

# JACK LAWRENCE

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Astrophysicist and machine vision engineer looking to outperform the current generation of engineers by applying a physics-based mindset to novel machine learning applications, optical systems, and research.

## SKILLS

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<b>Programming:</b>	C/C++, Python, PyTorch, Tensorflow, Qt, Arduino, L <sup>A</sup> T <sub>E</sub> X, MATLAB, Mathematica, Teach Pendant
<b>Software:</b>	Fusion360, SolidWorks, OnShape, Cin7 Core, <i>mume</i> , Microsoft Office, Google Suite, Atlassian Suite, UpKeep, Notion, Asana, Connected Components Workbench, Adobe Photoshop, waveSharp (RegiStax6), AutoStakkert!3, KStars
<b>Experimental:</b>	Optical Systems, $\gamma$ -Ray Spectroscopy, HPGe Detector Upkeep & Maintenance, Solar Telescope Configuration & Maintenance, Background Subtraction and Signal Tuning, Data Acquisition System Development, NIM/VME System Design, Vacuum and Cryo System Design
<b>Other:</b>	Electrical Fault Diagnosis and Repair, QA Testing, Network Configuration, Computational Image Processing, Signal Tracing, Supervised and Unsupervised ML Construction, Monte Carlo Simulation, Dead-time Measurement, 3D Design and Printing, PLC Configuration

## EXPERIENCE

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### Vision Technician

**Nov 2023 - Present**

UnitX Labs

Santa Clara, CA, USA

- Design end-to-end custom machine vision inspection solutions for manufacturers (auto, battery, cosmetics, etc)
- Build custom mock inspection for 40+ customers, including physical assembly and CAD (SolidWorks, OnShape)
- Test lenses, filters, and wavelengths for optimal image capture
- Train neural networks (AI) for defect detection and dimensional analysis with custom image pre/post-processing scripts
- Create Proof of Concept presentations and Technical proposals detailing project-specific integration
- Build demos to showcase automated machine vision system integrated with robotic arm and PLC integration for tradeshow and customer visits
- Build deep clustering algorithms for improved defect detection and defect labeling assignment with tensorflow
- Configure customized industrial PCs (IPCs), outfit with various storage and processing capacity
- Designed and continually evolve a Test Platform for camera, light controllers, light domes, and IPCs to approve for deployment
- Conduct QA/QC and benchmark tests on all equipment (predeployment and returned malfunctioning items)
- Oversee an inventory management system including initial implementation, receiving, packing, shipping, and returned merchandise
- Write SOPs for POC, inventory, RMA, QC/QA workflows
- Compile RMA and QC information into shared Google sheets and detailed reports
- Establish and cultivate customer relations
- Troubleshooting communication between software, light controllers, and PLCs
- Track time and update project status/information daily
- Assist hardware team in design and rapid prototyping of new equipment and products

### DAQ System Developer - SULI Sponsorship

**May 2023 - Sept 2023**

Lawrence Livermore National Laboratory - Nuclear Criticality Safety Division

Livermore, CA, USA

- Utilized custom neural networks trained with real and simulated data for accurate dead-time corrections and background subtraction
- Developed DAQ system with reduced dead-time and live data-analysis capabilities for spectroscopy, multiplicity measurements, and fission-product yield detection (Lāpaki)
- Configured DAQ software with PLC and irradiated sample transport system for time-synced spectroscopy
- Designed unique experiments with radiation detectors, scintillators and PMTs for DAQ system validation
- Took Cf-252 spectra in vacuum with silicon detector, PMT, and Gd-loaded liquid scintillator
- Took Co-60 spectra with liquid-nitrogen-cooled HPGe clover detector
- Measured coincidence of Na-22 through  $\beta^+$  decay with liquid-nitrogen-cooled HPGe detectors
- Maintained and repaired detectors and vacuum equipment

- Cooled detectors with liquid nitrogen daily to maintain a noise-free signal environment
- Kept detailed notes of all tasks performs to track issues and changes, as well as increase project reproducibility
- Compiled DAQ system development and experiments into a detailed report submitted to the DOE through SULI
- Edit and provide feedback for group research papers and reports
- Attended weekly lectures from research groups around the laboratory

#### **Astronomy Instrumentation Engineer - Undergrad Research**

**Oct 2022 - April 2023**

Morehead Planetarium & Science Center

Chapel Hill, NC, USA

- Stationed and calibrated an H-Alpha telescope on Morehead Planetarium roof-deck for UNC-sponsor stellar research and public education
- Implemented a Raspberry Pi and virtual desktop to remote control batch image capture with KStars
- Implemented AutoStakkert!3 stacking and waveSharp (RegiStax6) wavelet filtering to produce consistently high resolution images
- Designed custom circuitry and servo system for remote telescope etalon tuning
- Built GUI for remote precision etalon tuning
- Built contrast and brightness filters in Photoshop for normalized image enhancement
- Designed telescope enclosure with Fushion360
- Constructed telescope enclosure with servo-controlled hood for protection from the environment
- Built a manual for system operation
- Built and presented my project poster at the UNC 2023 Celebration of Undergraduate Research Symposium

