

Zaki AHMAD



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RESEARCH

My research interests lie in the field of particle physics, with a focus on the study of matter at the most fundamental level. The interactions of elementary particles are described by the Standard Model (SM), which serves as the theoretical foundation of my work. Within this framework, I specialize in Quantum Chromodynamics (QCD) phenomenology, the theory that governs strong interaction. Specifically, my research involves calculating the properties of hadrons by employing models of strong interactions. These theoretical predictions provide valuable insights for experimental high-energy physicists and contribute to the interpretation and design of collider-based experiments. In addition, I am actively involved in supervising postgraduate students and contributing to multidisciplinary research groups.

QUALIFICATIONS

1. PhD in High energy physics

Centre for High Energy Physics, University of the Punjab, Lahore

Course work CGPA: 3.78/4.00

Thesis Title: Decays of Charmonia using Realistic Wave Functions

Description: In this thesis a relativized quark model is used to predict the mass spectrum of charmonium states and their strong decay widths. Open flavor strong decay amplitudes are calculated by using the 3P_0 decay model. Two choices of the wave function are adopted, and the corresponding results are compared. The predicted results are also compared with experimental data and are helpful in assigning the newly discovered charmonium states for which internal structure is not well defined.

2. MPhil in High Energy Physics

Centre for High Energy Physics, University of the Punjab, Lahore

CGPA: 3.87/4.00

Thesis Title: Open flavor strong decays using the realistic meson wave function

Description: In 3P_0 model $q\bar{q}$ pair is produced with vacuum quantum numbers $J^{PC}=0^{++}$ and goes to different mesons for the open flavor case. Lattice Hamiltonian interaction $q\bar{q}$ gives gradient operator. Thus, the meson strong decay amplitude is an integral of product of wave functions and gradient of wave function. In this way we calculated the amplitude using position space SHO wave function.

3. BS (Hons) in Computational Physics

Centre for High Energy Physics University of the Punjab, Lahore

CGPA: 3.75/4.00

Project Title: Meson Decay Amplitude in 3P_0 Model using Realistic Wave function

Description: We used interpolated function (numerical solution of Radial Schrödinger's equation) to find the Radial realistic wave function and after it we have generated 3D realistic wave function for charmonium. After generating wave function, we have checked the orthogonality of wave function. We have used this wave function to calculate the meson decay amplitude in 3P_0 Model.

4. ICS (Physics)
Govt. College of Science Wahadat Road Lahore
Division: 1st
5. Matriculation (Science)
Govt. High School Mozang Lahore
Division: 1st

ACADEMIC EXPERIENCE

1. Lecturer, 29 March 2022 to Continue, Department of Physics, Govt College Women University, Sialkot.
 - Electrodynamics
 - Nuclear Physics
 - Particle Physics
 - Modern Physics
2. Lecturer, 22 December 2018, to 25 March 2022, Department of Physics, The University of Lahore.
 - Electromagnetic theory
 - Nuclear physics
 - Linear Algebra
 - Computational Physics
3. Visiting Lecturer, April 2017 to 2022, **Punjab University College of Information Technology (PUCIT)**, University of the Punjab, Lahore
 - Applied Physics
 - Basic Electronics
 - Electricity and magnetism
4. Visiting Lecturer, March 2015 to 2018, **Centre for High energy Physics**, University of the Punjab, Lahore
 - Integral Calculus and Analytical Geometry
 - Infinite Series and Sequence
 - Computational Physics Simulation Lab
 - Computer Programming
 - Numerical Linear Algebra
 - Scientific Computation
5. Teaching Assistant, 28 February 2017 to 15 January 2018, Information Technology University Lahore
 - Linear Algebra

- Applied physics
- 6. Research Assistant, July 2015 to June 2016, CHEP, PU, Lahore
 - Scientific Computation
- 7. Lecturer, September 2014 to April 2017, Concordia College, Walton Campus, Lahore
 - Physics
- 8. Lecturer, January 2010 to September 2013, Nobel High School, Lahore
 - Physics
 - Mathematics
- 9. Internship Certificate of Institute of Nuclear Medicine and Oncology, Lahore

RESEARCH PUBLICATIONS

1. **Zaki Ahmad**, et. al ‘Strong Decays of Charmonia Physical Review D 111, no. 3 (2025): 034007.
2. Nosheen Akbar, Ishrat Ashgar and Zaki Ahmad Properties of Toponium Mesons with Non-relativistic QCD Potential Model. arXiv preprint arXiv:2411.08548 **(submitted)**.
3. Zaki Ahmad, et. al ‘Charmonium spectrum and its decay properties’ **(submitted)**.

