Popular summary of the research project

The existence of all elementary particles predicted by the Standard Model (SM) of the electro-weak interactions has been confirmed experimentally. The culmination of this process was the 2012 discovery of the Higgs boson at CERN in the LHC collider. So far, the search for particles outside the SM has not yielded any results. Nevertheless, this does not mean the end of elementary particle physics. SM has deficiencies that justify the belief that it is only an approximation of a more fundamental theory. For instance, many independent astrophysical observations confirm the existence of dark matter, which is a non-luminous form of gravitationally interacting matter. SM does not contain a particle that could be a realistic candidate for the dark matter, so it can be expected that it needs to be extended to include at least a stable particle that interacts with SM gravitationally and (perhaps) weakly. Another problem of SM is the difficulty of explaining why the Universe is dominated by matter, with a negligible admixture of anti-matter. The above arguments, the strongest being the absence of a dark matter candidate, imply that there are interactions beyond the SM. Their search/study is the aim of this project. In particular, we want to study the consequences of the Higgs sector extension for cosmology. We believe that solving the mystery of dark matter and baryon asymmetry will contribute to the discovery of a more complete theory of fundamental interactions. It should be emphasized that both issues: dark matter and the lack of antimatter in the Universe, are extremely important, timely and researched by many leading groups in the world. A satisfactory solution to any of the mentioned problems would already be an extremely valuable result.