

ABOUT COST

COST (European Cooperation in Science & Technology) is the longest-running European framework supporting **trans-national cooperation** among researchers, engineers and scholars across Europe.

It anticipates and complements the activities of the EU Framework Programmes, constituting a “bridge” towards the scientific communities of COST Inclusiveness Target Countries. It also increases the mobility of researchers across Europe and fosters the establishment of **scientific excellence**.

COST Actions are bottom-up science and technology networks, open to researchers and stakeholders with a duration of four years. They are active through a range of networking tools, such as workshops, conferences, training schools, short-term scientific missions (STSM), and dissemination activities.

FOR MORE INFORMATION

www.cost.eu

HOW TO JOIN PARTICLEFACE

COST Actions are dynamical networks aimed at increasing the number of participants along the life of the project. If you are interested in joining PARTICLEFACE, open a profile at e-services.cost.eu and contact the Chair of the Action.

PARTICIPATING COST COUNTRIES

AT, BA, BE, DE, CH, DK, EE, EL, ES, FI, FR, HU, HR, IE, IT, NL, PL, PT, SE, SI, UK

PARTICIPATING NNC AND IPC COUNTRIES

AR, BR, CO, MX, RU, US

MANAGEMENT STRUCTURE

Chair of the Action: Dr. Germán Rodrigo (ES)

ViceChair of the Action: Prof. Sven-Olaf Moch (DE)

STSM Coordinator: Dr. Vittorio del Duca (CH/IT)

Science Communication Manager: Dr. Gudrun Heinrich (DE)

WG1 Leader: Prof. Claude Duhr (BE), Dr. Carsten Schneider (AT)

WG2 Leader: Dr. Malgorzata Worek (DE), Prof. Daniel de Florian (AR)

WG3 Leader: Prof. Janusz Gluza (PL), Dr. Radja Boughezal (US)

WG4 Leader: Prof. Sven-Olaf Moch (DE)

WG5 Leader: Dr. Gabor Somogyi (HU), Dr. Martin Gorbahn (UK)

GRANT HOLDER



GRANT PERIOD

24.10.2017 - 23.10.2021

WEBSITE

particleface.eu

SOCIAL NETWORKS



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COST Action CA16201

**Unraveling new physics at
the LHC through the
precision frontier**



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the EU Framework
Programme Horizon 2020

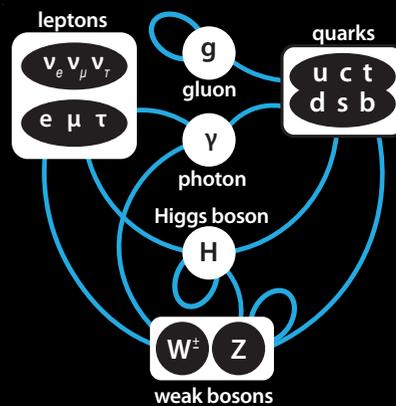
ABOUT PARTICLEFACE

PARTICLEFACE is a COST Action in the field of **theoretical elementary particle** and **high energy physics**. It involves an interdisciplinary community of more than 120 researchers from 27 countries with outstanding expertise in physics, mathematics and computer science.

THE STATE OF THE ART

Elementary particle physics is currently described by the Quantum Field Theory called the **Standard Model (SM)**. The SM, being the greatest success in particle physics, is well known to be theoretically incomplete. Fundamental questions underlying its **deep quantum structure** are still unanswered. The SM accounts neither for the observed **mass hierarchy** among elementary particles, ranging from the mass of the very light and elusive neutrinos to the top quark which is as heavy as a gold atom, nor for **dark matter** or **dark energy**. Most importantly, it cannot remain valid to arbitrarily high energies and does not include **gravity**. After the confirmation of the **Higgs boson's** existence at the CERN's Large Hadron Collider (LHC) in 2012, entirely new questions come into focus in the field.

