

Sadman Ahmed Shanto

BUDDING PHYSICIST · ASPIRING MATHEMATICIAN · ARDENT PROGRAMMER

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Education

University of Southern California (USC)

Los Angeles, USA

DOCTOR OF PHILOSOPHY (PHD) IN PHYSICS

2021 – 2026

Texas Tech University (TTU)

Texas, USA

BACHELOR OF SCIENCE (BSc) IN APPLIED PHYSICS

2017 – 2021

- Minors: *Computer Science* and *Mathematics*
- Applied Physics Concentration: *Quantum Information and Computation*

Peer Review publications

1 CHALLENGES OF MICROSIMULATION CALIBRATION WITH TRAFFIC WAVES USING AGGREGATE MEASUREMENTS

2021

SA Shanto, G Gunter, DB Work, R Ramadan, B Seibold

2021 Transportation Research
Board Annual Meeting

2 HIGH-RESOLUTION MUOGRAPHY USING A PROTOTYPE PORTABLE MUON TELESCOPE

2020

R Perez, SA Shanto, M Moosajee, & S Cano

Journal of Undergraduate
Reports in Physics

3 MACHINE LEARNING APPLICATIONS IN MUON TOMOGRAPHY

in prep.

SA Shanto, S Cano, K Binu, M Howard, C Gabriel, C Moreno, V Bradley

4 DRIVE LIKE ANTS: DESIGN AUTONOMOUS VEHICLE BEHAVIORS IN HETEROGENEOUS TRAFFIC FLOW

in prep.

SA Shanto, J Li

Employment

Levenson-Falk Lab (LFL)

Los Angeles, CA, USA

GRADUATE RESEARCH ASSISTANT

Jan. 2022 - Present

- Advisor: Eli Levenson-Falk PhD.

University of Southern California

Los Angeles, CA, USA

TEACHING ASSISTANT

Aug. 2021 - May 2022

- Mentored and led 36 undergraduate engineering students for the lab section for the "Fundamentals of Physics II: Electricity and Magnetism" course

Advanced Particle Detector Laboratory (APDL)

Lubbock, TX, USA

UNDERGRADUATE RESEARCH ASSISTANT

Nov. 2018 - Aug. 2021

- Led a team of 3 Summer Interns to use Machine Learning to develop auto-focus, depth perception and non-linear Filtered Back Propagation algorithms in the field of Muon Tomography
- Developed a Neural Network Architecture (Asymmetric Deep Mixture Density NN) that predicts muon hit locations from photon time propagation with a 87% accuracy
- Designed a 3D reconstruction algorithm that uses CNN's to approximate a binary focus metric and dynamic k-means clustering with Image Segmentation and homomorphic transforms
- Designed and implemented Monte Carlo simulations (Geant4, ROOT) and wrote fully automated analysis programs (python) to test experimental data integrity, assess theorized designs and measure telescope efficiency
- Conducted Monte Carlo studies on the scattering/absorption behaviour of muons and the consequent effects in image quality
- Refactored and deployed all software used by the lab on our university's High Performance Computing (HPC) Cluster
- Engineered the calibration and installation of 40 SiPM's (Phase 1) and 44 PMTs (Phase 2) on the telescopes
- Facilitated the design of custom PCB's (kiCAD, LTspice) and designed (CAD and CNC machines) custom Winston Cone light collectors for increased optical transmission from Scintillators to SiPM array
- Supervisors: Shuichi Kunori, PhD. & Nural Akchurin, PhD.

Texas Tech University

Lubbock, TX, USA

TEACHING ASSISTANT, "Introduction to Quantum Information and Computation (QIC)"

Aug. 2020 - Dec. 2020

- Delivered supplemental lecture notes and interactive jupyter notebooks to teach quantum computing through the use of IBM's qiskit
- Prepared bi-weekly computational assignments on the implementation of various Quantum Information and Computing topics
- Helped students with their problems during office hours each week
- Graded both computational and theoretical/mathematical assignments for the 25+ students enrolled in the course
- Assisted and collaborated with the students in their semester research project
- Materials covered: *qiskit API, single and multi qubit systems, statevector evolution, superposition and entanglement, quantum circuit model, quantum teleportation, Deutsch's algorithm, Deutsch-Jozsa Algorithm, Grover's Algorithm, Bernstein-Vazirani algorithm, VQE, and Jordan's Algorithm*
- Supervising Professor: Ismael Regis de-Farias, PhD.

