEARCH EXPERIENCE

Doctoral Research Assistant, University of Florida, Gainesville, Florida

Aug 2020 – Present

- Defined and developed approach to characterize electro-optic devices. Identified agreement with COMSOL modeling at 100%.
- Verified and calibrated the electro-optic beam deflector, achieving alignment accuracy within $\pm 0.5 \mu\text{rad}$ for high-precision optical experiments (animation [here](#))
- Established detailed noise performance budgets for two precision optical alignment schemes, mitigating thermal drift, mechanical vibration, and detector readout noise.
- Automated calibration, characterization, and data acquisition using LabVIEW and Python, increasing measurement efficiency by 70%.
- Managed and maintained a Python data analysis repository, enabling 5+ group members to reduce numerical data handling time by over 50%
- Assessed incoming Ph.D. students in Python-based data analysis and optical measurements, guided progress through regular reviews.

Simulation Fellow, LIGO Collaboration, Pasco, Washington

Apr 2025 – Jun 2025

- Modeled optomechanical effects with Python DSP tools, boosting low-frequency stability accuracy.
- Operated hands-on work with precision positioning systems including motorized stage micrometers, mirrors, and lenses in cleanroom environments.
- Coordinated with optical and mechanical engineers to align AIT plans and requirements, **ensuring** control systems compatibility.

Exchange Researcher, University of Padova, Padova, Italy

May 2024 – Aug 2024

- Modeled optical mode matching for Virgo using Python simulations and alignment diagnostics, with almost 100% agreement with experiments.
- Designed and characterized a proof-of-concept for integrating an electro-optic lens into tabletop optical systems, showcasing innovative experimental design.
- Communicated AIT data analysis results and technical findings in over 10 presentations to our group and 800+ Virgo collaborators worldwide.

Research Assistant, *Miami University*, Oxford, Ohio

Aug 2018 – Jul 2020

- Contributed to simulations of galactic rotation curves using MOND, achieving over 80% results consistent with observed dynamics without dark matter.
- Supported numerical models in Fortran, focusing on high-performance computing and physical accuracy.

Projects

pygator – a Python Package

- Developed and built a Python Package for the research groups LIGO and LISA at the University of Florida
- Maintained the package periodically
- Available on GitHub [here](#)

Personal Website Project

- Built and launched personal website using HTML to showcase research projects.
- Self-taught through online resources.
- Understood the workflow and logic behind websites and DNS.

Leader of Interferometry Simulation Workshop

- Designed and led workshop session to teach FINESSE, Python-based simulations, to LIGO and LISA colleagues. The workshop can be found on my website.
- Ensured technical concepts clearly presented to diverse audiences.

Animation Project

- Developing skills in creating visualization to present scientific ideas easily using Blender. This can be extended to data visualization.

EDUCATION

Doctor of Philosophy in Physics, *University of Florida*, Gainesville, Florida

Dec 2025

- **Dissertation topic:** Investigating a New Alignment and Mode Matching Sensing Schemes for Advanced Gravitational Waves Detectors such as LIGO.
- **Selected awards:** Research Assistant Fellowship (stipend & tuition); Physics Department Travel Award (CLAS); LIGO Scientific Collaboration Fellowship.
- **GPA:** 3.8/4 (US system)

Master of Science in Physics, *Miami University*, Oxford, Ohio

Jul 2020

- **Thesis topic:** The Dynamics of Stars in Dwarf Spheroidal Galaxies Around the Milky Way in the MOND Regime.
- **GPA:** 3.5/4 (US system)

LANGUAGE SKILLS

Languages: Arabic (native); English (fluent); German (B1)