Project 5.1. Characterization and certification of quantum resources

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Background:

Recently, there has been a growing interest in designing certification methods allowing to verify that quantum devices operate on certain quantum states and perform certain measurements on them. The aim of the project is to join this endeavor and propose such certification methods that are efficient and robust to experimental imperfections. We will consider the key resources quantum theory offers such as entanglement, steering or nonlocality as well as we will take into account various scenarios typically considered within quantum information such as device-independent, semi-device independent etc.

The project requires learning quantum information theory, in particular such its aspects as quantum entanglement or quantum nonlocality. Also, certain knowledge of numerical methods such as convex optimization methods will be required.

Within the project there is a possibility of visiting ICFO-The Institute of Photonic Sciences in Barcelona, which is one of the best places in quantum information in Europe.

The PhD will be financed by the Sonata-Bis project entitled Characterization and certification of quantum resources. We will work in team: the project leader, a PhD student, postdoctoral researcher and master students.

Aim:

The first aim of the project is characterization of certain key resources of quantum information such as quantum entanglement, steering or nonlocality. The second aim is to harness these resources to design efficient and robust-to-experimental imperfections methods of certification of quantum devices. We will consider various scenarios such as device-independent, semi-device-independent etc.

Requirements:

- very good knowledge of quantum theory,
- high level of mathematical skills,
- good attitude for cooperation,
- some competences in programming,
- good knowledge of English,
- experience in research in quantum information will be an additional asset.