

# BIJAY SHRESTHA

Physicist | Professor | Data Scientist

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## EDUCATION

### The University of Oklahoma

Ph.D. in Experimental High Energy Physics

Advisor: Michael G. Strauss

Dissertation Topic: "Legacy Analysis of Standard Model Higgs boson in the  $H \rightarrow WW^* \rightarrow \ell^- \bar{\nu}_\ell \ell'^+ \nu_{\ell'}$  decay channel from  $pp$  collisions at  $\sqrt{s}=13$  TeV with the ATLAS detector at the LHC"

Norman, OK

Aug. 2017 – Dec. 2024

### Southeastern Louisiana University

Bachelor of Science in Physics, Minor in Mathematics

Advisor: Hye-Young Kim

Dissertation Topic: "Development of Coarse-Grained Model of Self-assembled Structures of VECAR"

Hammond, LA

Aug. 2013 – May 2017

## RESEARCH INTEREST

Granular convection and segregation in vibrated systems; experimental non-equilibrium physics; pattern formation in granular matter; machine-learning-assisted analysis of experimental data; interdisciplinary applications of granular physics to sustainability; undergraduate-centered experimental research.

## EXPERIENCE

### Visiting Assistant Professor | University teaching, Experimental Design, Python, Data Analytics

Catawba College

Aug. 2025 – Present

Salisbury, NC

- Founded an experimental granular convection research lab, from initial design through data acquisition, while mentoring 3 undergraduate researchers in experimental techniques and data analysis.
- Developed undergraduate research pathways aligned with summer research and REU-style projects.
- Expanded laboratory curriculum to enhance student comprehension of theoretical concepts.
- Collaborated with faculty across departments to promote STEM retention and outreach, reaching over 100 local students through events and open labs.

### Postdoctoral Researcher | Python, C++, TensorFlow, Gitlab, CERN ROOT

European Organization for Nuclear Research (CERN)

Jan. 2025 – Jul. 2025

Remote

- Curated and uploaded datasets to HEPdata by refining scripts and verifying figures; initiated RECAST preservation by collaborating with over 15 groups to identify and package software versions for CERN.
- Streamlined large-scale data analysis workflows for Run 3 Analysis; authored over 3 internal notes; mentored graduate students on Python-based data analysis, version control, ML workflows, and CERN software tools.

### Doctoral Researcher | Python, C++, TensorFlow, Gitlab, CERN ROOT, LATEX

The University of Oklahoma and European Organization for Nuclear Research (CERN)

Aug. 2017 – Dec. 2024

Norman, OK

- **Project 2:** Run 2 Legacy Analysis for Two ggF jets
  - Engineered a data science pipeline to analyze the Run II dataset for an in-depth legacy study on the Higgs boson, contributing to multiple published papers.
  - Implemented and trained Deep Neural Networks (DNN) models using TensorFlow, resulting in a 13.7% reduction of misidentified events.
  - Investigated the correlation between  $P_t^{ll}$  and DNN to assess the model's effectiveness in minimizing sensitivity to the known  $Z_{ll}$  mis-modeling, with findings subsequently adopted by over 10 groups.
- **Project 1:** Cost Optimization of Bjet Triggers
  - Developed and integrated an automated CPU consumption analysis for b-jet trigger algorithms, enabling nightly performance evaluations that reduced processing time by 28% on average.
  - Investigated the impact of 5 tracking parameters on resource consumption by developing Python and C++ scripts, yielding actionable insights in the workflows of 7 analysis teams.

- Identified and resolved critical bugs in the HLT reconstruction code; compiled a comprehensive report to streamline analysis processes for the 7 analysis groups.

## **Instructor of Record**

*The University of Oklahoma*

Aug. 2017 – May 2021

*Norman, OK*

- Taught 4 semesters as primary instructor for calculus-based introductory physics.
- Supervised and trained a team of 5-6 Teaching Assistants on best practices for classroom management, assessment practices, and effective demonstration techniques
- Redesigned entire curriculum for remote learning during the COVID-19 pandemic (Spring 2020), incorporating video lectures, interactive problem-solving sessions, and virtual labs
- Established a feedback loop with over 100 students per semester to identify and resolve recurring issues.

