

## Editorial

# Preface

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The conference “The Rise of Particle Physics” was conceived in late 2023 to commemorate the 50th anniversary of the discovery of the  $J/\psi$  particle in 1974. Initially, we envisioned this conference as part of a series of history of physics events co-supported by the Institute of Physics (IOP); however, we soon recognized the need for a fully dedicated symposium. We applied for grants from Sapienza University of Rome and Istituto Nazionale di Fisica Nucleare (INFN), both of which decided to support our initiative.

The conference took place at Sapienza University of Rome on the 23 and 24 September 2024. More information about the event can be found on the official conference website: <https://www.roma1.infn.it/conference/rise-hep-roma/>

Following the conference, we began compiling and editing a document that includes (nearly) all written versions of the talks presented by the speakers. Finally, we established a collaboration with the editor Guido Tonelli with the purpose of publishing this work in the HiHep peer-reviewed journal.

The resulting document offers a conceptual journey through some of the most significant steps in the construction of the Standard Model of particle physics.

From the discovery of the  $J/\psi$  particle in 1974, which triggered the “November Revolution” and solidified the Standard Model, to the development of Quantum Chromodynamics (QCD) and the experimental confirmation of weak interactions via the  $W$  and  $Z$  bosons, a reflection is made to trace the evolution of particle physics from a fragmented set of theoretical models to a coherent and predictive framework.

The 1970s, in particular, stand as a defining decade, transforming quantum field theory itself from a theoretical challenge (taming the infinities) into a toolkit to describe both electroweak and strong interactions.

Many of the contributions in this volume revisit that transformative period, culminating in the 2012 discovery of the Higgs boson at the Large Hadron Collider—an event that marked both a major scientific triumph and the beginning of new, enduring challenges in the field.

Beyond the theoretical breakthroughs, these proceedings highlight the role of experimental physics in the definition of the Standard Model. In addition, it is discussed how the advent of high-energy colliders, beginning with AdA and ADONE, followed by the proton-antiproton collider at CERN, shows the relation between technological innovation and fundamental research.

As we look ahead, the legacy of these discoveries continues to inspire new generations of physicists. Whether through the ongoing exploration of Beyond Standard Model physics, the search for new particles and phenomena, or the revolutionary field of gravitational wave detection, the pursuit of fundamental knowledge remains as strong as ever. It is our hope that this document not only preserves the history of these remarkable achievements but might also spark some discussions on the future directions of particle physics.

The authors thank all the contributors for their reflections, insights, and dedication to advance our understanding. May this volume serve as both a record of past achievements and a guidepost for future discoveries.

The Organizing Committee for this symposium consisted of Pia Astone, Fabio Bellini, Gianluca Cavoto, Riccardo Faccini, Stefano Giagu, Aleandro Nisati, Giulia Pancheri, Riccardo Paramatti, Antonio Davide Polosa, Shaharam Rahatlou, Paolo Valente, and Cecilia Voena.

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## Conflicts of Interest

The author declares no conflict of interest.



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