

Press release
16 June 2021

Cutting-edge research into quantum computing: BMW Group and Technical University of Munich agree to create an endowed chair in “Quantum Algorithms and Applications”.

- €5.1 million for TUM professorship, equipment and personnel
- Bridge between outstanding research and industry application
- Great potential of quantum computing for optimisation problems

Munich. The BMW Group will in future be supporting research into quantum computing at the Technical University of Munich (TUM). Today, Prof. Thomas F. Hofmann, President of TUM, Frank Weber, Member of the Board of Management of BMW AG, Development, and Alexander Buresch, CIO of BMW AG, signed an agreement to establish an endowed chair in “Quantum Algorithms and Applications”. Over a period of six years, the BMW Group will make a fund of €5.1 million available to TUM for a professorship, equipment and personnel. By taking this step, the BMW Group and TUM are seeking to bridge the gap between the outstanding basic research carried out in Germany and its specific application in industry. The holder of the chair will conduct applied research into specific problems and issues in the field of quantum computing at the same time as establishing an ongoing exchange of knowledge and findings between TUM and the BMW Group.

“It is clear to the BMW Group that quantum computing is a pioneering technology that holds great potential for a multitude of applications – from materials research to battery cell chemistry and the future of automated driving using quantum machine learning,” **says Frank Weber.** “This technology is at an early stage of development and we want to provide the best possible support for cutting-edge research and its transfer into industrial applications.”

“Thanks to this collaboration, the BMW-TUM axis is set to further strengthen Munich Quantum Valley’s reputation as Germany’s leading ecosystem for quantum technologies,” comments **Prof. Thomas F. Hofmann.** “Quantum computing could hold the key to solving the sort of complex tasks that are beyond even today’s supercomputers. The new endowed chair will focus on developing quantum algorithms for this and on trialling areas of application. The generous funding from the BMW Group will create the leverage needed to transfer the findings of quantum physics to industrial applications.”

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“Close collaboration between research, industry and the startup landscape is a prerequisite for cost-effective implementation of our specific use cases,” **explains Alexander Buresch.**

“The purpose of this is to relay the requirements of industrial applications so that they can be incorporated into the development of quantum computing demonstrators. Our team of experts is looking forward to joining forces with TUM and driving forward this important field of research while focusing on its practical application.”

The creation of the endowed chair underlines how the BMW Group is endeavouring to further the sustained development of the Munich region as a high-tech industrial base and is also a key building block for [Munich Quantum Valley](#), whose various initiatives have received €300 million in funding from the Bavarian state authorities.

TUM and the BMW Group already collaborate closely on a wide variety of other topics, with notable examples including battery research, circular economy, automated driving, artificial intelligence in production and mobility research. On the teaching side, the BMW Group helps to boost the practical relevance of courses with various guest lectures and project work, while the company also enjoys a close partnership with the TUM Institute for Lifelong Learning.

Great potential for solving optimisation problems.

At the BMW Group, high-performance computers handle some 2,000 computing tasks a day – such as high-end visualisations and crash/flow simulations – for approximately 3,000 users from R&D. The bulk of the computing operations are processed on servers in Iceland and Sweden that run on hydroelectric and geothermal green energy, reducing CO₂ emissions by around 5,900 tonnes annually. Once a certain level of computational complexity is reached, however, even today’s high-performance computers hit their limit, as they process information using a binary system, just as a laptop or smartphone would. Bits – a contraction of ‘binary digits’ – have a value of 0 or 1. In the case of quantum computers, the smallest unit of information is called a quantum bit, or qubit for short. Qubits can be far more than simply 0 or 1. Phenomena of quantum mechanics, such as the tunnelling effect, quantum entanglement

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and quantum interference, are used to put qubits in superposition, a state in which they can also assume values between 0 and 1 – and, theoretically, an infinite number of such values at the same time.

The BMW Group recognised the importance of quantum computing as a pioneering technology for the future back in 2017, prompting it to set up an interdisciplinary, cross-departmental project team with the task of identifying potential uses.

One of the BMW Group’s first research projects involved calculating the optimum circuit to be followed by a robot sealing welding seams on a vehicle. The existence of highly complex parameters means that even the latest high-performance computers would take years to find the optimum solution. Quantum computers are capable of computing all the possible permutations in just a few seconds.

The high level of complexity in the automotive value chain gives rise to various multi-faceted optimisation problems in areas such as production, parts logistics and vehicle development. It will be possible to use quantum computers in materials research to simulate the behaviour of material compositions at a whole new level, for example when researching new types of battery.

Another field of research that is growing in importance is quantum machine learning, where quantum computers are used to speed up specific processes of traditional machine learning. These innovative learning processes for artificial intelligence could be particularly useful for automated driving, too.

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Tel: +49-(0)176-601-56097, e-mail: christophe.koenig@bmw.deInternet: www.press.bmwgroup.com/globalE-mail: presse@bmwgroup.com**The BMW Group**

With its four brands BMW, MINI, Rolls-Royce and BMW Motorrad, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles and also provides premium financial and mobility services. The BMW Group production network comprises 31 production and assembly facilities in 15 countries; the company has a global sales network in more than 140 countries.

In 2020, the BMW Group sold over 2.3 million passenger vehicles and more than 169,000 motorcycles worldwide. The profit before tax in the financial year 2020 was € 5.222 billion on revenues amounting to € 98.990 billion. As of 31 December 2020, the BMW Group had a workforce of 120,726 employees.

The success of the BMW Group has always been based on long-term thinking and responsible action. The company set the course for the future at an early stage and consistently makes sustainability and efficient resource management central to its strategic direction, from the supply chain through production to the end of the use phase of all products.

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Home to over 600 professors, 45,000 students and 11,000 employees, the Technical University of Munich (TUM) is one of the most research-focused technical universities in Europe. It specialises in engineering, natural sciences, life sciences and medicine, together with economics and social sciences.

TUM is an entrepreneurial university that fosters talent and creates added value for society. At the same time, it benefits from its alliances with powerful partners from science and industry. The university has also gone global, with the TUM Asia campus in Singapore and TUM liaison offices in Brussels, Mumbai, Beijing, San Francisco and São Paulo.

A number of Nobel laureates and inventors have been among the researchers at TUM, including Rudolf Diesel, Carl von Linde and Rudolf Mößbauer. It was awarded the title of University of Excellence in 2006, 2012 and 2019, and consistently rates among Germany's top universities in international rankings.

<https://www.tum.de/en/about-tum/news/quantum-technology/>