Bijay Shrestha

Physicist | Professor | Data Scientist

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Education

The University of Oklahoma — Norman, OK
Ph.D. in Experimental High Energy Physics — *Aug. 2017 – Dec. 2024*

Advisor: Michael G. Strauss

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

Southeastern Louisiana University — Hammond, LA
Bachelor of Science in Physics, Minor in Mathematics — *Aug. 2013 – May 2017*

Advisor: Hye-Young Kim

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

Experience

Visiting Assistant Professor | ***University teaching, Experimental Design, Python, Data Analytics*** — Aug. 2025 – Present
Catawba College — *Salisbury, NC*

- Designed and initiated a new granular convection research lab, including selection, installation, and calibration of vibration equipment, high-speed cameras, and tracking tools, while mentoring 2 undergraduate researchers in experimental techniques and data analysis.
- Instructed General Physics courses for over 50 students, integrating demonstration-based and simulation-driven instruction to visualize complex physics phenomena and maintain high student engagement.
- Expanded laboratory curriculum to enhance student comprehension of theoretical concepts.

Postdoctoral Researcher | ***Python, C++, TensorFlow, Gitlab, CERN ROOT*** — Jan. 2025 – Jul. 2025
European Organization for Nuclear Research (CERN) — *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 in advanced analysis techniques and CERN software tools.

Doctoral Researcher | ***Python, C++, TensorFlow, Gitlab, CERN ROOT, LATEX*** — Aug. 2017 – Dec. 2024
The University of Oklahoma and European Organization for Nuclear Research (CERN) — *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 Aug. 2017 – May 2021
The University of Oklahoma *Norman, OK*

- Supervised and trained a team of 5-6 Teaching Assistants on best practices for classroom management.
- Designed and introduced a comprehensive curriculum adapting to remote learning challenges.
- Established a feedback loop with over 100 students per semester to identify and resolve recurring issues.

Undergraduate Research Assistant | ***FORTRAN, VMD, GROMACS, Docker*** Jan. 2014 – May 2017
Southeastern Louisiana University *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.

Selected Honors & Awards

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.

Courses Taught

PHYS 2521: General Physics I (Professor), Catawba College
Introductory physics course covering mechanics, waves, and fluids.

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, introduction to Lagrange's equations.

Technical Skills

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

Publications

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 $H \to WW^* \to \ell^- \bar{\nu}_\ell \ell'^+ \nu_{\ell'}$ with 140 fb^{-1} of data collected with the ATLAS detector at $\sqrt{s}$ = 13 TeV, In Prepartion.

Full publication list: Google Scholar Profile

Selected Talks and Presentations

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, New Orleans, LA

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

Outreach and Volunteer

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.