Purvaash P U
(Purvaash Panduranghan Udhayashankar)
MSc Physics
Weizmann Institute of Science

ORCID iD
purvaashtri@gmail.com
Personal Website
GitHub Profile
LinkedIn Profile

Education

•Weizmann Institute of Science, Rehovot, Israel *2021-*
MSc Physics Percentage: 93.5

•Indian Institute of Technology Bombay, Mumbai, India *2018-2021*
MSc Energy Science and Engineering CPI: 9.42

•Loyola College, Chennai, India *2015-2018*
BSc Physics CGPA/Percentage: 9.09

Research Experience

•Weizmann Institute of Science (WIS) *2022-*
Masters Project under the supervision of Prof. Yosef Nir
– Studied various BSM frameworks
– Constrained parameters in a couple of BSM frameworks using data from LHC

•Indian Institute of Technology Bombay (IITB) *2020-2021*
Masters Project under the supervision of Prof. Karthik Sasihithlu and Prof. M. P. Gururajan
– Conducted literature survey of near-field heat transfer and studied its mechanism
– Performed molecular dynamics simulation of near-field heat transfer across two nanospheres using LAMMPS

Research Interests

My research interests lie in theoretical physics. In the future, I would like to infuse computational methods like deep learning, tensor networks and quantum computing in my projects.
Using deep learning to study jet structure or to develop a generative network producing collider events appeals to the coder cum particle physicist inside me. Studying quantum fields and strongly correlated systems using tensor networks, quantum computing excites me as an aspiring theoretical physicist and computational enthusiast.

Technical Skills and Interests

Languages (Proficient): English, Tamil
Languages (Less proficient): German, Telugu
Software: Python, Julia, LAMMPS, Mathematica, LaTeX, Git
Areas of Interest: Theoretical physics, Deep learning, Tensor networks, Quantum computing, High-perfomance computing

Advanced Courses Taken

•Theoretical Condensed Matter Physics *at IITB*
Instructor: Prof. Hridis Kumar Pal
– Second quantization, Interacting electron gas, Superconductivity, Magnetism

•Statistical physics 1 *at WIS*
Instructor: Prof. Oren Raz
– Equilibrium statistical physics: Phase transitions and critical phenomena, Ising type models; Analytical and numerical methods, renormalization group approach; correlation functions
– Spin Glass physics: mean-field models, the replica trick, replica symmetry breaking

•Quantum field theory 1 *at WIS*
Instructor: Prof. Ofer Aharony
– Perturbation theory and Feynman diagrams from Path Integrals (scalars and fermions), perturbative regularization and renormalization, optical theorem and the LSZ reduction formula, Renormalization group
– QED, gauge fixing and the Faddeev-Popov procedure, Ward Identities, non-Abelian gauge theories
– Non-perturbative field theory: QCD (qualitative). 3d QED, instantons and confinement
– Symmetries in QFT, Goldstone's theorem, renormalization and symmetry, the Higgs mechanism (classical and quantum)

•Elementary particles 1 *at WIS*
Instructor: Prof. Yosef Nir

– *The Standard Model: From Fundamental Symmetries to Experimental Tests* authored by Yuval Grossman and Yossi Nir (the course was taught from the draft version of the book)

•General relativity *at WIS*

Instructor: Prof. Ulf Leonhardt

– Mathematics required for GR, Einstein equations, Gravitational waves, Black holes, elementary cosmology

•Practical Deep Learning for Science *at WIS*

Instructor: Prof. Eilam Gross

– Convolutional Neural Nets, Graph Neural Nets, Transformer, Diffusion

•Supersymmetry (not yet graded) *at WIS*

Instructor: Prof. Micha Berkooz

– Supersymmetric QM, SUSY algebra and representations, SUSY in 4d, SUSY Gauge theories

Key Course Projects

•Accent modulation using cVAE architecture *at WIS*

Course: Practical Deep Learning for Science 1 month

– Learnt various audio processing features like STFT, Mel spectrogram, MFCCs etc.
– Build a cVAE using pytorch modules in python
– Used one hot encoding to switch between accents using audio features like MFCC and time-domain data
– Dataset used: AccentDB - Core & Extended

•Deep Learning with particle collider collision event *at WIS*

Course: Experimental Projects 3 weeks

– Understood blocks of code developed by the group of Prof. Eilam Gross
– Modified it to suit the goal of our project, i.e. to determine the fraction of charged and uncharged particles in a collider event

Workshop & Schools

•Tri-Institute Summer School on Elementary Particles *2023*

– Exposure to various aspects of particle physics. Topics in the summer school ranged from theoretical to experimental/observational aspects of particle physics: Underground experiments, cosmology and gravitational waves, to list a few.