Suyog Shrestha — Curriculum Vitae

Contact Information

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Positions

Postdoctoral Researcher, The Ohio State University	2014 - Present
Visiting Scholar, Kathmandu University	2017 - Present
Research Assistant, Iowa State University	2011 - 2014
Teaching Assistant, Iowa State University	2007 - 2010
Math Instructor, Shattuck - St. Mary's School (MN)	2006 - 2007

Education

Iowa State University, Ames, Iowa, USA
Ph.D., Experimental Particle Physics, July 2014

Dissertation: "Search for new heavy quarks in proton-proton collisions with the ATLAS detector at the LHC," resulting in a publication: Phys. Rev. D 92, 112007 (2015)
Advisor: Prof. James H. Cochran

Grinnell College, Grinnell, Iowa, USA
B.A., Physics, May 2006

Grants

ICTP University Course Development Grant, Italy (approved)	2020
National Science Foundation US-ATLAS Outreach Grant, USA	2019
ICTP Physics Without Frontiers Outreach Travel Grant, Italy	2019
National Science Foundation US-ATLAS Outreach Grant, USA	2018
Science & Technology Facilities Council Travel Grant, UK	2018
CERN International Relations Travel Grant, CERN	2017
International Centre for Theoretical Physics Travel Grant, Italy	2015
CERN & ICTP Physics Without Frontiers Outreach Grant, CERN & Italy	2015
CERN & ICTP Physics Without Frontiers Outreach Grant, CERN & Italy	2014

Honors/Awards

Outstanding Postdoctoral Mentor Award, The Ohio State University (nominated)	2019
Outstanding Postdoctoral Mentor Award, The Ohio State University (nominated)	2018
Graduate College Teaching Excellence Award, Iowa State University	2009
Richard G. Patrick Outstanding Teaching Award, Iowa State University	2009
Outstanding First Year Teaching Award, Iowa State University	2008
H. George Apostle Outstanding Senior Award in Physics, Grinnell College	2006
First runner-up, Iowa Collegiate Mathematics Competition	2005
International Merit Scholarship, Grinnell College	2003

Teaching Experience

Teaching Assistant, Iowa State University 2007- 2010
Conducted recitations and labs for algebra-based and calculus-based physics courses. Clarified weekly lectures, created conceptual problems and quizzes, graded assignments, quizzes, and lab reports, and proctored exams. Evaluated student performance.

Math Instructor, Shattuck-St. Mary's School 2006 - 2007
Taught introductory and advanced calculus, and compulsory algebra. Supervised students and served on an accreditation gender and diversity committee.

Teaching Assistant, Grinnell College 2003 - 2006
Tutored students in small groups for physics, calculus, and linear algebra. Monitored & assisted students' lab work for general and modern physics courses. Graded assignments & lab reports.

Student Supervision

I have immensely enjoyed working with students. In a big collaboration such as ATLAS, there are several self-contained and well-defined projects to which students can make significant contributions. Below is a list of select students I have supervised and links to their research reports. All of these works have contributed to papers we have published, or will publish.

- Mr. Zhenyu Wu, REU 2019 (in progress) (student at The Ohio State University, USA)
- Mr. Chaosong Chen, REU 2019 (in progress) (student at The Ohio State University, USA)
- Ms. Caeley Pittman, CERN Summer Student 2019, Report Link (student at William Jewell College, USA. Will start as a graduate student at Boston University in Fall 2020.)
- Mr. Roshan Joshi, CERN Summer Student 2019, Report Link (Guest Researcher at The Ohio State University, USA)
- Ms. Rami Dhungana KC, CERN Summer Student 2018, Report Link (Master's student at St. Xavier's College, Nepal)
- Ms. Jessica Sydnor, CERN Summer Student 2018, Report Link (PhD candidate at Western Virginia University, USA)
- Mr. Anthony Ciavarella, REU 2017, Thesis Link (PhD candidate at University of Washington, USA)
- Ms. Kalpanie Liyanage, CERN Summer Student 2017, Report Link (PhD candidate at University of Ruhuna, Sri Lanka)
- Ms. Stephanie Fouts, REU 2016 (graduated from Washington & Lee University, USA)
- Mr. Mahesh Thakuri, CERN Summer Student 2016, Report Link (Master's student at Tribhuvan University, Nepal)
- Mr. Santosh Parajuli, CERN Summer Student 2015, Report Link. I also directed Santosh's master thesis, which he completed from Tribhuvan University, Nepal. CERN Thesis Link (PhD candidate at Southern Methodist University, USA)

In addition, I have also supervised the works of several Ph.D. students during their stay at CERN. Below is a list of select Ph.D. students whose research I supervised and whose theses have been completed.

