Description for the general public

Two theories, to which the project is related, are theory of random matrices in mathematics and conformal field theory in physics. Lest us make a short introduction to both of them.

Matrix models were introduced by Eugen Wigner during this studies of the quantum systems in nuclear physics. Those systems are described by Schrödinger equations $H\psi = \lambda\psi$, where operator H is the Hamiltonian of the model, and λ is his eigenvaule. Because the operator H in such systems can have very complicated form (and sometimes the exact form is even not known), Wigner proposed to look how a "typical" operator should look like. This lead him to the definition of the random operators (restricted to the finite, high dimensional space, hence a matrix). Local analysis of the behaviour of such random operators turned out to be very consistent with the experimental data.

Conformal field theory (CFT) is characterized by the invariance of its quantities under the maps, which preserves angles. An example of such a map is scaling. Because such maps are most numerous on the plane, a lot of studies in CFT is done in dimension 2. This theory finds applications in theory of critical phenomena, where the scale of length does not play role.

Connection of those two theories comes from the fact that random matrices have conformal symmetry. This allows to analyse them from the point of view of CFT and prove in this way new results. The object of this project is to search for new such results in the generalisations of the matrix models: theory of super-matrix models and theory of multi-matrix models. Moreover research task also are related with the search for the new definitions of those results in the language of CFT.