The aim of the project is to make a major step-change in developing novel effective tools for studying complex systems based on stochastic geometry and stochastic evolution methods, on appropriate methods of analysis and combinatorics, as well as on numerical methods and computer simulations. The network we are going to create will unite efforts of leading specialists in this area towards scientific excellence, will establish new and strengthen existing long-term collaboration links between them, and will train a new generation of young researchers in this multidisciplinary area.

The proposed research is assumed to employ existing and to elaborate new models of real-world object, and hence to have direct applications. The systems we are going to study consist of large number of interacting entities and may evolve in continuous space and time. Both their structure and evolution are of our interest. Such systems appear in broadly understood statistical physics, including its industrial applications, in spatial ecology, evolutionary and population biology, epidemiology, etc. In view of this, along with mathematicians the network includes physicists and biologists working with the corresponding experimental data and experienced in modeling real world objects of the mentioned areas. In this direction, we plan to study structure and properties of complex networks, such as polymers, irregular and random graphs, random fields on graphs, and their applications in the mentioned areas. The microscopic evolution of complex systems of this type will be studied in Markovian and time-delayed frameworks. Their meso- and macroscopic dynamics will be deduced from the microscopic theory by various types of scaling procedures. Along with systems of interacting entities we will study objects which can be characterized as evolving complex shapes, where methods of stochastic geometry ought to be especially effective. Such models have various applications, e.g., in neurogeometry and visual recognition. Recent progress in this direction has been based on several ideas of Laplacian growth, stochastic Loewner evolution, conformal welding and potential-theoretical skeletons evoking a revolutionary development at the crossroad of statistical physics, stochastic geometry, complex analysis and dynamical system theory. The problems to be attacked include the Riemannian and sub-Riemannian geometries of the infinite-dimensional space of shapes, shape comparison and modeling by making use of infinite random configurations, deterministic and stochastic shape tuning and its geodesic equations.