Unpredictability of outcomes of a quantum measurement belongs to the core features of quantum mechanics, which is inherently probabilistic in its structure. For instance, the famous Einstein-Podolski-Rosen paradox and related ”spooky action over distance” can be seen as tension between local measurement and highly non-local state of two photons, that give rise of random, but perfectly synchronised results. This particular problem baffled great scientists such as Einstein and Bell, famous for Bell inequality limiting possible correlations between measurement results. Experimental violation of Bell inequality shatter the world understood as a classical entity.

Measurement in quantum mechanics can be also related to the problem of **determination** of quantum state, called also **quantum state tomography**. The problem is difficult, as the number of parameters determining state of a quantum system consisting of n qubits grows exponentially with n. For a fixed system size several schemes of full quantum tomography exist, including these which provide maximal information concerning the measured state.

In this project we pose a related issue, how to construct quantum measurements optimal under selected restrictions concerning accessibility of information gathered from various subsystems. We wish to analyze this problem from both theoretical and experimental side by providing theoretical limitations such measurements must satisfy as well as by describing specific experimental schemes.

In particular, we will study the problem of proposing schemes of generalized quantum measurements performed on a single subsystem, which yield as much information about the entire state of the bipartite system as possible. Similar questions will also be studied for a more general setup of quantum measurements performed on a multipartite quantum system, but the information is registered in the fraction of subsystems only. Results obtained in this project may prove useful in future experiments related to quantum information processing and quantum computing.