- Dr. Benjamin Tannenwald, The Ohio State University (Postdoc at the University of Virginia)
- Dr. Nurfikri Norjoharuddeen, University of Oxford (Faculty at the University of Malaya)
- Dr. John Myers, University of Oregon (defended thesis in 2019)

Research Experience

Lead Analyser & Contact Editor: b-jet trigger performance 2017 - Present

I lead the study of the b-jet trigger performance in Run2 LHC data. I coordinate a team of 30 researchers from 17 institutes for a paper expected to be public in 2020 for which I am a paper contact editor.

Analysis Coordinator & Contact Editor: Di-Higgs 1-lepton analysis 2015 - 2019

I was a lead analyser, analysis coordinator, and contact editor of an analysis that searched for pair produced Higgs bosons in $bbWW$ final state. I led a team of 20 researchers from 7 institutes to publish the result in **JHEP 04 092 (2019)**. This is the first result from ATLAS in $bbWW$ channel.

Lead Analyser & Analysis Coordinator: Di-Higgs 2-lepton analysis 2017 - 2019

Building on the success of the 1-lepton channel, I initiated the effort to include the 2-lepton channel. The analysis targeting only the non-resonant SM Higgs pair production in the $bbll + MET$ final state has been submitted to **Phys. Lett. B 801 135145 (2020)**, in which I demonstrated a great improvement in sensitivity to the signal by employing deep neural networks.

Lead Analyser: Detector Simulation 2015 - 2017

I developed the framework for mapping the material distribution in the ATLAS detector using secondary hadronic interactions. This result, published in **JINST 11 11020 (2017)** significantly improved the uncertainties associated with tracking.

Lead Analyser: Charged-particle multiplicities in the ATLAS detector 2015 - 2016
As a lead analyser of the analysis that measured the charged-particle multiplicity in proton-proton collisions, I validated simulated sample and measured the systematic uncertainty on the tracking efficiency. The paper is published in **Phys. Lett. B 758 67 (2016)**.

Analysis Coordinator & Contact Editor: Vector-Like Quark Analysis 2013 - 2015
I was a lead analyser, analysis coordinator, and contact editor of an analysis that searched for pair produced vector-like quarks in the $Hq/Zq/Wq$ final states. Leading a team of 8 researchers from 3 institutes, I improved the previous limit on the mass of the new particle by 350 GeV, and also produced the first result on the mass of a VLQ in the two dimensional plane of BR($Q \to Wq$) versus BR($Q \to Hq$). The analysis was published in **Phys. Rev. D 92, 112007 (2015)**.

Likelihood-based kinematic fitting package 2013 - 2017
I developed a likelihood-based kinematic fitter for reconstruction of top-quark events. I also defined a log likelihood ratio discriminant that distinguishes new, heavy quarks from the main background, top-quarks. In 2017, I supervised a student to derive transfer functions at a higher center-of-mass energy for a kinematic fitting package, extensively used to reconstruct top-quark events in ATLAS.

Colloquia and Seminars

"Higgs Boson as a Tool in the Search for New Physics," Physics Seminar, Washington College, MD, USA, January 2020

"Final Test of the Standard Model," High Energy Physics Seminar, Ohio State University, OH, USA, January 2020

"Higgs Boson as a Probe in the Search for New Physics," Physics Seminar, Marietta College, OH, USA, January 2020

"Higgs Boson as a Probe in the Search for New Physics," Physics Seminar, University of Sussex, UK, April 2019

"Higgs Boson as a Tool to Discover New Physics and New Physicists," Physics Seminar, Grinnell College, Iowa, September 2018

"Arresting God Particle in Kathmandu," Public Seminar, Oxford University, UK, March 2018

"Pushing the Frontiers of Knowledge at CERN's Large Hadron Collider," Physics Colloquium, St. Olaf College, Northfield, MN, USA, September 2017