#### **DAQ Software Developer - DSTI Sponsorship**

**May 2022 - Aug 2022**

Lawrence Livermore National Laboratory - Nuclear Criticality Safety Division

Livermore, CA, USA

- Developed DAQ system for Lāpaki and NeutronStars
- Improved detector readout capability through added spectroscopy windows
- Increased DAQ system flexibility to streamline the unification of multi-detector systems
- Cooled detectors with liquid nitrogen daily to maintain a noise-free signal environment
- Built and delivered slide presentation at DSTI Summer 2022 Research Symposium

#### **Bakery Sales and Service Lead**

**Jan 2022 - May 2022, Aug 2022 - Feb 2023**

Great Harvest Bread Co.

Chapel Hill, NC, USA

- Managed opening, midday, and closing shifts, including daily cleaning, register and tip count, ingredient inventory tracking, to ensure a smooth transition between shifts and optimal hygiene
- Prepared bakery and deli ingredients, mixed recipes, kept regular attention ovens, proofers, refrigerators, and freezers in adherence with health codes to deliver fresh goods
- Baked cafe treats in accordance with company standards to ensure repeatability in the product
- Developed a reliable customer base and ensured a positive, welcoming environment for Great Harvest patrons and team members

#### **DAQ Software Developer - Undergrad Research**

**Jan 2021 - May 2022**

Triangle Universities Nuclear Laboratory - LENA & The Tandem Laboratory

Durham, NC, USA

- Developed open-source DAQ software (*mvme*) to improve flexibility and usability for LENA at TUNL
- Performed comparative dead-time tests between mvme and MIDAS nuclear DAQ software
- Constructed efficient, clock-synced data streams from detectors to NIM modules to software
- Assisted a grad student in research with Alpha spectroscopy
- Assisted in designing a small-footprint, electrically isolated vacuum chamber
- Became the TUNL point of contact for modern nuclear DAQ software (*mvme*)
- Presented research and DAQ progress weekly to TUNL board

## **EDUCATION**

**Bachelor of Science, Astrophysics\***, University of North Carolina at Chapel Hill

**Aug 2019 - May 2023**

\*minor in English

## TRAINING & CERTIFICATION

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<b>DOE Certificate of Core Radiological Training</b> Radiation Worker I	<b>May 2021 - May 2025</b>
<b>DOE Certificate of Core Radiological Training</b> Radiation Worker II	<b>May 2023 - May 2025</b>
<b>Machine Learning, Stanford University &amp; DeepLearning.AI (ID RTBETC4ZVQL1)</b> Supervised Machine Learning: Regression and Classification (ID ECE4CZYJPANU) Advanced Learning Algorithms (ID BQMYKWB6MF9B) Unsupervised Learning, Recommenders, Reinforcement Learning (ID FLWZPO1N9WEY)	<b>Jan 2025</b>

## PUBLICATIONS

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- <sup>1</sup> J.Garcia-Duarte, Y. Mishnayot, A. S. Tamashiro, **J. R. Lawrence**, and J. T. Harke, “Innovative dead-time correction and background subtraction for neutron multiplicity measurements using neural networks”, Scientific Reports 14, Available online ([here](#)), 7579 (2024).

## AFFILIATIONS AND VOLUNTEERING

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<b>SF Recreation and Parks Dept. Volunteer Program</b> , Habitat Restoration Volunteer A program where volunteers participate in a wide variety of restoration activities, such as planting and propagating native plants, controlling erosion, and monitoring wildlife habitat.	<b>Apr 2025 - Present</b>
<b>OutLoud Sports</b> , Player, Volunteer An LGBTQ+ sports league that fosters a safe community for queer athletes and hosts charity events for underprivileged members of the queer community	<b>Aug 2023 - Present</b>
<b>Platelet Donor at UNC Hospitals</b> , Volunteer 30+ platelet (and plasma) donations to the UNC Hospital Surgical Center (I was chiefly motivated by emails following my appointments, described the patients who benefited from my donation!)	<b>Oct 2021 - May 2023</b>
<b>UNC Physics Foundations Seminary</b> , External Liaison A student-led organization hosting faculty and guest speakers to teach foundational physics topics, promoting understanding and engagement for both majors and non-majors	<b>Jan 2021 - Jan 2022</b>
<b>UNC Visibility in Physics</b> , Student Member An organization that aims to provide resources, advice, and an encouraging social atmosphere for underrepresented minorities and allies in the field of physics	<b>Jan 2020 - May 2023</b>
<b>UNC Society for Physics Students</b> , Student Member A chapter based society that exists to help students transform themselves into contributing members of the professional Physics community	<b>Jan 2020 - May 2023</b>
<b>UNC Running Club</b> , Member, Travel Coordinator A student-led club affiliated with the National Intercollegiate Running Club Association that connects a community of student runners, providing training and registration resources for affiliate and non-affiliate races	<b>Aug 2019 - May 2023</b>