Differential and partial differential equations have been considered as basic mathematical tools for modeling various phenomena in physics, technical and natural sciences. However very often stochastic differential equations and stochastic partial differential equations are more fundamental and relevant to modeling the word then deterministic equations. For example the theory of Mathematical Finance is based on stochastic linear equation of time evolution of a stock price.

Although the theory of stochastic differential equations (SDEs for short) has many applications in the technical and natural sciences it is based on very sophisticated and advanced branches of modern mathematics. Namely, from an analytical point of view, SDEs are based on analysis of (often non-linear) semigroups in Banach spaces, analysis of various spaces of functions depending on infinite many coordinates, properties of solutions to nonlinear equations with partial derivatives and very singular coefficients. From the point of view of probability theory, in SPEs one is looking for conditions for the existence and uniqueness of stationary measure for nonlinear problems, and for the rate and type of convergence to the limit distribution.

In the project we would like to study certain important problems of the theory of SDEs. We expect to obtain new results concerning long time behaviour of solutions, their stability, estimation of the coefficients. We wish to investigate equations with very singular coefficients, where some new techniques based on harmonic analysis and theory of distributions has been recently developed.