An Overview of the Latest Quantum Technologies and Their Accessibility for Science

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***Abstract*—The aim of the presentation is to present the most important technological breakthroughs in the field of quantum computing, with particular emphasis on solutions that have found practical application in recent years. An emphasis will also be placed on technologies available to the scientific community. The evolution of key hardware architectures, such as superconducting, photonic, and ion-trap architectures, will be briefly discussed, as will the Majorana 1 processor. The development of cloud platforms enabling broad access to real quantum computers for both research and educational purposes will also be addressed. More attention will be paid to IBM Quantum, Google Quantum AI, Microsoft Azure Quantum, D-Wave projects, and European initiatives, including the Polish EuroQCS systems. The presentation will also discuss current limitations, challenges, and prospects for the further development of this dynamic industry. Additionally, readers will learn about available programming tools and the possibility of remote use quantum infrastructure, which allows even centers without their own laboratories to actively participate in the global technology race. The presentation is aimed at scientists interested in modern computing technologies and those planning to begin research using quantum computers.**

***Keywords*—Quantum computer, Majorana, Qubits.**

I. Introduction

In recent years, quantum computers [1] have ceased to be solely the subject of theoretical considerations and futuristic visions. They are increasingly establishing themselves as a viable direction for the development of modern computing technologies. The pace of progress in this field means that quantum computers are now perceived not only as a subject of fundamental research but also as a potential tool for solving selected scientific, industrial, and engineering problems. The question remains whether quantum technologies are mature enough to find practical applications, and which access models to this infrastructure allow centers without their own laboratory facilities to participate in research. This issue will be discussed in more detail later. It should be noted, that due to space limitations and extensive topic, this article is an introduction to the issue.

II. Conclusions

The analysis leads to the conclusion that contemporary quantum computing should be viewed not only as the development of advanced computing technology, but also as a process of building a new research environment of strategic importance. Although the current phase of development of this field remains burdened by significant technological limitations, the growing importance of cloud infrastructure, programming tools, and transnational models of scientific collaboration is clear. Consequently, the real value of modern quantum computers lies not only in the parameters of the devices themselves, but also in the creation of competencies, standards, and research ecosystems that will determine the pace of further development of this discipline.

For this reason, the development of quantum computers should be analyzed not only as a technological problem, but also as an organizational, infrastructural and strategic challenge for modern science.

References

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