Texas Tech Multidisciplinary Research in Transportation (TechMRT)

Lubbock, TX, USA

UNDERGRADUATE RESEARCH ASSISTANT

Jan. 2019 - Jun. 2020

- Developed an open source analysis and simulation software for studying various heterogeneous traffic flow of Human Driven (HVs) and Autonomous Vehicles (AVs)
- Designed and tested various AV models for efficient shared lane mobility in multi-lane networks using a novel approach based on the Nagel-Schreckenberg Cellular Automaton Model
- Observed and explained intelligent herding phenomena in certain regimes of heterogeneous traffic flow in a journal paper
- Incorporated Reinforcement Learning functionality to the simulation and analysis software
- Supervisor: Jia Li, PhD.

TECHniques Center

Lubbock, TX, USA

STEM PEER TUTOR

Jan. 2018 - May 2019

- Provided course-specific tutoring to undergraduate students with documented evidence of learning disabilities
- Received Level 2 International Tutor Certification from College Reading & Learning Association (CRLA)
- Documented over 670 hours of student tutoring while maintaining federal confidentiality guidelines
- Courses tutored: *Physics I and II, Calculus I and II, Circuits I, Object Oriented Programming, Wind Energy, Linear Algebra, Advanced Calculus, Differential Equations, Combinatorics and Statistics*

TexPREP (Prefreshman Engineering Program) Lubbock

Lubbock, TX, USA

COURSE INSTRUCTOR

May 2019 - Jul. 2019

- Taught advanced programming principles - data types, variables, control flow theory, compilers, loops, animation, game design, booleans, discrete numerical analysis - to middle school students on MIT's Scratch IDE.
- Administered the after-school tutoring program by leading and training a group of Assistants.

Internships

Institute for Software Integrated Systems (ISIS), Vanderbilt University

Nashville, TN, USA

SUMMER RESEARCH INTERN

Jun. - Aug. 2020

- Designed computationally efficient models for various microscopic traffic simulations using a system written in C++, Python, Bash and XML
- Contributed to developing a computational framework (Flow by UC Berkeley) for deep RL and control experiments for traffic microsimulation
- Established an objected oriented system for calibrating results from stochastic simulations under multi-objective methods using gradient free algorithms
- Incorporated Ray to the software package to parallelize the simulations resulting in massive speedup of running simulation experiments
- Developed scripts to convert microscopic data from the Intelligent Driver Model (IDM) to RDS/radar style data
- Implemented various non-trivial optimization routines to fit simulation data to macroscopic RDS data sets
- Studied the various challenges of Microsimulation Calibration with Traffic Waves using Aggregate Measurements and co-authored a conference paper
- Supervisors: Daniel Work, PhD. & George Gunter (PhD Candidate)

Virtual-Thermal-Fluids LLC

Lubbock, TX, USA

BUSINESS DEVELOPMENT INTERN

Aug. - Dec. 2019

- Conducted primary market research for commercialization of our consultation services for a National Science Foundation-funded program
- Developed data-driven strategies to explore emerging markets by implementing Web Scraping algorithms in Python with BeautifulSoup and creating visualizations using Tableau
- Prepared and led presentations to pitch our company raising \$50000 in series A funding

