Algebraic geometry is a branch of mathematics, classically studying zeros of polynomials of several variables. Modern algebraic geometry is based on the use of abstract algebraic techniques, mainly from commutative algebra, for solving geometrical problems about these sets of zeros. The fundamental objects of study in algebraic geometry are algebraic varieties, which are geometric manifestations of solutions of systems of polynomial equations. Examples of the most studied classes of algebraic varieties are: plane algebraic curves, which include lines, circles, parabolas, ellipses, hyperbolas, cubic curves like elliptic curves.

Algebraic geometry occupies a central place in modern mathematics and has multiple conceptual connections with such diverse fields as complex analysis, topology and number theory. Initially a study of systems of polynomial equations in several variables, the subject of algebraic geometry starts where equation solving leaves off, and it becomes even more important to understand the intrinsic properties of the totality of solutions of a system of equations i.e. of algebraic manifolds.

The project concern the study of a special class of algebraic manifolds called projective hyperkähler manifolds. Such manifolds occupy a central place in the classification theories of algebraic manifolds. Our main goal is to tackle the difficult problem of classification of hyperkähler manifolds. We expect to perform a substantial progress in this area: at least in the case of smallest unknown dimension four. Our results will give a new perspective to solve classical problems in geometry and analysis. We hope that they will also find applications in physics and cryptography.

This topic is close to my current research interests and to the topic of my habilitation. I would like to create a strong and dynamic group in Cracow working on modern problems of algebraic geometry.