"Borders and Their Human Impacts Colloquium Series: Science Without Borders at CERN," Public Colloquium, Washington and Lee University, Lexington, VA, USA, September 2017

"Search for Pair Production and Rare Decay of the Higgs Boson With the ATLAS Detector," High Energy Physics Seminar, Iowa State University, Ames, IA, USA, September 2017

"Higgs Boson as a Probe in the Search for Physics Beyond the Standard Model," High Energy Physics Seminar, The Ohio State University, Columbus, OH, USA, September 2017

"Get Inspired: Pushing the Frontiers of Knowledge at CERN," Public Talk, United States Education Fund, Nepal, June 2017

"Taking High Energy Physics to Higher Altitudes," Public Seminar, ETH Zurich, Switzerland, April 2017

"Voyage to the Heart of Matter," Public Colloquium, Kathmandu University, Nepal, January 2016

"Search for New Heavy Quarks at ATLAS," University of Maryland, MD, USA, May 2014

Invited Talks in Conferences & Workshops

"ATLAS results on Di-Higgs," Higgs Hunting, Orsay-Paris, France, July 2019

"Overview of ATLAS Results on Di-Higgs Search in bbVV Channel," Di-Higgs Workshop, Göttingen, Germany, May 2019

"B-tagging trigger signature for Run3," Trigger Workshop 2019, Elba, Italy, May 2019

"Status and Prospect of Run2 Di-Higgs Analyses in $bbWW$ and $WWWW$ Channels," DBL-HBSM Workshop, Annecy, France, November 2017

"Search for Rare and Exotic Higgs Boson Decay Modes and Higgs Boson Pair Production With the ATLAS Detector," ICNFP2017, Crete, Greece, August 2017

"Prospects for the Search of Higgs Boson Pair Production in pp Collisions at $\sqrt{s} = 13$ TeV With the ATLAS Detector," HH Orsay Workshop, Orsay, France, January 2016

"Analysis of Events With b-jets and a Pair of Leptons of the Same Charge in pp Collisions at $\sqrt{s} = 8$ TeV With the ATLAS Detector," PASCOS 2015, Trieste, Italy, June 2015

"Understanding material distribution in the ATLAS inner detector with Run2 data," ATLAS Tracking Plenary, CERN, Switzerland April 2015

"Search for new heavy quarks that decay into a W boson and a light quark," U.S. ATLAS Workshop, Chicago, July 2013

"Search for new heavy quarks that decay into a W boson and a light quark," ATLAS Physics and Performance Week (Exotics Plenary), CERN, May 2013

"Search for New Heavy Quarks at ATLAS," CIPANP 2012, St. Petersburg, FL, USA, May 2012

"Measurement of W boson helicity in top quark decay," APS Prairie, Iowa, November 2009

Leadership

***De facto* National Contact: Nepal @ CERN** 2013 - Present

I worked with the Ministry of Science and the Ministry of Foreign Affairs to accomplish the signing of International Cooperation Agreement with CERN. I coordinated the actions between CERN and researchers from Nepal and contributed to the grant proposal submitted to the European Commission. I work with CERN Education and Outreach to recruit students and teachers from Nepal for training programs.

Organizer: Supercomputing Workshop, Kathmandu University October 2019

I organized a high performance computing workshop at Kathmandu University with 3 guest scientists from CERN and several local scientists. Subsequently, given the available technical expertise and resources, Kathmandu University intends to join the ATLAS collaboration as a technical institute.

Convener: Di-Higgs Kickoff Workshop, CERN February 2019

As a chair of the Di-Higgs search session, I prepared the agenda, invited the speakers, led the discussion, and prepared the summary of the session. As a result, 6 distinct analyses are underway targeting distinct topologies. Each analysis is expected to result in a paper between 2020 and 2021.

Convener: HH Production at Colliders Workshop, Fermilab September 2018

As a convener of the $bbVV$ session, I prepared the agenda, invited the speakers, led the discussion, and prepared the summary of the session. Subsequently, I edited a chapter of the workshop white paper, **arXiv:1910.00012**.

