Since the dawn of our spice, people were interested in exploring world around them. The impulse was coming from practical reasons as well as hunger for knowledge. The one of the fundamental questions was about the composition and properties of matter. The resolution of the human eye (a measure of the distance at which two items blur into one) was a natural barrier from investigating small objects for a long time. After the invention of instruments such as magnifying glass or microscope the objects with a sizes of microns become open for investigation.

The current optical microscopes allow one to get a magnification of order of several thousand times. This is due to the fact that in order to observe the structure of an object, the light wavelength must be smaller than its size. Scientists were able to overcome these limitations by *e.g.*. building the so-called "scanning microscopes" which, thanks to the precise electronic measurements, can study objects of a size of single atoms.

In order to have a deeper look at the structure of matter, *e.g.*. to study the composition of a single atom, it is necessary to apply another solution – instead of light (photons) particles, such as electrons or protons have to be used. It is known from the quantum mechanics that the wavelength of the particle depends on its energy – the greater is the energy, the shorter is the wavelength. Therefore, a "particle microscope" is the solution! Such devices are called "accelerators" and are being constructed for more than 100 years. Moreover, the technological progress makes such microscopes better and better, with more energy available to investigate structures of matter. The largest accelerator built so far is called Large Hadron Collider (LHC ). It located at the European Organization for Nuclear Research (CERN) and has a circumference of 27 km!

What are the scientists searching for using the so monstrous devices? Studies are focused on the two main points:
— finding new aspects of matter (such as the recently discovered Higgs boson),
— checking if our current understanding of the behaviour of our World is consistent with the new data.
My work, entitled "Studies of Hard Diffractive Production with the ATLAS Experiment" addresses the second point.

Within this project I plan to investigate behaviour of particles at the lowest possible scales. Especially, I focus on so-called diffractive events. They can be characterised as particle interactions in which no quantum numbers (like spin or colour) are exchanged. Due to such exchange, nature of interacting particles is not changed, regardless that energy or momentum were transferred. Such exchange is carried by a special object called the Pomeron. The aim of this project is to study its structure and nature. It is worth mentioning that theoretical predictions suffer large uncertainties. Without precise experimental input many interpretations are possible. This project will shed more light on diffractive physics.