

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*
- CGPA: 3.7

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

in prep.

SA Shanto, J Li

Employment

Advanced Particle Detector Laboratory (APDL)

Lubbock, TX, USA

UNDERGRADUATE RESEARCH ASSISTANT

Nov. 2018 - Present

- Objective: Develop portable muon telescope capable of 0.5 milliradian resolution imaging capability
- Aided in the mechanical assembly of the phase 1 muon telescope
- Designed custom Winston Cone light collectors for increased optical transmission
- Facilitated the design of custom PCB's and assembled various components
- Implemented a multi-thread sync mechanism in the DAQ system comprised of 40 Arduino's and CAMAC systems
- Engineered the calibration and installation of 40 SiPM's (Phase 1) and 44 PMTs (Phase 2) on the telescope
- Designed and implemented Monte Carlo simulation and automated analysis program 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
- Deployed all software used by the lab on our university's High Performance Computing Cluster
- Trained new undergraduate members in the lab to use Geant4, ROOT, and our custom software base
- Assisted with the tomogram generation algorithm using the muon tracks
- Coauthored the proposal for IRIS-HEP Fellows Program
- Currently leading 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
- Supervisors: Shuichi Kunori, PhD. & Nural Akchurin, PhD.

Texas Tech University

Lubbock, TX, USA

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

Aug. 2020 - Present

- 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

- Project 1: Develop a customisable analysis and simulation software for studying various heterogeneous traffic flow of Human Driven (HVs) and Autonomous Vehicles (AVs)
- Project 2: Design and test various AV models for efficient shared lane mobility in multi-lane networks using a novel approach based on the Nagel-Schreckenberg Cellular Automaton Model
- Project 3: Incorporate Reinforcement Learning functionality to the simulation and analysis software (incomplete - Covid 19)
- 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*

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
2019	TTU Undergraduate Research Conference , <i>Muon Tomography Talk</i>	Virtual Conference
	TTU Undergraduate Research Conference , <i>Autonomous Vehicle Model Poster</i>	Virtual Conference
	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
2018	International Conference for Physics Students 2019, University of Köln	Köln, Germany
	Undergraduate Colloquium: Programming Principles , <i>SPS TTU</i>	Lubbock, USA

Honors & Awards

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

Leadership & Involvement

Sigma Pi Sigma Physics Honor Society	North America
MEMBER	2020-Present
American Physical Society (APS)	North America
MEMBER	2019-Present
PrivaC Female Only Virtual Hackathon	Bangladesh
TEAM MENTOR	2020
RaiderHacks	Texas, USA
MEMBER AND REPRESENTATIVE	2019
National Science Foundation (NSF) Regional Innovation Corporations (I-Corps) Program	Texas, USA
ENTREPRENEURIAL LEAD	2019
Free Market Institute	Texas, USA
MCLANE POLITICAL ECONOMY SCHOLAR	2018 - 2019
College of Arts & Sciences, TTU	Lubbock, USA
STUDENT AMBASSADOR	2018-2019
Society of Physics Students (SPS)	Lubbock, USA
PUBLIC RELATIONS OFFICER (TTU CHAPTER) & MEMBER	2017-2019
The Quark Newsletter, SPS	Lubbock, USA
OFFICER IN CHARGE	2018-2019
Alpha Lambda Delta & Phi Eta Sigma Honor Society (ALD/PES)	Lubbock, USA
SOCIAL COORDINATOR OFFICER (TTU CHAPTER)	2018-2019
Undergraduate Colloquium Series, SPS	Lubbock, USA
INITIATOR AND ORGANIZER	2018
Red Raider Orientation, TTU	Lubbock, USA
ORIENTATION CREW LEADER	2018
Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)	Lubbock, USA
VICE PRESIDENT (TTU CHAPTER), RECRUITMENT CHAIR & MEMBER	2017-2018

Projects

Senior Capstone Project: Quantum Optimization Algorithms

Lubbock, TX, USA

RESEARCH PROJECT

Apr. 2020 – Present

- 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
- Presently conducting literature review of Quantum Computing applied to Chemistry

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

HTML5, CSS, JS (React), nodeJS

Training

Summer schools

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

Workshops

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

Hackathons

Mar. 2020	Hacklahoma 2020 , Major League Hacking (MLH)	<i>Oklahoma, USA</i>
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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	Multiple 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>