Seminars, Poster Presentations & Conference Talks

2021	American Physical Society April Meeting , <i>Machine Learning in Muon Tomography Talk</i>	Online
	Physics Departmental Colloquium , <i>Dancing in the "Muon" light</i>	Lubbock, USA
	University Research Conference, TTU , <i>Economic Impact of Quantum Computers</i>	Virtual
	SPS and Women In Physics (WiP) Programming Principles , <i>speaker</i>	Lubbock, USA
	SPS and Women In Physics (WiP) Programming Principles , <i>speaker</i>	Lubbock, USA
2020	SPS and Women In Physics (WiP) Introduction to Programming , <i>speaker</i>	Lubbock, USA
	Departmental Poster Competition, Department of Physics and Astronomy, TTU	Lubbock, USA
	Quantum 2020 (Institute Of Physics) Virtual Conference , <i>Analysis of VQE Regimes in NISQ Era</i>	Virtual
	Summer Showcase! at the Institute for Software Integrated Systems	Tennessee, USA
	International Symposium on Transportation Data and Modeling (ISTDM) , <i>postponed</i>	Michigan, USA
	TTU Undergraduate Research Conference , <i>Muon Tomography Talk</i>	Virtual Conference
	TTU Undergraduate Research Conference , <i>Autonomous Vehicle Model Poster</i>	Virtual Conference
2019	Far West Section of American Physical Society (FWSAPS), Stanford University	Stanford, USA
	Texas Section of American Physical Society (TSAPS)	Lubbock, USA
	Departmental Poster Competition, Department of Physics and Astronomy, TTU	Lubbock, USA
	International Conference for Physics Students 2019, University of Köln	Köln, Germany
2018	Undergraduate Colloquium: Programming Principles , <i>SPS TTU</i>	Lubbock, USA

Honors & Awards

2021 – 2026	University of Southern California Dornsife College of Arts, Sciences and Letters Graduate Fellowship	Los Angeles, CA, USA
2017 – 2021	Texas Tech University Presidential Scholarship	Lubbock, TX, USA
2017 – 2021	Dean's Honor List , <i>TTU</i>	Lubbock, TX, USA
2021	Best Talk in <i>Economic Impact</i> , <i>Undergraduate Research Conference, TTU</i>	Lubbock, TX, USA
2021	Best Virtual Presentation in <i>Economic Impact</i> , <i>Undergraduate Research Conference, TTU</i>	Lubbock, TX, USA
2020	Certification of Quantum Excellence , <i>IBM Qiskit</i>	International
2020	TrUE Undergraduate Scholar Project Fund , <i>Center for Transformative Undergraduate Experiences, TTU</i>	Lubbock, TX, USA
2020	Second Place for Best Undergraduate Presenter , <i>Department of Physics and Astronomy, TTU</i>	Lubbock, TX, USA
2020	C.C. Schmidt and Alma K. Schmidt Award in Physics , <i>Physics and Astronomy Department, TTU</i>	Lubbock, TX, USA
2018-2019	Bucy Undergraduate Scholarship Physics Award , <i>Physics and Astronomy Department, TTU</i>	Lubbock, TX, USA
2018-2019	Raiders Who Rock: Pursuit of Excellence Award , <i>Office of Engagement and Transition, TTU</i>	Lubbock, TX, USA
2019	Outstanding Student Presenter , <i>Texas Section of APS</i>	Texas, USA
2019	Best Poster Presenter , <i>Department of Physics and Astronomy, TTU</i>	Lubbock, TX, USA
2019	Certified Tutor, Level II , <i>College Readiness and Learning Association (CRLA)</i>	International
2019	Honorable Mention: Best Undergraduate Poster Presenter , <i>Far West Section of APS, Stanford University</i>	Stanford, CA, USA
2019	TrUE Undergraduate Scholar Project Fund , <i>Center for Transformative Undergraduate Experiences, TTU</i>	Lubbock, TX, USA
2019	TrUE Travel Funds Award , <i>Center for Transformative Undergraduate Experiences, TTU</i>	Lubbock, TX, USA
2018	Silver Medal , <i>University Physics Competition (UPhysC)</i>	International
2017	Gangapadhya Physics Scholarship Award , <i>Department of Physics and Astronomy, TTU</i>	Lubbock, TX, USA
2017	Glen Mann Physics Scholarship Award , <i>Department of Physics and Astronomy, TTU</i>	Lubbock, TX, USA

Projects

Senior Capstone Project: Quantum Optimization Algorithms

Lubbock, TX, USA

RESEARCH PROJECT

Apr. 2020 – May 2021

- Conducting research work done under the supervision of Dr. Ismael Regis de-Farias in collaboration with National Laboratory of Scientific Computing (LNCC) of Brazil
- Implemented methods to calculate Hilbert-Schmidt-Product and decompose any given square matrix into sum of Pauli matrices
- Created a computational framework for testing Variational Quantum Eigensolver (VQE) Algorithms
- Initiated a study to explore the dynamics of changing each component - *Hermitian matrix type, variational form, circuit depth* and *optimizer* - used in the VQE routine by conducting sensitivity analyses on two performance metrics – time taken to solve the problem and accuracy of the solution
- Contributed to the development efforts of NEBLINA - a Quantum Random Walk Simulator Software Suite

