The Large Hadron Collider (LHC), the world's most powerful particle accelerator at CERN in Geneva, has reached the major milestone in 2012. This is the discovery of the Higgs boson, with which we have found all the elementary particles predicted in the Standard Model. However, this theory leaves many mysterious puzzles left unsolved. For example, the existence of an unknown particle, the dark matter in the Universe, has been confirmed by several cosmological observations. The gravity is not explained in the Standard Model, and its inclusion makes the strength of the weak nuclear force destabilised, begging for a new symmetry and mechanism to stabilise it. Many of these arguments strongly indicate the existence of more fundamental theory underlying the Standard Model, which could be within the reach of the LHC and various other experiments.

At the time of writing, the LHC and other relevant experiments have not found any conclusive evidence of such a new theory in their data. What is the implication of it to the dark matter and the aforementioned puzzles in the Standard Model? How can the results of many experiments be summarised as a useful and concise information on the possible underlying theories? These are the questions this project is going to answer.

There are two main challenges to be tackled. First, the contemporary experiments are very complex and interpreting their results is very technical and time-consuming. Second, there are so many different possibilities to extend the Standard Model. One must explore this vast "landscape" of possible theories by confronting each of them with the experimental results. This project will overcome those obstacles by developing and using various state-of-the-art theoretical and computational tools and techniques. For example, we will develop a unique hybrid method of analytical and numerical calculations, and based on it create a tool that computes the particle production rate in a fraction of a second with the highest accuracy. This tool is expected to be 3-4 orders of magnitude faster than the existing tools on the market.

Using these tools, the first part of the project is devoted to excavating the signatures of new physics potentially hidden in the present LHC data. Currently, experimentalists are analysing the data by asking "is this particular signature present in the data?". However, this might miss a sign of new physics if the signature is drastically different from what we have presupposed. In this project we develop and use a new analysis method asking "what potentially interesting excesses are present in the data?". This new approach is more active and model-independent and better suited to the current stage of the LHC experiment.

In the second part of the project, we explore the vast possibilities of the extensions of the Standard Model, "landscape of new physics", by confronting each model with the LHC and other experimental results with a sophisticated sampling algorithm. This task requires a development of several tools that fill the gap between theory and experiments as well as a large scale collaboration with excellent and mixed expertise of theory, experiments and code development. We carry out this part of the project in collaboration with the world-wide `MasterCode` project. Particularly important question is whether the currently reported small anomalies in the data can be explained by the new physics models consistently with the LHC and other experimental results. This part of the project will answer those important and timely questions.