

# Sadman Ahmed Shanto

BUDDING PHYSICIST · ASPIRING MATHEMATICIAN · ARDENT PROGRAMMER

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## Education

### Texas Tech University (TTU)

Texas, USA

#### DUAL BACHELOR OF SCIENCE (Applied Physics AND Mathematics)

2017 – 2021

- Minor: Computer Science
- Applied Physics Concentration: Quantum Computing
- Mathematics Track: Statistics
- CGPA: 3.701

## Employment

### Advanced Particle Detector Laboratory (APDL)

Lubbock, TX, USA

#### UNDERGRADUATE RESEARCH ASSISTANT

Nov. 2018 - Present

- Objective: Develop prototype for 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 in the telescope
- Facilitated the design of custom PCB's and helped soldered various components on them
- Implemented a multi-thread sync mechanism in the Data Acquisition System comprised of 40 Arduino's
- Engineered the calibration and installation of 40 SiPM's (Phase 1) and 20 PMT's (Phase 2) on the telescope
- Created Monte Carlo simulations to test experimental data integrity and measure phase 1 telescope efficiency
- Upgraded the simulation software to include custom test cases, theorized designs and phase 2 telescope simulation
- Programmed an automated data analysis program to extract key information from experimental data
- 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 computing cluster
- Trained new undergraduate members in the lab to use Geant4, ROOT, and our custom software base
- Assisted with the tomograph generation algorithm using the muon trajectory data
- Currently, trying to incorporate concepts of image segmentation and ML to enhance final image and improve muon track reconstruction efficiency
- Presently, also working on installing various CRATES for the CAMAC system used for Phase 2 prototype
- Supervisors: Shuichi Kunori, PhD. & Nural Akchurin, PhD.

### Department of Industrial, Manufacturing, and Systems Engineering (IMSE), Texas Tech University

Lubbock, TX, USA

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

Aug. 2020 - Present

- Create and deliver biweekly supplementary lectures for this graduate level introductory quantum computing course
- Prepare weekly computational assignments for the students to improve their knowledge of QIC, qiskit and python
- Help students with their problems during office hours each week
- Grade both computational and theoretical/mathematical assignments for the 25+ students enrolled in the course
- 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 heterogenous traffic flow of Human Driven (HVs) and Autonomous Vehicles (AVs)
- Project 2: Design and Test out 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 - Covid19)
- Interpreted and analyzed the results of various experiments led by Dr. Li and reported work in poster presentations
- A comprehensive journal paper is in works presently
- Supervisor: Jia Li, PhD.

## TECHniques Center

STEM PEER TUTOR

Lubbock, TX, USA

Jan. 2018 - Jun. 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

COURSE INSTRUCTOR

Lubbock, TX, USA

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

SUMMER RESEARCH INTERN

Nashville, TN, USA

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 Berkely) 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

BUSINESS DEVELOPMENT INTERN

Lubbock, TX, USA

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

## Peer Review publications

### 1 HIGH-RESOLUTION MUOGRAPHY USING A PROTOTYPE PORTABLE MUON TELESCOPE

2020

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

Journal of Undergraduate

Reports in Physics

### 2 CHALLENGES OF MICROSIMULATION CALIBRATION WITH TRAFFIC WAVES USING AGGREGATE MEASUREMENTS

under review

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

Transportation Research Board

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

in prep.

SA Shanto, J Li

### 4 ANALYSIS OF CLASSICAL OPTIMIZATION ROUTINES USED IN THE PREPARATION OF QUANTUM STATES IN VARIATIONAL QUANTUM EIGENSOLVER CIRCUIT MODELS

in prep.

