

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

First-author publications:

- 1 CHALLENGES OF MICROSIMULATION CALIBRATION WITH TRAFFIC WAVES USING AGGREGATE MEASUREMENTS
SA Shanto, G Gunter, DB Work, R Ramadan, B Seibold
under review
Transportation Research Board
- 2 DRIVE LIKE ANTS: DESIGN AUTONOMOUS VEHICLE BEHAVIORS IN HETEROGENEOUS TRAFFIC FLOW
SA Shanto, J Li
in prep.
- 3 ANALYSIS OF CLASSICAL OPTIMIZATION ROUTINES USED IN THE PREPARATION OF QUANTUM STATES IN VARIATIONAL QUANTUM EIGENSOLVER CIRCUIT MODELS
S. A. Shanto, J. Slocum
in prep.

Second-author publications:

- 1 HIGH-RESOLUTION MUOGRAPHY USING A PROTOTYPE PORTABLE MUON TELESCOPE
R Perez, SA Shanto, M Moosajee, & S Cano
2020
Journal of Undergraduate Reports in Physics

Seminars, Poster Presentations & Conference Talks

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| 2020 | Gulf Coast Undergraduate Research Symposium, Rice University , <i>registered</i> | Houston, USA |
| | Quantum 2020 (Institute Of Physics) Virtual Conference , <i>registered</i> | Virtual |
| | Physics Departmental Colloquium , <i>invited</i> | Lubbock, USA |
| | 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 |
| 2019 | 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, SPS TTU | Lubbock, USA |

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

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

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| 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 |
| National Science Foundation (NSF) Regional Innovation Corporations (I-Corps) Program | Texas, USA |
| ENTREPRENEURIAL LEAD | 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 |

Technological Skills and Languages

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| Human Spoken Languages | Bengali (native), English (bilingual), Hindi (professional), 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, 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

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| 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

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| In Process | ALD Leads Certified: Leadership Program, Alpha Lambda Delta Honor Society | <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

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

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| 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 | 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> |