SUPERVISION OF MPHIL/BS RESEARCH PROJECTS

Sr. No.	Degree	Status	Title	Institution
1	MPhil (2018-2020)	Completed	Strong decays of charmonia using numerical wave functions	Centre for High Energy physics, University of the Punjab Lahore
2	MPhil (2020-2022)	Completed	Annihilation decays of Quarkonia	Centre for High Energy physics, University of the Punjab Lahore
3	MS (2022-2024)	Completed	Theoretical Investigation of Electronic and Electrical properties of ZnWO_4 and BaWO_4 under pressure	Department of physics, Govt. College Women University, Sialkot
4	MS (2023-2025)	Under Process	Numerical Study of Schrodinger equation for charmonium	Department of physics, Govt. College Women University, Sialkot
5	MS (2023-2025)	Under Process	Computing mass of conventional charmonium meson with relativistic correction	Department of physics, Govt. College Women University, Sialkot

6	BS Research Project	Completed	More than 30 Students	Department of physics, Govt. College Women University, Sialkot
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RESPONSIBILITIES AND DUTIES

1. Timetable In-charge
2. Applied and Modern Physics Lab In-charge
3. Member and Secretary of Board of Studies
4. Member of Laptop committee

POSTER PRESENTED IN CONFERENCE

Name of the event: “8th International Meeting on Particles and Fields 2015” to be organized by COMSATS institute of Information Technology, Lahore – Pakistan

Title of the Poster Presentation: *Strong decays in 3p_0 and Flux tube model*

CONFERENCE

1. 5th International Conference on particles and field (2013)---Attended, Organized by Centre for High Energy Physics, University of the Punjab, Lahore – Pakistan
2. “Symposium on Particle Physics December 17-19, 2014” organized by National Center for Physics (NCP), Islamabad – Pakistan
3. 7th International Conference on particles and field (2014)---Organized and Attended, Centre for High Energy Physics, University of the Punjab, Lahore – Pakistan
4. 8th International Conference on particles and field (2015)---Attended, organized by COMSATS institute of Information Technology, Lahore – Pakistan
5. 6th School on LHC Physics: 2016-----Attended, National Center for Physics (NCP), Islamabad – Pakistan
6. 7th School on LHC Physics: 2017-----Attended, National Center for Physics (NCP), Islamabad – Pakistan
7. 1st International Conference on Science and Society (2017)---Organized and Attended, Centre for High Energy Physics, University of the Punjab, Lahore – Pakistan
8. International workshop on computational in particle physics (2019) Organized and Attended, The university of Lahore, Pakistan.
9. 10th School on LHC Physics: 2021-----Attended, National Center for Physics (NCP), Islamabad – Pakistan
10. International school on physics and Allied Disciplines (2022), National Center for Physics (NCP), Islamabad – Pakistan
11. 11th School on LHC Physics: 2023-----Attended, National Center for Physics (NCP), Islamabad – Pakistan

CURRICULAR ACTIVITIES

- Certificate of Participation on 3rd Dr. Riaz-Ud-Din Memorial School on Physics 2022 organized by Department of physics University of Agriculture Faisalabad, Pakistan.
- Certificate of Participation on 3rd Dr. Riaz-Ud-Din Memorial School on Physics 2023 organized by Department of physics University of Agriculture Faisalabad, Pakistan.
- Certificate of Successfully completed the Third Refresher Course for Physics Teachers (1st Module) organized by National Centre for Physics (NCP), Islamabad Pakistan in 2024 (Won 2nd Position).
- Certificate Hands-on Workshop on Patent Writing/Drafting and submission Organized by Punjab Higher Education Commission, Pakistan (November 2024)

CURRICULUM DEVELOPMENT

I have developed the courses of following degree programs for Department of Physics, Govt College Women University, Sialkot.

- BS Computational Physics
- Member of Board Studies

COMPUTER SKILLS

1. Python
2. C Sharp
3. C++
4. Wolfram Mathematica
5. Latex
6. Mat Lab

OUTSTANDING ACHIEVEMENT

Merit scholarship 2012, 2013 Centre for High Energy Physics, PU Lahore