

JEAN PIERRE TWAGIRAYEZU

PHD Candidate

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EDUCATION

Doctor of Philosophy in Physics

Michigan State University

📅 Jan 2020 - 2025

Master of Science in Physics

Michigan State University

📅 Aug 2018 - May 2020

Master of Science in Mathematical
Sciences

**African Institute for Mathematical
Sciences - Rwanda**

📅 Aug 2017 - Jun 2018

Bachelor of Education in Physics

**University of Rwanda, College of
Education**

📅 Sep 2011 - July 2015

TECHNICAL SKILLS

- Python, SQL, git, Numpy, Pandas, Jupyter notebook, Keras, Tensorflow, sklearn
- Statistical data analysis, Astroparticle Physics, Scientific research

COURSES

- Machine Learning Application in Physics
- Object Oriented Programming (Python)
- Statistical Methods for Data Analysis (Python)
- Methods in Computational Modelling (Python, git, Unit testing)
- Big Data and Machine Learning (R)
- Scientific software development in Python

ABOUT

I am a Ph.D. candidate working on **experimental neutrino astroparticle physics research spanning data analysis and software development for scientific applications**. Current research includes producing Monte Carlo Simulation for the Pacific Ocean Neutrino Experiment (P-ONE), development of neutrino event directional reconstruction algorithms for the P-ONE, conducting statistical data analysis to forecast the sensitivity of the P-ONE to astrophysical point sources of neutrinos.

WORK EXPERIENCE

Research Assistant

Michigan State University, Pacific Ocean Neutrino Experiment

📅 Aug 2021 - 2025 📍 East Lansing, MI, USA

- collaborated with a team of software engineers and scientists to study the performance studies of the Pacific Ocean Neutrino Experiment (P-ONE) using Monte Carlo simulations.
- developed a data analysis pipeline leveraging statistical methods to estimate the sensitivity of the P-ONE experiment to astrophysical point sources of neutrinos.
- co-developed track directional reconstruction algorithms for neutrino events improving pointing resolution and event localization in the sky.
- processing large datasets of Monte Carlo simulations from neutrino event generation to detector response simulation for the P-ONE using high-performance computing clusters.
- presented research findings at local research group meetings, the P-ONE collaboration calls, meetings and at International conferences and workshops.

Research Assistant

Michigan State University, IceCube Neutrino Observatory

📅 May 2020 - Aug 2021 📍 East Lansing, MI, USA

- used likelihood method and photon propagation to reconstruct the energy of cascade events from IceCube Monte Carlo Simulation dataset on high-performance computing clusters and GPUs.
- conducted a one week IceCube monitoring shift for data quality and detector operation and presented the monitoring report to the collaboration call.

Student Researcher

African Institute for Mathematical Sciences, AIMS Rwanda

📅 Apr 2018 - Jun 2018 📍 Kigali, Rwanda

- co-developed a kernel regression model with network cohesion that extends a linear regression version by previous researchers.
- used mean squared error metrics to evaluate models on simulated datasets using R packages.
- presented research findings in a thesis showed kernel regression models with network cohesion improved prediction accuracy by compared to linear models.

TEACHING AND MENTORING

- **Student Reseach Mentor, Michigan State University** (Spring 2023 - 2025): Mentored two undergraduate students in a local research group for their research projects leading to presentations at the P-ONE collaboration call and meetings.
- **Teaching Assistant, Michigan State University** (Aug 2018 - May 2020): Taught and graded three sections of Introductory Physics laboratory course to about 100 students for three semesters. Assisted in setting up the experimental demonstration setup and conducted help room sessions for an introductory physics course over the course of one semester.
- **High School Physics Teacher, Kigali Rwanda** (Sep 2014 - July 2017): Taught junior and senior level Mathematics and Physics courses to more than 100 students each year at four different secondary schools in Kigali. Conducted physics laboratory classes, created lesson plans, graded assignments, and communicated with parents about students progress.