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Dr. Syed Salman Ahmad Warsi is an accomplished physicist, academician, and educator with extensive expertise in condensed matter physics. He currently serves as an Associate Professor in the Department of Physics at Integral University, Lucknow, and brings more than 25 years of experience in teaching, research, and academic mentorship.

Throughout his academic career, Dr. Warsi has taught undergraduate and postgraduate students, making significant contributions to physics education through his dedicated teaching and research guidance. He has successfully supervised numerous B.Sc. and M.Sc. dissertations and projects and is actively involved in mentoring doctoral scholars pursuing Ph.D. research in Physics.

His research interests include liquid-crystal systems, nanoscale materials, and contemporary topics in condensed matter physics. Dr. Warsi has published several peer-reviewed research papers in reputed journals and continues to contribute actively to scientific research and academic development.

In addition to his research contributions, Dr. Warsi has co-authored important educational books, including:

- *ICSE Physics for Class X (2025)*
 - *ISC Practical Physics for Classes XI & XII (2021)*
- He has also served as editor of the following scholarly books:*
- *Characterization of Liquid Crystals and Photonic Crystals (2022)*
 - *Advances in Contemporary Physics: High Energy, Cosmology and Soft Matter (2025)*

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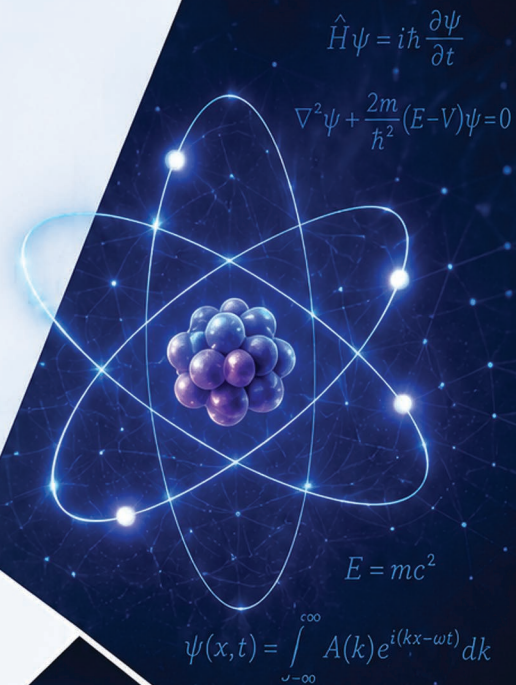
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Dr. Syed Salman Ahmad Warsi



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PREFACE

The rapid advancement of science and technology in the twenty-first century has been driven by the convergence of fundamental physics, innovative materials research, and powerful computational techniques. Together, these disciplines have transformed our understanding of nature, enabled the development of novel technologies, and opened new avenues for addressing complex scientific and societal challenges. Recognizing the growing interconnectedness of these fields, this volume, *Contemporary Advances in Physics, Materials and Computational Sciences*, presents a collection of scholarly contributions that highlight recent developments and emerging trends across a broad spectrum of modern scientific research.

The chapters in this book encompass diverse yet complementary areas of study. Fundamental aspects of particle physics are explored through discussions on nuclear emulsion techniques and the transport properties of hot Quantum Chromodynamics (QCD) matter, providing insights into the behavior of matter under extreme conditions. The volume further extends into cosmology through an examination of cosmological neutrinos and their influence on the evolution of the Universe, demonstrating the profound links between elementary particles and large-scale cosmic phenomena.

In parallel, the transformative impact of computational methodologies is reflected in the chapter dedicated to artificial intelligence and machine learning in astronomy. The integration of data-driven approaches with traditional scientific methods is revolutionizing the way astronomical observations are analyzed and interpreted, exemplifying the growing importance of computational sciences in contemporary research.

The book also addresses key developments in quantum science through a comprehensive treatment of quantum entanglement, from its conceptual foundations to its practical applications in emerging quantum technologies. Complementing these themes are chapters devoted to the hydrogen atom and advanced theoretical investigations of electronic and thermoelectric properties of half-Heusler compounds, emphasizing the continuing relevance of both fundamental and applied physics.

Materials science constitutes another major focus of this volume. Contributions on functional magnetic nanoparticles, liquid crystals, and liquid crystal-based plasmonic systems illustrate the remarkable versatility of modern functional materials and their applications in sensing, photonics, energy technologies, and nanoscience. Furthermore, the chapter on thermodynamic investigations of drug–DNA interactions highlights the expanding role of physical principles in understanding complex biological and biomedical systems.

Collectively, the chapters presented in this volume reflect the multidisciplinary character of contemporary scientific research, where advances often emerge at the interfaces of traditional disciplines. By bringing together contributions from experts across diverse fields, this book seeks to provide readers with a comprehensive overview of current developments while fostering dialogue and collaboration among researchers from different scientific backgrounds.

This volume is intended for graduate students, researchers, academicians, and professionals interested in the latest advances in physics, materials science, and computational sciences. We hope that the knowledge and perspectives presented herein will not only serve as a valuable reference but also inspire future investigations and innovations.

I express my sincere appreciation to all contributing authors for their expertise, dedication, and scholarly contributions. I am also grateful to the publishing team for their invaluable support throughout the preparation of this volume. Their collective efforts have been instrumental in maintaining the quality and integrity of this work.

It gives me immense pleasure to acknowledge all those people whose ideas and suggestions made this book possible especially to Dean, Research and Development, Integral University, Lucknow.

I would also like to thank Honorable Chancellor, Vice Chancellor, Pro Chancellor, Registrar, Dean, Faculty of Science and Head, Department of Physics, Integral University Lucknow, U.P. (India) for providing this opportunity to bring out the quality research work in form of this book.

I trust that *Contemporary Advances in Physics, Materials and Computational Sciences* will contribute meaningfully to the dissemination of scientific knowledge and will encourage readers to explore the exciting frontiers of modern interdisciplinary research.

Dr. Syed Salman Ahmad Warsi

May, 2026

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