The quest for quantum gravity is one of the most important unfinished challenges of modern high energy theoretical physics. Its solution will presumably provide us, among others, with an understanding of very early stages of the evolution of the universe and physics of black holes. Unfortunately, in the construction of this theory we not only encounter enormous technical problems, but also, we seem to be guided by only few experimental hints. This is due to the fact that the energy scale where quantum gravity effects become dominant is about 15 orders of magnitude higher that the highest energies seen at LHC. It is of major importance therefore to investigate possible traces that quantum gravity generically leaves at lower energies, changing slightly the theories that we know well and for which we can try to experimentally observe minute departures from the expected behavior. For example, the influence of quantum gravity may modify the early universe cosmological scenarios and the theory of quantum fields, used in the construction of the Standard Model of elementary particle physics.

One of the possible ways to organize these possible quantum gravity corrections is to take as a starting point the hypothesis that they are captured by a subtle modification of our low energy theories associated with the emergence of quantum groups that become necessary to properly describe the spacetime symmetries. This hypothesis is the starting point of our investigations.

Our research project consists of three research tasks.

In the first we would like to find out how quantum groups emerge as an effective description of symmetries of fields and particles when quantum gravity effects are considered.

In the second we investigate a class of field theories with particular simple, but not trivial, form of quantum symmetries, defined by the so-called twist. We will investigate the properties of these theories, and find the associated Feynman rules.

Finally, in task three we will use the results of the abovementioned investigations to find a modified formulation of the Standard Model that would be a starting point of its phenomenological analysis.

The project will be carried out by the project leader, a senior investigator, and two junior investigators, in collaboration with several foreign partners of the project team.