Organizer: SAHEPI Workshop June 2017

I organized the first South Asian High Energy Physics Instrumentation (SAHEPI) Workshop. This was the first of a series of workshops to be held across South Asia to strengthen the region's ties with CERN. Following the workshop, I led a partnership with CERN to establish a high performance computing facility at Kathmandu University, the first of its kind in Nepal.

Education and Outreach

Organizer: Particle Physics Winter School, Kathmandu University December 2018

I organized a Particle Physics Winter School in Nepal in partnership with ICTP (Italy) and US ATLAS Outreach Program of the National Science Foundation (USA). I gave lectures on particle physics to undergraduate students, and led hands-on session to analyse LHC data. I discussed career choices for physics students and reviewed their resumes.

Coordinator: Particle Physics @ CERN, Washington & Lee University 2016 - 2018

As the coordinator for the CERN visit of the spring term particle physics course given at Washington & Lee University, I prepared the visit agenda, gave lectures, invited guest lecturers from various CERN experiments, and moderated scientific and career-related discussions for students.

Organizer: Physics Without Frontiers-Nepal 2014 - 2016
I organized the first (2014-15) and second (2015-16) Physics Without Frontiers programs in Nepal in partnership with ICTP (Italy) and CERN. I gave lectures on particle physics and led hands-on session to analyse LHC data. I also moderated a video conference with scientists in the ATLAS Control Room, and discussed career choices for physics students and reviewed resumes. As part of the program, I visited high schools in rural Nepal, engaged the general public by screening the movie, Particle Fever, and served on the panel discussing the importance of basic science.

Particle Physics Masterclass 2013 - 2016
I moderated video conference from CERN to high schools across the world within the framework of the International Particle Physics Masterclass program. I led the student discussion on the hands-on analysis of LHC data that the students carried out, and discussed career options for physics majors.

Service to Community

Referee: *Journal of Instrumentation (JINST)* 2017 - Present
I review manuscripts on instrumentation in high energy and medical physics.

Member: HPC Steering Committee, Kathmandu University 2019 - Present
I serve on the high performance computing (HPC) steering committee, which drafted the directives and usage policy for the computing facility for university-wide use. I also coordinate between the experts at CERN and the local team to maintain and operate the HPC facility.

Panelist: Roadmap for Sustainable Development, EPFL, Switzerland August 2017
I presented a case for the need to invest in basic science for sustainable development and the immediate need to establish a high performance computing facility in Nepal in order to digitize, collect, preserve, and analyse data on all fronts so as to inform policy-making.

Editorial Board Member: Vector-Like Quark Search 2016 - 2017
I was an editorial board member of an ATLAS analysis that searched for pair-produced vector-like quark in the ZtX final state, resulting in 2 conference notes and a paper, **JHEP 08 052 (2017)**.

Founding Secretary: Youth For Nepal (YFN) 2007 - 2017
I was the founding secretary of Youth For Nepal, a non-profit organization registered in New York. I led a team of over 20 volunteers in fundraising campaigns, and renovated public schools, organized health camps, started computer literacy programs, and established libraries in rural Nepal.

Shifter: Data Quality Shifts in the ATLAS Control Room 2012 - 2016
During data taking periods, I monitored the performance of different sub-systems of the ATLAS detector and the luminosity infrastructure, identified any potential problem, and coordinated among system shifters, ensuring high-quality data for the ATLAS experiment.

Software Developer: Data Production and Software Validation 2009 - 2011
I produced D3PD (flat ntuple) for both Monte Carlo and collision data. I significantly expanded the prototype D3PD validation package and validated the official D3PDMaker software. I investigated codes across different performance groups and documented the D3PD content for collaboration-wide use.

Public Articles/ Interviews

- Sharing CERN with Nepal, Symmetry Magazine
  - https://www.symmetrymagazine.org/article/sharing-cern-with-nepal
- A Career in Quantum Physics, Sujhaab Chautaari
  - https://chautaari.com/career-quantum-physics
- Physics Diplomacy, ICTP News
  - https://www.ictp.it/about-ictp/media-centre/news/2016/2/physicswithoutfrontiersnepal.aspx
- Taking CERN Physics to South Asia, CERN Bulletin

  - https://cds.cern.ch/journal/CERNBulletin/2015/04/News%20Articles/1981524

- Representatives from CERN to Visit W&L, The Columns
  - https://columns.wlu.edu/representatives-from-the-european-organization-for-nuclear-research-to-visit-wl

Selected Peer-Reviewed Publications (Major Contribution)

I am a member of the ATLAS collaboration, which publishes about 100 papers each year. To many of these, I contribute through data-taking operations, trigger performance studies, detector calibration and simulation, and executing other responsibilities. However, below is a list of publications where I have made crucial contributions.