## **Undergraduate Research Assistant | *FORTAN, VMD, GROMACS, Docker***

*Southeastern Louisiana University*

Jan. 2014 – May 2017

*Hammond, LA*

- Processed and analyzed large-scale molecular dynamics (MD) dataset using Hadoop, improving data accessibility and computational efficiency across distributed nodes.
- Wrangled 2TB of MD dataset using SQL to model and visualize the behavior and stability of self-assembled micelles of a novel molecule using LONI supercomputers; published in a peer-reviewed journal.
- Developed a coarse-grained force field for VECAR, containerized with Docker, to enable simulations of the interactions with lipid bi-layer membranes; experimentally validated and used in 3 subsequent studies.
- Mentored three high school students, with one student earning the “Best Research” award for their project.

## **FUNDING & RESEARCH SUPPORT**

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- **Internal College Research Funding (2025)** supporting the establishment of an experimental granular convection research program.

## **UNDERGRADUATE RESEARCH MENTORSHIP**

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- Currently mentoring three undergraduate researchers — Luke Bardinas, Nikita Poliakov, and Christopher Brown, to investigate pattern formation and size segregation in vibrated granular materials
- Guiding students through experimental setup, instrumentation calibration, data acquisition, and introductory data analysis.
- Research projects structured to develop student ownership with accessible entry points and progress toward publication-level outcomes as the program matures.

## **SELECTED HONORS & AWARDS**

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### **Breakthrough Prize in Fundamental Physics, 2025**

Awarded to the ATLAS and CMS Collaborations for the detailed measurements of Higgs boson properties

**Role:** Researcher, ATLAS Collaboration (2017–2025)

### **Provost Certification of Distinction in Teaching, 2020** at The University of Oklahoma

Awarded to graduate students who demonstrated outstanding professional interaction with students and faculty as a graduate teaching assistant.

### **Student Ambassador for College of Science and Technology, 2016** at Southeastern Louisiana University

Awarded to students willing to promote the benefits of experiential learning.

### **Honor Research Scholar, 2017** at Southeastern Louisiana University

A distinction awarded to students who have done more than 2 semesters of research, presented their findings, and written an undergraduate thesis (reviewed by a panel of scholars).

### **Undergraduate Physics Research Award, 2015–2017** at Southeastern Louisiana University

Awarded three times for accomplishments in undergraduate physics research.

### **Norman Higginbotham Scholarship, 2015–2017** at Southeastern Louisiana University

Awarded three times for academic performance and involvement in physics outside of the classroom.

## PUBLICATIONS

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Kim, H. Y., Novak, B. R., Shrestha, B., Lee, S. E., & Moldovan, D., The role of the asymmetric bolaamphiphilic character of VECAR on the kinetic and structural aspects of its self-assembly: A molecular dynamics simulation study. *Colloids and Surfaces A: Physicochemical and Engineering Aspects*, 523, 9–18 (2017)

G. Aad *et al.* [ATLAS], Configuration, Performance, and Commissioning of the ATLAS  $b$ -jet Triggers for the 2022 and 2023 LHC data-taking periods. *JINST* 20 P03002 (2025)

G. Aad *et al.* [ATLAS], Measurements of the Higgs boson production cross-section via ggF and VBF in  $H \rightarrow WW^* \rightarrow \ell^- \bar{\nu}_\ell \ell'^+ \nu_{\ell'}$  with  $140 \text{ fb}^{-1}$  of data collected with the ATLAS detector at  $\sqrt{s} = 13 \text{ TeV}$ , In Preparation.

**Full publication list:** [Google Scholar Profile](#)

## SELECTED TALKS AND PRESENTATIONS

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Jun 15, 2019 | *An Analysis of Vector-like Quark* (oral), US ATLAS Computing CAMPFIRE, Argonne National Laboratory, IL

March 13-17, 2017 | *Coarse-Grained Force Field Development of Novel Bolaamphiphilic Molecules: VOTCA or Martini?* (oral), APS March Meeting, New Orleans, LA

Feb 12-14, 2016 | *Large-scale Computational Study of Biomolecular Self-Assembly Systems: Undergraduate Research* (poster), 14th Annual LBRN Meeting, Monroe, LA

Jan 9-12, 2016 | *Computational Study of Self-Assembly of VECAR in Water* (poster), AAPT Winter Meeting, NOLA

MAR 5, 2015 | *Self Assemblies of Novel Molecule, VECAR* (oral), APS March Meeting, San Antonio, TX

## COURSES TAUGHT

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### **PHYS 2521: General Physics I (Professor), Catawba College**

Introductory physics course covering mechanics, waves, and fluids.

