Dear Prof. Dr. Silvia Masciocchi,

I am Saranya from India, writing to you with regard to the advertisement for a PhD position in your research group (experimental heavy-ion physics) at the University of Heidelberg, Germany. I am currently a Junior Research Fellow at Indian Institute of Technology, Hyderabad under the guidance of Dr. Saurabh Sandilya. I will be working on the measurements related to rare B-decays for the Belle-II experiment. I completed my Masters in Physics from Central University of Karnataka, India, in July 2023. The final semester of the course was devoted to project work and I worked under the guidance of Dr. Deepak Samuel on the development of a fast track finding algorithm for the muon g-2/EDM experiment at J-PARC, Japan.

The main aim of my project work is to develop a fast and efficient trackfinding algorithm based on graph neural networks (GNN) for the muon g-2/EDM experiment. The current algorithm, based on hough transform is slow for pileup events becoming a bottleneck in the entire analysis chain. Therefore, an algorithm which is up to 40 times faster and at the same time efficient, is a crucial requirement for the experiment. There are few ideas that we have proposed, one based on a GPU-based track finding algorithm, another based on Graph Neural Network. I worked on the GNN-based model using embedded space. The work is still under progress but the initial study which formed a part of my project work have shown encouraging results. I developed a prototype code for the first steps of the GNN pipeline and studied the efficiency.

Preliminary studies under low pileup conditions are encouraging, indicating a track finding efficiency of more than 85% with a track purity greater than 70%. At this stage, the first studies indicate that the algorithm requires refinement for all classes of tracks. Benchmarking the performance of the algorithm under experimental conditions is currently underway.

I had the privilege of completing an internship at KEK, Japan, where I was engaged in two key aspects. Firstly, I was actively involved in trackfinding for the muon g-2/EDM experiment, contributing to the fundamental research efforts. Secondly, I participated in the testing of

detector components, gaining valuable hands-on experience in experimental physics. During my internship, I had the opportunity to engage in meaningful discussions and interactions with experienced researchers, which broadened my understanding of the field. This experience has been instrumental in shaping my passion for continued research and my desire to contribute to the scientific community.

In working for this project as well as from internships, I have gained a decent experience in programming in Python, C++, in developing basic machine-learning models and in experimental particle physics. I am also hopeful with my experience and skills, I will be a good fit for your group.

My areas of interest include advanced algorithms for particle physics experiments, machine learning applications in High-Energy Physics, and the exploration of new phenomena for a deeper understanding of fundamental particles and interactions. Accurate measurements of the predictions posited by the standard model (SM) of particle physics present a robust approach to investigating unexplored realms in physics, particularly by meticulously examining any deviations from SM expectations. In my view, the intensity frontier experiments in High Energy Physics offer an ideal platform for conducting precise measurements. That's why I am particularly interested in working in ALICE (A Large Ion Collider Experiment), the dedicated heavy-ion experiment at the Large Hadron Collider (LHC) at CERN.

I am confident that my background, skills, and research experience align with the objectives of your research group. I am eager to contribute to ongoing research, further my academic journey, and contribute meaningfully to the scientific advancements in these fields.

Please find attached my CV for your reference. I shall be available for any queries in the future.

Saranya Nandakumar

SARANYA NANDAKUMAR

PERSONAL INFORMATION

Nationality	Indian
GitHub	https://github.com/Saranya-N1
ORCID ID	0000000167744037
LinkedIn	https://www.linkedin.com/in/saranya-n-2732b4248
Date of birth	24th January 2000

AREAS OF INTEREST

Nuclear and Particle Physics

ACADEMIC QUALIFICATIONS

M.Sc Physics	*2021-2023* CGPA: 8.45	Central University of Karnataka, India
B.Sc Physics	*2018-2021* CGPA: 9.25	Govt Victoria College, Calicut University, Kerala, India

RESEARCH EXPERIENCE

JUNIOR RESEARCH FELLOW: MEASUREMENTS RELATED TO RARE B-DECAYS (AND TO SET-UP A HIGH ENERGY PHYSICS PHOTO-DETECTOR LABORATORY)

November 2023   Indian Institute of Technology, Hyderabad, India

SUMMER INTERNSHIP PROJECT WORK: TRACK FINDING FOR MUON G-2 EXPERIMENT AND TESTING OF DETECTOR COMPONENTS IN MAGNETIC FIELD

June 2023   KEK, Japan

I worked on the improvement of track finding algorithm using GNN for muon g-2 experiment at KEK. I developed a prototype code for the first steps of the GNN pipeline and studied the efficiency.

I also worked on the testing of detector vane components in magnetic field and estimated its magnetic susceptibility.

M.SC PROJECT WORK: PROPOSAL FOR GNN BASED TRACK FINDING FOR MUON G-2 EXPERIMENT

Feb 2023   Central University of Karnataka, India

One of the bottlenecks in the analysis chain of the muon g-2 experiment at KEK is the track finding section, which, at present requires at least a factor 40 improvement in the computation speed. Though many approaches are being attempted in this direction, in my project work, guided by Dr. Deepak Samuel, I developed a machine learning model using embedded space and identified the cluster of hit points belonging to same track with an efficiency of 99%.

SUMMER FELLOWSHIP PROGRAMME: MACHINE LEARNING ON MECHANICS

June 2022	Indian Institute of Technology, Madras, India

In this work, I developed machine learning models in python for studying the Lennard-Jones potential relations and crystal structures. These models gave the correlation between the various physical quantities like activation energy and lattice constants.

B.SC PROJECT: AUTOMATIC HAND SANITIZER DISPENSER USING ARDUINO UNO

March 2021	Govt Victoria College, Calicut University, Kerala, India

Programmed an Arduino-Uno board and developed an automatic hand sanitizer dispenser.

CONFERENCES

16th International Conference on Heavy Quarks and Leptons
28 November- 2 December 2023, TIFR, Mumbai, India
Best Poster Award, Oral talk

ACHIEVEMENTS

Received DST-Inspire scholarship from Government of India for higher education.

2023	Qualified GATE (Graduate Aptitude Test in Engineering) in Physics

SKILLS

Softwares	OriginPro, LabVIEW, LaTeX, Inventor
Programming	Python(4+ years), C++
Libraries	ROOT, DGL, Scikit-learn, Tensorflow and Pytorch
GPU	Short exercise using CUDA (1 month)
Operating Systems	Proficient in both Linux and Windows
Others	Machine Learning, MS Office

REFERENCES

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