

News Release

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Merck KGaA, Darmstadt, Germany, and Heisenberg Quantum Simulations Cooperate in Quantum Computing

- **Three-year cooperation between both companies**
- **Unique approach to quantum chemistry on near-term quantum computers**

Darmstadt, Germany, June 4, 2019 – Merck KGaA, Darmstadt, Germany, a leading science and technology company, today announced that today announced a three-year cooperation with Heisenberg Quantum Simulations (HQS), a startup based in Karlsruhe, Germany. The cooperation between the startup and EMD Digital will focus on applying and commercializing software for quantum chemical applications on quantum computers. Merck KGaA, Darmstadt, Germany, has the option for a distribution license.

“Quantum computing is poised to disrupt classical computing and enable a variety of unprecedented opportunities. The applications touch upon many fields with direct relevance to us and to our customers, for example materials research, drug discovery, artificial intelligence, and e-commerce,” said Philipp Harbach, Head of In Silico Research, at EMD Digital.

“We make software for near-term quantum computers,” said Michael Marthaler, CEO of HQS. “Conventional simulation can be used to reduce the space of possible candidates. By using near-term quantum computers, it is possible to reduce the number of molecules that need to be tested even further.”



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HQS was the winner of the [Anniversary Research Grant](#) in Digitalization and Computing, one of the research grants Merck KGaA, Darmstadt, Germany, initiated last year during its 350th anniversary year. The startup has special expertise in enabling quantum chemistry on near-term quantum computers, specifically on Noisy Intermediate-Scale Quantum (NISQ) devices.

Merck KGaA, Darmstadt, Germany has an interdisciplinary and cross-functional quantum computing taskforce in place. EMD Digital has strong expertise in quantum chemistry, an application which will be one of the first to benefit from the advent of quantum computers.

Quantum computing is a fundamentally new computing architecture that creates a new paradigm for computational capability potentially extending far beyond classical computing. In essence, quantum computers replace the functional unit of classical computers (bits) with new functional units (quantum bits, or qubits) which have massive parallel computing power. For specific problems, quantum computers reduce the total number of calculation steps exponentially.

The past three years have seen an unprecedented increase in public funding of quantum computing in all major countries around the world. Established public funding programs are in place for academia and private and public industry to spur technology development. Academic excellence in quantum computing exists around the world.

NISQ computers suffer from big quantum errors and pose a great challenge to near-term applications. Overcoming these obstacles through new, groundbreaking approaches is a major element of this cooperation. With regards to possible applications, the field of chemistry is expected to be the first to use quantum computers, enabling the performance of scalable and accurate quantum chemical calculations. The other three major fields that will benefit from quantum computers are predicted to be artificial intelligence, finance and pharmaceutical research.

About Heisenberg Quantum Simulations

The development of molecules for materials and pharma is a difficult, expensive and long process. Simulations are a tool to accelerate these R&D processes, but can't be efficiently used in many cases. HQS is developing quantum algorithms to predict molecular properties for chemical and pharmaceutical companies. The HQS software works on conventional computers and potentially on state of the art quantum computers. As a consequence, HQS can accelerate research and development processes for

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customers and widen the understanding of chemical and physical interactions which leads to better products and processes.

Quantum computers will bring fundamental changes to the development of materials and drugs, HQS will guide the customers to profit from the new chances and minimize the risks of change – via information, pilot projects and quantum simulation of molecules and processes.

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About Merck KGaA, Darmstadt, Germany

Merck KGaA, Darmstadt, Germany, a leading science and technology company, operates across healthcare, life science and performance materials. Around 52,000 employees work to make a positive difference to millions of people's lives every day by creating more joyful and sustainable ways to live. From advancing gene editing technologies and discovering unique ways to treat the most challenging diseases to enabling the intelligence of devices – the company is everywhere. In 2018, Merck KGaA, Darmstadt, Germany, generated sales of € 14.8 billion in 66 countries.

The company holds the global rights to the name and trademark "Merck" internationally. The only exceptions are the United States and Canada, where the business sectors of Merck KGaA, Darmstadt, Germany operate as EMD Serono in healthcare, MilliporeSigma in life science, and EMD Performance Materials. Since its founding 1668, scientific exploration and responsible entrepreneurship have been key to the company's technological and scientific advances. To this day, the founding family remains the majority owner of the publicly listed company.