Contemporary theory of strong interactions, Quantum Chromodynamics (QCD) describes the fundamental strong interactions of six types of quarks. Three of them are called light (L), and the remaining three are called heavy (H), with respect to the fundamental scale of the theory. QCD is not yet solved, but various regimes of this theory can be well approximated by the effective theories. In particular, the domain corresponding to light quarks is described by the chiral perturbation theory, based on the phenomenon of the spontaneous breakdown of the chiral symmetry of the light quarks. The physics of the heavy quarks is described by another kind of effective theory, where interactions are ordered in the expansion in the inverse mass of the heavy quark. In Nature, there exist several particles, build of heavy *and* light quarks.
Almost 25 years ago, the author of this proposal together with his collaborators,
Mannque Rho (CEA Saclay, Paris) and Ismail Zahed (Stony Brook, New York) have realized, that the consistent theoretical description of heavy-light particles enforces the appearance of pairs of such particles with opposite parities, so-called chiral doublers. Moreover, the authors of this hypothesis have estimated the mass gap separating the doublers.
First experimental confirmation of this hypothesis was possible only a decade after, when three independent experiments worldwide have observed the predicted pair with the lightest heavy quark, so-called charm quark. Only in 2015 the experiments possessing the possibility of observing the next generation of doublers, based on bottom quark, became operational. Moreover, the discovery potential of such experiments is not restricted to the mesons (quark-antiquark systems), but can in principle yield to the discovery of baryonic (three quarks) doublers and even exotic heavy-light particles (unconventional number of quarks/antiquarks). Taking into account the huge noisy background in such experiments, it is absolutely crucial to provide most precise theoretical predictions for the masses and coupling of expected particles. This is precisely the target of the project, which is based on new theoretical methods, including the holography - description based on dualities between string theory and black hole theory. Success of the project will lead to the new pattern of classification of all heavy-light hadrons.