Setting Up Kim Lab and FDTD Analysis of Silicon Carbide (SiC) Permittivity

Lubbock, TX, USA

RESEARCH PROJECT

Nov. 2019 – Apr. 2020

- Collaborated with University of Texas, Rio Grande Valley to conduct experiments and record the permeability value of SiC
- Verified the recorded data by simulating a 2D FDTD implementation of the experimental condition
- Volunteered in setting up Kim lab for Infrared optics & polarimetry for novel quantum system and nanostructures
- Supervisor: Myoung-Hwan Kim, PhD.

Geometric Optics: Modelling Scalar Irradiance of light sources under water

Lubbock, TX, USA

RESEARCH PROJECT

Aug. 2018 – May. 2019

- Assisted Masud (Math PhD candidate) with his thesis by accepting to take on one of his problems as my project
- Created a mathematical model for the downwards scalar irradiance of light from first principles
- Discovered that the derived model is exponentially more accurate than the traditional model of Lambert-Beer at optical densities greater than 0.4 in the context of water bodies.

Web Application for a Health Care System

Lubbock, TX, USA

ACADEMIC PROJECT: Software Engineering 1

Sept. 2020 – Present

- Developed the static model for the healthcare system
- Documented the interaction model that depicts objects participating in each use case and the sequence of interactions among the objects
- Designed database tables to store information about appointments, patient charts, payments, and reports in the healthcare system.
- Implemented the program in JAVA using XXX libraries

Design and Implementation of AI used in Bang! The Dice Game

Lubbock, TX, USA

ACADEMIC PROJECT: Object Oriented Programming

Apr. 2020 - May 2020

- Utilized ideas of Probabilistic State Vectors and Unitary Evolutions from Quantum Mechanics to model AI behavior for Bang! the Dice Game
- Implemented concepts Markov Decision Processes (MDP) to simulate AI gameplay with a Human user
- Documented, debugged and conducted various test cases to ensure AI reliability and robustness

Dynamics of a laser propelled nanocraft on a fly by mission to Proxima Centauri B

Lubbock, TX, USA

PHYSICS COMPETITION PROJECT

Nov. 2018

- Modelled the design and trajectory needed for a light sail propelled nanocraft to the nearest star system Alpha Centauri in order to perform a flyby of Proxima Centauri b subject to various constraints defined by the University Physics Competition Committee
- Co-authored a research paper addressing the problem under 48 hours as per the guidelines of the competition
- Won the Silver Medal for our efforts

Technological Skills and Languages

Human Spoken Languages

Bengali (native), English (bilingual), Hindi (intermediate), Urdu (intermediate)

Programming

Python, C++, C, JAVA, Mathematica, Matlab, R, Julia, Bash, TeX, Dart, Swift

Operating System

MAC OS, Linux, Raspbian, Windows 10

Data Analysis

Numpy, Scipy, SymPy, Matplotlib, Ray, Vaex, Modin, Pandas, StatsModels, Seaborn, BeautifulSoup

Machine Learning

Tensorflow, Keras, SciKit Learn, Pytorch, Open AI Gym

Quantum Computing

Qiskit, PyQuil, PennyLane, Microsoft QDK, Forest SDK

High-Energy/Particle Physics

CERN Geant4, CERN Root, PyROOT, CAMAC System Analysis

Digital Electronics

LTspice, Vivado Design Suite, KiCad

Microcontrollers

Arduino, Raspberry Pi, Basys 3, Iconikal Rockchip RK3328

3D Modelling

Inventor, Blender

Database

SQLite, MySQL

Management

Git, Yarn/NPM, Apache

Web

HTML, CSS, JavaScript, nodeJS, Flask

Leadership & Involvement

Sigma Pi Sigma Physics Honor Society

MEMBER

North America

2020-Present

American Physical Society (APS)

MEMBER

North America

2019-Present

PrivaC Female Only Virtual Hackathon

TEAM MENTOR

Bangladesh

2020

RaiderHacks

MEMBER AND REPRESENTATIVE

Texas, USA

2019

National Science Foundation (NSF) Regional Innovation Corporations (I-Corps) Program