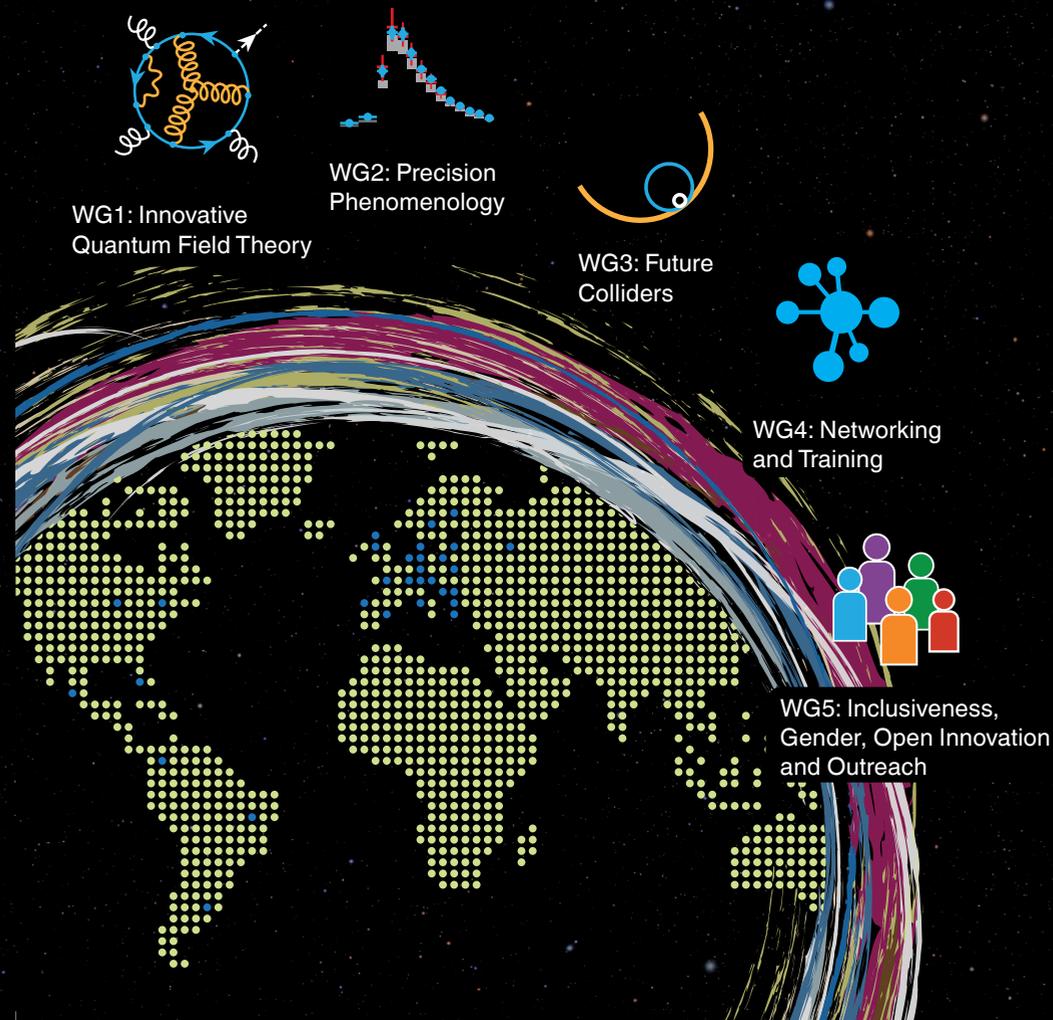
The key to address those questions is to confront experimental data with theoretical predictions of the highest possible precision. This strategy is driven by the **quantum corrections** describing the collisions of elementary particles at the highest energies.



THE CHALLENGE

The aim of PARTICLEFACE is to **shift the current precision frontier** in theoretical high energy physics to a new level of accuracy and to create new resources of networking and innovation, with the **quest for discovery** at the LHC and future high-energy colliders as the main motivation.

It is designed to work through long-standing challenges on the basis of the most encouraging advances in Quantum Field Theory and related areas of pure **mathematics** and **computer science** by uniting the leaders of the field in a coherent effort.



HOW

Quantum corrections in Quantum Field Theory are encoded by physicists through **loop Feynman diagrams**. These diagrams, invented by the Nobel Prize Richard P. Feynman, represent pictorially all the quantum processes that occur at the subatomic level in high-energy collisions, like the creation and annihilation of new particles from the vacuum. Loop Feynman diagrams translate into complex mathematical expressions from which physicists can predict the behaviour of elementary particles at colliders. The LHC, and in the future other colliders, is producing data of such a high quality that more and more complex diagrams are necessary to interpret correctly potential signals of new physics with sufficient theoretical precision, then challenging our current understanding of QFT and its underlying mathematical structure.

The Action is structured into five Working Groups

WG1: will develop **innovative and cutting edge algorithms and methods** in QFT and computer algebra in the search for new advances regarding the understanding of the underlying quantum and mathematical structure. Developments will be tested with proof-of-concept computations.

WG2: will work on **precision phenomenology**. Based on the achievements of WG1, it will provide theoretical predictions and tools in fully differential kinematics to analyse specific processes at the LHC and push the frontier regarding the sensitivity to new discoveries.

WG3: will assess the discovery potential of **future high energy colliders**, based on the results obtained in WG1 and WG2.

WG4: is responsible for the organisation of **networking events**, specialised **training schools** and **short-term scientific missions** for the exchange of new ideas and the training of the next generation of researchers in the field.

WG5: regards the implementation of the COST **inclusiveness** and **gender policies**, **dissemination** and **exploitation** of results and **public engagement**.