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Particle physics is an area of physical science that seeks to understand the basic building blocks of matter, identify and quantify the fundamental forces that govern all interactions, construct theories that unify all the facts in the most efficient way possible, and identify remaining questions and new theories that address them. Along the way there is crucial feedback between theoretical hypotheses and experimental findings. Only the combination of these two yields a discovery. For example, the top quark was discovered not just because there were two leptons, two b quarks and missing energy in a subset of Tevatron data. It was discovered because there was a theory that predicted its existence and gave meaning to the experimental findings. This proposal is by theorists, and heavily emphasizes the theoretical side of discoveries making.

Elementary interactions, the structure of matter and the history of the Universe, are all linked to each other. One observes fascinating continuity and evolution in time of its questions and goals but its basic purpose remains unchanged over the centuries: it is to discover the fundamental constituents of matter and their interactions, and to understand the history of our Universe from as early times as possible. The notion of elementary has been changing over time (atoms, nuclei, hadrons, quarks and leptons), and the number of elementary forces has been increasing (gravity, electromagnetism, strong and weak forces). After 100 years of research and profound revolutions in physics, the observations of Henri Becquerel, Marie Sklodowska-Curie and Pierre Curie and Ernest Rutherford have been finally (almost) understood in the framework of quantum field theory. The Standard Model (SM) of strong, electromagnetic and weak interactions is a very successful theory, describing all data in particle physics available at present and clarifying important events in the history of the Universe such as Big Bang nucleosynthesis and, much later, atom recombination.

Now we know the structure of matter and elementary forces operating down to 10^{-18} m. This length scale corresponds to 10^{-11} s after the Big Bang. The Large Hadron Collider (LHC) at CERN has started to probe energy scales in the TeV range, or equivalently down to the length scale 10^{-19} – 10^{-20} m, which corresponds to 10^{-13} s after the Big Bang.

The discovery of the HIggs boson in the first phase of the LHC experiments (RUN I) has confirmed the SM, at least as the correct effective theory of elementary interactions at the energy scales of order of 100 GeV. Nevertheless, particle physicists, cosmologists and astroparticle physicists have been grappling with several of the most challenging and fundamental questions in science: What explains the quantum stability of particle masses? What explains the hierarchy of masses of quarks and leptons? What is the dark matter of the Universe? What explains the predominance of matter over anti-matter in our Universe? This means that the SM is not the Theory of Everything and has to be for sure extended or completed.

So far, the theoretical and experimental research on physics beyond the SM was mainly focused on theories and ideas in which the esential role was played by new particles carrying the color quantum numbers of Quantum Chromodynamics. Such particles interact strongly and should have been produced already in RUN I, if their masses were about 1 TeV or less, but have not been discovered. This fact justifies the hypothesis that underlies this research project: Particle physics beyond the SM does not contain colored new particles or such particles are much heavier than 1 TeV. This hypothesis of uncolored way beyond the SM can explain the mentioned above fundamental questions left over by the SM. Its experimental verification is, however, much more difficult than discovering new strongly interacting particles, if they existed in the mass range accessible in the next phase of the LHC experiments (RUN II). Its verification requires theoretical investigations on the theoretical structures with uncolored particles that would address the questions unanswered by the SM, on the nature of those particles and their experimental signatures.