### **PHYS 2522: General Physics II (Professor), Catawba College**

Introductory physics course covering electricity and magnetism, optics, and thermodynamics.

### **PHYS 2514: Physics for Engineering and Science Majors (Instructor of Record), University of Oklahoma**

Introductory physics course covering mechanics, waves, electricity and magnetism, optics, and thermodynamics.

### **PHYS 1311: Physics for Engineering and Science Majors (Instructor of Record), University of Oklahoma**

Experiments in basic law of mechanics and thermodynamics.

### **PHYS 1321: Physics for Engineering and Science Majors (Instructor of Record), University of Oklahoma**

Experiments in basic laws of electricity, magnetism, and optics.

### **PHYS 2203: Introductory Physics III: Modern Physics (Teaching Assistant), University of Oklahoma**

An introduction to and overview of key concepts in contemporary physics, with emphasis on the contrast between classical and modern ways of thinking about the physical universe.

### **PHYS 3043: Physical Mechanics I (Teaching Assistant), University of Oklahoma**

Differential equations based continuum mechanics: Newtonian particle mechanics, driven and damped oscillations, vibrations and waves, and their application to other linear systems, non-linear oscillations, Lagrange's equations.

## SERVICE

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### **Professional Service:**

- ATLAS Collaboration Service Work, CERN (2022-2024): Served on the Inner Detector (ID) performance monitoring team, providing control room shift coverage during LHC data-taking periods.

### **Institutional Service:**

- Academic Planning and Assessment (APA) Committee, Catawba College (2025–present) : Reviewer for Learning Enhancement Progress Reports (LEPR); evaluated departmental learning outcomes, assessment methods, and evidence of student learning.

## OUTREACH AND VOLUNTEER

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### **Conferences for Undergraduate Women in Physics (CUWiP), University of Oklahoma (2019)**

Designed the event website, moderated research talks and panels, and facilitated logistics to ensure a smooth and inclusive experience for all attendees.

**You Be the Chemist, Girl Scout and CaPPS, Southeastern Louisiana University (2013-2017)**

Fielded and inspired students toward science through demonstrations and explanations.

**Science Olympiad, Southeastern Louisiana University (2015 & 2016)**

Facilitated and promoted the University's 2015 and 2016 Regional Science Olympiad environment.

**Volunteer Teacher, Sunlight English Secondary School (2012-2013)**

Taught physics and mathematics to middle and secondary schoolers.

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**PROFESSIONAL DEVELOPMENT**

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**US ATLAS Physics Workshop (2018, 2019)** : Advanced analysis techniques and machine learning applications

**HPC-LSU Workshop (2016)** : Parallel Computing on MPI, OPENACC and OPENMP

**Graduate Teaching Assistant Training (2017)** - Center for Teaching Excellence, University of Oklahoma

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**TECHNICAL SKILLS**

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**Languages:** Python, C++, FORTRAN, Bash, SQL (MySQL, Postgres), MongoDB, SAS, Java, LaTeX, Mathematica

**Developer Tools:** Git, GitLab CI/CD, Docker, Jupyter, VS Code, Mattermost, Jira

**Teaching skills:** Research Supervision, Course Design, Student-Centered Learning, Lab expertise, Conflict Resolution

**Molecular Dynamics skills:** GROMACS, LAMMPS, VOTCA, VMD

**Experimental Skills:** Design & Setup, OpenSCAD, 3D modeling and printing, Arduino, COMSOL Multiphysics, LIGGGHTS

**Data Science Techniques:** Tableau, Hadoop, Spark, Excel, Data science pipeline (wrangling, visualization, statistical modeling, and interpretation), Machine Learning, Statistics, Hypothesis Testing, A/B Testing, Time Series