SA Shanto, J. Slocum

## Seminars, Poster Presentations & Conference Talks

2020	<b>Gulf Coast Undergraduate Research Symposium, Rice University</b> , <i>registered</i> <b>Quantum 2020 (Institute Of Physics) Virtual Conference</b> , <i>registered</i> <b>Physics Departmental Colloquium</b> , <i>invited</i> <b>Summer Showcase! at the Institute for Software Integrated Systems</b> <b>International Symposium on Transportation Data and Modeling (ISTDM)</b> , <i>postponed</i> <b>TTU Undergraduate Research Conference</b> , <i>Muon Tomography Talk</i> <b>TTU Undergraduate Research Conference</b> , <i>Autonomous Vehicle Model Poster</i>	<i>Houston, USA</i> <i>Virtual</i> <i>Lubbock, USA</i> <i>Tennessee, USA</i> <i>Michigan, USA</i> <i>Virtual Conference</i> <i>Virtual Conference</i>
2019	<b>Far West Section of American Physical Society (FWSAPS), Stanford University</b> <b>Texas Section of American Physical Society (TSAPS)</b> <b>Departmental Poster Competition, Department of Physics and Astronomy, TTU</b> <b>International Conference for Physics Students 2019, University of Köln</b>	<i>Stanford, USA</i> <i>Lubbock, USA</i> <i>Lubbock, USA</i> <i>Köln, Germany</i>
2018	<b>Undergraduate Colloquium: Programming Principles, SPS TTU</b>	<i>Lubbock, USA</i>

## Projects

### Senior Capstone Project: Quantum Optimization and Search 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
- Currently studying the relation between of variational quantum circuits and quantum walk algorithms to derive a robust and efficient Quantum Optimization regime

### 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
- problem description and project relevance
- 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.

### Comprehensive GUI Client Facing Health Care System Software

*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

## Honors & Awards

2017 – 2021	<b>Texas Tech University Presidential Scholarship</b> , TTU	Lubbock, TX, USA
2020	<b>C.C. Schmidt and Alma K. Schmidt Award in Physics</b> , Physics Department, TTU	Lubbock, TX, USA
2018-2019	<b>Bucy Undergraduate Scholarship Physics Award</b> , Physics Department, TTU	Lubbock, TX, USA
2018-2019	<b>Raiders Who Rock: Pursuit of Excellence Award</b> , Engagement and Transition, TTU	Lubbock, TX, USA
2019	<b>Outstanding Student Presenter</b> , TSAPS	Texas, USA
2019	<b>Best Poster Presenter</b> , Department of Physics and Astronomy, TTU	Lubbock, TX, USA
2019	<b>Honorable Mention: Best Undergraduate Poster Presenter</b> , FWSAPS, Stanford University	Stanford, CA, USA
2019	<b>TrUE Undergraduate Scholar Project Fund</b> , Center for Transformative Undergraduate Experiences	Lubbock, TX, USA
2019	<b>TrUE Travel Funds Award</b> , Center for Transformative Undergraduate Experiences	Lubbock, TX, USA
2018	<b>Silver Medal</b> , University Physics Competition (UPhysC)	International
2017	<b>Gangapadhya Physics Scholarship Award</b> , Department of Physics and Astronomy, TTU	Lubbock, TX, USA
2017	<b>Glen Mann Physics Scholarship Award</b> , Department of Physics and Astronomy, TTU	Lubbock, TX, USA

## Leadership & Involvement

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

## Technological Skills and Languages

<b>Human Spoken Languages</b>	Bengali (native), English (bilingual), Hindi (professional), Urdu (intermediate)
<b>Programming</b>	Python, C++, C, JAVA, Mathematica, Matlab, R, Julia, Bash, TeX, Dart, Swift
<b>Operating System</b>	MAC OS, Linux, Raspbian, Windows 10
<b>Data Analysis</b>	Numpy, Scipy, SymPy, Matplotlib, Pandas, StatsModels, Seaborn, BeautifulSoup
<b>Machine Learning</b>	Tensorflow, Keras, SciKit Learn, Pytorch, Open AI Gym
<b>Quantum Computing</b>	Qiskit, PyQuil, PennyLane, Microsoft QDK, Forest SDK
<b>High-Energy/Particle Physics</b>	CERN Geant4, CERN Root, PyROOT, CAMAC System Analysis
<b>Digital Electronics</b>	LTspice, Vivado Design Suite, KiCad
<b>Microcontrollers</b>	Arduino, Raspberry Pi, Basys 3, Iconikal Rockchip RK3328
<b>3D Modelling</b>	Inventor, Blender
<b>Database</b>	SQLite, MySQL
<b>Management</b>	Git, Yarn/NPM, Apache
<b>Web</b>	HTML5, CSS, JS (React), nodeJS

## Training

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### Summer schools

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

### Workshops

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

### Hackathons

Mar. 2020	<b>Hacklahoma 2020</b> , Major League Hacking (MLH)	<i>Oklahoma, USA</i>
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## Outreach & Community Service

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