ENTREPRENEURIAL LEAD

Texas, USA

2019

Free Market Institute

MCLANE POLITICAL ECONOMY SCHOLAR

Texas, USA

2018 - 2019

College of Arts & Sciences, TTU

STUDENT AMBASSADOR

Lubbock, USA

2018-2019

Society of Physics Students (SPS)

PUBLIC RELATIONS OFFICER (TTU CHAPTER) & MEMBER

Lubbock, USA

2017-2019

The Quark Newsletter, SPS

OFFICER IN CHARGE

Lubbock, USA

2018-2019

Alpha Lambda Delta & Phi Eta Sigma Honor Society (ALD/PES)

SOCIAL COORDINATOR OFFICER (TTU CHAPTER)

Lubbock, USA

2018-2019

Undergraduate Colloquium Series, SPS

INITIATOR AND ORGANIZER

Lubbock, USA

2018

Red Raider Orientation, TTU

ORIENTATION CREW LEADER

Lubbock, USA

2018

Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)

VICE PRESIDENT (TTU CHAPTER), RECRUITMENT CHAIR & MEMBER

Lubbock, USA

2017-2018

Training

Summer schools

Sept. 2020	Summer School on Machine Learning and Big Data with Quantum Computing (SMBQ), University of Porto & Polytechnic Institute of Porto	Virtual
Jun. - Aug. 2020	Lunch and Learn Lecture Series, Cyber-Physical Systems Virtual Organisation (CPS VO)	Tennessee, USA
Jul. 2020	Qiskit Global Summer School, IBM	International

Workshops

In Process	ALD Leads Certified: Leadership Program, Alpha Lambda Delta Honor Society	Virtual
Nov. 2020	Quantum Week of Fun, Cambridge Quantum Computing	Virtual
Sept. 2020	Introduction to Parallel Computing, TTU High Performance Computing Center (HPCC)	Texas, USA
Sept. 2020	Basic Programming for Quantum Machine Learning, National Institute for Theoretical Physics	Virtual
Virtual	A Progress Report from the Wolfram Physics Frontier, Neural Engineering Research Venture (NERV)	
Jul. 2020	Cybersecurity Basics Training, TTU	Texas, USA
Jun. 2020		
Nov. 2019	Career in Physics Workshop, Stanford University	California, USA
Oct. 2020	Customer Discovery and the Business Model Canvas for STEM innovations, TTU Innovation Hub	Texas, USA
Oct. 2018	Red Raider Startup Program, TTU Innovation Hub	Texas, USA

Outreach & Community Service

2020 - Present	Training and Professional Development Workshops, WiP	<i>Lubbock, TX, USA</i>
2018 - Present	Volunteering for Wheelchair Dodgeball Events, South Plains Adaptive Recreation Club	<i>Lubbock, TX, USA</i>
2018-2019	Trick or Treat: Science Demonstration, SPS	<i>Lubbock, TX, USA</i>
2019	Physics Department Annual Banquet Organizing, SPS	<i>Lubbock, TX, USA</i>
2019	Physics Department Representation at Major and Minor Fair	<i>Lubbock, TX, USA</i>
2019	Research Carnival Presentation, APDL	<i>Lubbock, TX, USA</i>
2019	College of Arts & Sciences Events, Student Ambassador	<i>Lubbock, TX, USA</i>
2017 - 2019	Multiple Fund Raisers, SPS	<i>Lubbock, TX, USA</i>
2018-2019	Multible Member Social Events, ALD/PES	<i>Lubbock, TX, USA</i>
2018-2019	Study Hall Monitoring and Organizing, ALD/PES	<i>Lubbock, TX, USA</i>
2017 - 2018	Volunteering at the Science Spectrum and OMNI Theatre, SACNAS	<i>Lubbock, TX, USA</i>
2017 - 2018	Astronomy Day at the Moody Planetarium, SPS	<i>Lubbock, TX, USA</i>
2018	Fund Raiser at Top Tier Catering, SACNAS	<i>Lubbock, TX, USA</i>
2018	Undergraduate Colloquium Organizing, SPS	<i>Lubbock, TX, USA</i>
2018	Grad Students 2 Undergrad Research Party Organizing, SACNAS	<i>Lubbock, TX, USA</i>