

# KUNAL VERMA

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Interested in theoretical and computational condensed matter physics.

## EDUCATION

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| <b>Indian Institute of Science Education and Research, Mohali</b><br>BS-MS Dual Degree, Physics Major<br>Cumulative GPA: 9.52/10.0 (till Semester 8). | <i>August 2018 - Present</i> |
| <b>Apeejay School, Sheikh Sarai, New Delhi</b><br>All India Senior Secondary School Examination<br>Percentage - 95.4% (CBSE)                          | April 2017 - March 2018      |
| <b>Apeejay School, Sheikh Sarai, New Delhi</b><br>All India Secondary School Examination<br>CGPA - 10.0 (CBSE)  | April 2015 - March 2016      |

## RESEARCH EXPERIENCE

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- Masters thesis with Prof. Vijay B. Shenoy, IISc (*Ongoing*)** January 2022 - Present  
*Project Assistant* *IISc, Bengaluru*
  - Currently working on studies to explore the phases of  $\mathbb{Z}_2$  lattice gauge theory using Quantum Monte Carlo methods.
  - Preliminary work involved studying the classical Ising model in 2D and extracting critical exponents via finite-size scaling analysis.
- Research internship with Dr. Anosh Joseph, IISER Mohali** April 2021 - Sept 2021  
*Research Intern* *Remotely*
  - Complex Langevin* and the *Lefschetz Thimble* methods as primary candidates to deal with the “sign problem” (which makes application of standard Monte Carlo methods problematic) in Lattice QCD.
    - Complex Langevin*: Based on stochastic quantization of the fields. The field configuration is evolved according to a SDE and its equilibrium configuration is chosen as the sampling configuration.
    - Lefschetz Thimbles*: new manifolds, equivalent to the original domain of integration, are found in the complexified space, along which the imaginary part of the action is constant and, therefore, the integral is (mostly) real.
- Winter Project (NIUS 16.2) with Dr. Rudrajyoti Palit, TIFR Mumbai** December 2019  
*Research Intern* *TIFR, Mumbai*
  - Introduction to methods of radiation emission and detection, radiation-matter interaction, etc.
  - Methods of gamma ray detection using scintillation detectors and PMTs. Wrote a code for detection of peaks in a  $\gamma$ -ray spectrum.
- Research internship with Dr. Kavita Dorai, IISER Mohali** May 2019 - July 2019  
*Research Intern* *IISER Mohali, Punjab*

- Introduction to basics of Quantum Computing and physically realizing it using NMR.
- Explored algorithms for experimentally computing expectation values of operators, and performing Quantum State Tomography of mixed states to extract the approximate density matrix using IBM-Q Experience.

## TEACHING EXPERIENCE

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**PHY101-Mechanics**      Help Session Tutor, Spring Semester 2022 - IISER Mohali.

## AWARDS

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<b>INSPIRE Scholar 2018-2023</b>	SHE (Scholarship for Higher Education).
<b>Certificate for Academic Excellence</b>	for a 10.0 SPI in Semester 4, 6 and 7.
<b>S.W.A.N Imaging Challenge 2019</b>	Winner (Team), organized by RRI Bangalore.

## TECHNICAL SKILLS

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### Computational Methods

Monte Carlo simulations, Path Integral (quantum) Monte Carlo , Molecular Dynamics simulations, Runge Kutta methods, numerical integration techniques.

### Scientific Programming languages

*Fluent* in Python (scipy, numpy, matplotlib), *Intermediate* knowledge of C++, *Basic* knowledge of Fortran90, Mathematica.

### General computing tools

$\text{\LaTeX}$ , gnuplot, Git, GitHub.

## WORKSHOPS/CONFERENCES

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<b>From Quantum Matter to Quantum Computers, 2022</b>	MPI-PKS, Dresden.
<b>Frustrated Metals and Insulators (Hybrid), 2022</b>	ICTS, Bengaluru.
<b>Shivalik HEPCATS meeting, Winter 2021</b>	IISER Mohali.
<b>REYES Summer Workshop 2020 (Online)</b>	Old Dominion University, Virginia.
<b>Conference on QFTA 2019</b>	IISER Mohali.
<b>NIUS Physics 16.1 and 16.2 Camp</b>	HBCSE, TIFR, Mumbai.
<b>National Science (Vijyoshi) Camp 2018</b>	IISER Bhopal.