The main task of geodesy is determination of the shape and dimension of the Earth, however its realization is difficult without including the rotational and orbital motions, influence of the solar system bodies or phenomenon occurring in the fluid envelopes, that is the atmosphere, the oceans and the hydrosphere. All elements are strictly connected, it means that, for instance, changes in position of the Sun and the Moon, reflect in shape of the Earth, and changes in the atmosphere influence the Earth rotation. A great contribution to knowledge about Earth behavior had an optical astrometry, which is one of the oldest science. However, rapid progress in that field begun in late 1970-ties with the advent of space geodetic techniques, such as Very Long Baseline Interferometry (VLBI) or Global Navigation Satellite Systems (GNSS). On the one hand they allow to determine relative position with high accuracy, on the other hand, they define actual orientation of the Earth in the inertial space, with change of the spatial direction of the rotation axis known as precession-nutation. Moreover these techniques enable determination of the Earth's angular velocity which is manifested by changes in the Length of Day (LOD) or give information about position of the rotation axis relative to the Earth crust, so called polar motion (PM). And information about the rotation of the Earth and its position in space is of great importance in any satellite mission, navigation or determination of the shape and structure of the Earth's interior.

Apart from the space geodesy techniques, the Ring Laser Gyroscope (RLG) technique has gained great attention in recent years. In general, gyroscopes are devices widely used, most of all, in navigation (aircraft, marine), but also in consumer electronics (mobile phones, tablets). Nevertheless, appropriately large and stable instruments are able to observe changes in Earth rotation. Unlike the space geodetic techniques, the RLG is a strictly ground technique and it observes the instantaneous rotation pole, not the conventional Celestial Intermediate Pole, what is important in monitoring diurnal and subdiurnal variations in Earth's rotation. However, with the currently achieved accuracy of the RLG observations, the technique is considered rather as a potential complement of space geodesy techniques. Nevertheless, the technique is still under development, thus it is possible in the future, that the technique will be used independently.

The aim of our project is to show the whole potential of the RLG technique in monitoring diurnal and subdiurnal variations in Earth's rotation vector, also those non-harmonic, of geophysical origin. We want to show advantages of the combination of the RLG with both mentioned space geodetic techniques, as well as we want to study capabilities and conditions of an independent usage of the RLG technique. For that purpose, first we focus on proper modeling of RLG observations. It means that we are going to review the phenomena influencing RLG observations and determine how big is their impact. Next, we are going to use computational adjustment methods, like least squares algorithm or the Kalman filter, for processing real RLG observations which we received from the Geodetic Observatory at Wettzell in Germany (the RLG in Wettzell is considered to be the most accurate for geodetic purposes). Next we are going to process the RLG data together with observations of VLBI and GNSS techniques, to asses potential improvement in Earth's rotation parameters determination. At the end we are going to simulate observations from few RLG instruments in order to investigate the capabilities and conditions (*e.g.* number of instruments, geographical location) of independent usage of the RLG technique for monitoring Earth's rotation. The realization of proposed research is expected to contribute to the development of the RLG technique, in context of the algorithms of processing the RLG data (both in the individual mode and as a combination with VLBI and GNSS techniques) as well as regarding the location of potential new instruments. This research is also expected to enhance our understanding of the observed Earth rotation variations, mainly at diurnal and subdiurnal frequencies, which is essential for preparation and realization of the satellite missions or research on the internal constitution and rheology of the Earth.