

**PhD research topic proposal**  
**BME, Doctoral School of Mathematics and Computer Science**

**Name of supervisor :**

Gábor Ivanyos

**Degree:**

DSc

**Title of the topic:**

Algebraic methods in quantum information processing

**Short description:**

Physicists proposed the study of the question of applicability of quantum phenomena in information processing. In this regard considerable progress has been achieved during the past few years: there already exist devices for transmitting information that are encrypted using quantum mechanics and in a certain model of quantum computers in principle it is possible to factor integers and computing discrete logarithms. It is not yet clear how realistic the latter model is, but there are some promising results with implementing simple quantum machines consisting of a limited (but year by year increasing) number of gates. Here are some topics in which application of algebraic methods may result in further progress: (a) comparing complexity classes defined by various models of quantum computers with classical complexity classes; (b) looking for novel computational problems from algebra and arithmetics that can be solved efficiently on quantum computers (c) designing and testing quantum gates; (d) algebraic constructions for quantum error correcting codes

**Requirements:**

Msc/diploma in mathematics, physics, computer science or related disciplines; solid background in algebra and in theory of computation, skills in reading specialized literature in English.

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**Place of work:**

BME Mathematical Institute, Department of Algebra

**Statement:** *The conditions of the research above are satisfied, the theme is confirmed by the Head of the Department/Institute*