"Search for Higgs boson pair production in the dileptonic WWbb channel in pp collisions at $\sqrt{s} =$ 13 TeV," Phys. Lett. **B801** 135145 (2020). Contribution: Initial Analysis Coordinator, Analyser

"Search for Higgs boson pair production in the $bbWW^*$ final state at $\sqrt{s} = 13$ TeV with the ATLAS detector," JHEP **04** 092 (2019). Contribution: Lead Analyser, Analysis Coordinator, Paper Contact Editor

"Search for Higgs boson pair production in the $WW^{(*)}WW^{(*)}$ decay channel using ATLAS data recorded at $\sqrt{s} = 13$ TeV," JHEP **05** 124 (2019). Contribution: ATLAS Higgs-group designated reviewer

"Search for pair production of vector-like top quarks in events with one lepton, jets, and missing transverse momentum in $\sqrt{s} = 13$ TeV pp collisions with the ATLAS detector," JHEP **08** 052 (2017). Contribution: Editorial Board Member

"Measurement of the material of the ATLAS Inner Detector using Run-2 data from the LHC," JINST **11** 11020 (2017). Contribution: Lead Analyser

"Charged-particle distributions in $\sqrt{s} = 13$ TeV pp interactions measured with the ATLAS detector at the LHC," Phys. Lett. **B758** 67 (2016). Contribution: Analyser

"Search for pair production of new heavy quarks that decay into a W boson and a light quark in pp collisions at $\sqrt{s} = 8$ TeV with the ATLAS detector," Phys. Rev. **D92** 112007 (2015). Contribution: Lead Analyser, Analysis Coordinator, Paper Contact Editor

Selected Analyses in Preparation for Peer-Reviewed Publications (Major Contribution)

"Search for Higgs boson pair production in the final state with 2 b-quarks, 2 charged leptons, and missing transverse energy at $\sqrt{s} = 13$ TeV with the ATLAS detector," Contribution: Lead Analyser

"Search for Higgs boson pair production in the $bbVV^*$ final state with 0 or 1 charged lepton at $\sqrt{s} = 13$ TeV with the ATLAS detector," Contribution: Lead Analyser

"Performance of the ATLAS b-jet trigger in pp collisions at $\sqrt{s} = 13$ TeV," Contribution: Lead Analyser, Paper Contact Editor

Selected ATLAS Public Notes (Major Contribution)

Conference notes and other documents published by the ATLAS collaboration are subject to a high level of peer-review within the collaboration, and signed off by collaboration-designated responsible persons who represent almost 3000 authors. These are the notes in which I have made major contributions.

"Higgs boson pair production at colliders: status and perspectives," arXiv:1910.00012, Contribution: Editor

"Measurement of the ATLAS b-jet trigger efficiency in 2017 data," ATL-COM-DAQ-2019-077, Contribution: Lead Analyser

"Search for pair production of vector-like top partners in events with one lepton and an invisibly decaying Z boson at $\sqrt{s} = 13$ TeV pp collisions at the ATLAS detector," ATLAS-CONF-2017-015 (2017). Contribution: Editorial Board Member

"Search for pair production of vector-like top partners in events with exactly one lepton, at least four jets and large missing transverse momentum ,"ATLAS-CONF-2016-101 (2016). Contribution: Editorial Board Member

"Studies of the ATLAS Inner Detector material using $\sqrt{s} = 13$ TeV pp collision data," ATL-PHYS-PUB-2015-050 (2015). Contribution: Lead Analyser

"Charged-particle distributions in $\sqrt{s} = 13$ TeV pp interactions measured with the ATLAS detector at the LHC," ATLAS-CONF-2015-028 (2015). Contribution: Analyser

Search for 4th Generation Quarks with the ATLAS Detector at the LHC," S. Shrestha, AIP Conference Proceeding, 1560 (2013), Author