

Geometric Analysis is a branch of modern mathematics which studies geometrical objects, called manifolds, by using the methods of Mathematical Analysis. The evolution of the shape of a geometrical object (for example a tennis ball) can be described through partial differential equations. Contrary to school equations, these are almost never explicitly solvable. Thus modern geometric analysis focuses thus on qualitative studies of the solutions to such equations (i.e. it focuses on existence and uniqueness problems as well as on the stability of the solutions under a perturbation of parameters.)

A rather unexpected "effect" of the studies in Geometric Analysis was the discovery that many natural "physical" problems admit *singular* solutions which behave differently than physical intuition predicts. A classical example of this are the singular minimal surfaces in high dimensions. The understanding of the formation of singularities is not only mathematically interesting but also allows construction of better numerical algorithms for *approximate* description of the solutions.

In the project we shall deal with such equations. We plan to attack basic questions of existence of singularities (under what conditions the solutions are smooth, how large the singularities could be, what properties do they have). These problems are too general for *all* PDEs and hence we shall focus on special equations motivated by geometry.

This topic is close to my current research interests- my previous SONATA grant served me as an introduction to this theory. I would like to create a strong group in Cracow and broaden my research horizons.