Siddharth Sule

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Final year PhD student specialising in Monte Carlo simulation of particle physics. Key skills include mathematical modelling, numerical analysis and GPU programming. Looking for roles in academic and industrial research, open to roles in quantitative finance and software development.

Education

PhD in Particle Physics Sep 2022 - Present
The University of Manchester

- Applying Monte Carlo sampling and object-oriented programming to simulate high-energy particle collisions as observed at the Large Hadron Collider at CERN. Contributing to the development and maintenance of simulation programs, known as *event generators*.
- Serving as a junior developer for the open-source event generator *Herwig*, used worldwide in high-energy physics research for over 40 years. Specialising in simulating the radiation of gluons and quarks, known as a *parton shower*.

MPhys (Hons) Physics, First Class Sep 2018 - Jun 2022
The University of Manchester

- *Integrated BSc+MSc Course*. Modules covered topics including advanced statistical physics, scientific computing and mathematical modelling. For MPhys project, simulated the spread of infectious diseases across community network models using Monte Carlo methods.

Work Experience and Projects

GAPS: a GPU-Amplified Parton Shower Mar 2024 - Present
Head Developer and Author | *Publication below* | `gitlab:siddharthsule/gaps`

- Compute usage at CERN is predicted to surpass the available budget, with simulation being one of the most resource-intensive tasks. To address this, investigated GPU acceleration for Monte Carlo event generation.
- Redesigned the parton shower algorithm to enable parallel simulation of multiple events. Developed and benchmarked a prototype demonstrating GPU performance equivalent to 275 CPU cores.

Improving the Parton Shower Physics in Herwig 7 Sep 2023 - Present
Junior Developer, Project Lead | *Publication underway* | `herwig.hepforge.org`

- Future particle physics experiments demand higher precision in modelling radiation. To achieve this, integrated the newly developed PanGlobal and FHP parton shower algorithms into the Herwig event generator.
- Combined the showers with the Cluster Hadronisation model to produce hadron-level results. Demonstrated Next-to-Leading-Log accuracy, improving the theoretical reliability of event simulations.

Teaching and Assessment Experience

Associate Fellow of the Higher Education Academy (AFHEA) Jun 2021

Undergraduate Lab Demonstration Feb 2023 - Present
The University of Manchester

- Taught undergraduate students to record measurements and analyse results by fitting mathematical models. Assessed the students' knowledge in a viva-style interview to identify achievements and places for improvement. Taught over a hundred students over the last year.
- Marked undergraduate lab reports, evaluating the student's ability to explain experiments and justify results. Reviewed the report for a scientific writing style using a comprehensive and thorough rubric. Marked over thirty lab reports, across a variety of experiments.

Herwig Event Generator Tutorials
Terascale Monte Carlo School, DESY Hamburg Nov 2025
MCnet Summer School, University of Sterling Jun 2025
MCnet Summer School, CERN Jun 2024
Terascale Monte Carlo School, DESY Hamburg Feb 2024

- Introduced the Herwig Event Generator to students and PDRAs in particle physics. Guided the attendees to simulate particle physics collisions and to customise the simulation settings to vary the physics settings and add analyses of interest.
- After the tutorial, attendees were equipped with the knowledge to simulate Large Hadron Collider Events and compare them to Experiment Data.

Skills Overview

Technical Expertise: Monte Carlo Simulations, GPU Programming and Architecture

Programming Languages: C++, CUDA C++ and Python

Soft Skills: Problem-Solving, Critical Thinking, Adaptability, Collaboration

Publications

Nb: In particle physics publications, author names are arranged in alphabetical order.

M. H. Seymour and S. Sule, *An algorithm to parallelise parton showers on a GPU*, SciPost Phys. Codebases 33, 2024.

References available upon request.