WEIZMANN INSTITUTE OF SCIENCE

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

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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 (particularly particle physics/condensed matter). In the future, I would like to infuse computational methods like deep learning, tensor networks and quantum computing in my projects.

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)
– Computation of one-loop diagrams, regularization and renormalization (perturbative), optical theorem and the LSZ reduction formula
– Renormalization group
– QED, gauge fixing and the Faddeev-Popov procedure, Ward Identities
– An introduction to 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.