Workshop Proposal for

International Workshop on Quantum Data Science and Management (QDSM 2023)

in conjunction with the 49th International Conference on Very Large Data Bases (VLDB), Vancouver, Canada

Title of the Workshop

International Workshop on Quantum Data Science and Management (QDSM 2023)

Chairs and Organizers

Sven Groppe is a Professor at the University of Lübeck, Germany. He is the project coordinator of the BMBF-funded QC4DB project about database optimizations accelerated by quantum computing. Furthermore, he is currently the principal investigator of three DFG projects, one dealing with GPU acceleration of database indices, one in the area of Semantic Internet of Things and one about high-quality COVID-19 knowledge graphs. Together with Le Gruenwald and in 2020 additionally, with Valentina Presutti, he is the workshop organizer and chair of the Semantic Big Data workshop series (2016 to 2020) in conjunction with ACM SIGMOD. In 2021, 2022 and 2023 he organizes the International Workshop on Big Data in Emergent Distributed Environments (BiDEDE) @ SIGMOD together with Le Gruenwald and Ching-Hsien Hsu. Sven Groppe and Carlo Alberto Boano organized together the International Workshop on Very Large Internet of Things (VLIoT) in conjunction with VLDB 2017 and 2018, together with Markus Endler VLIoT 2019, together with Mu-Chun Su VLIoT 2020, together with Weizhi Meng VLIoT 2021, and together with Sanju Tiwari and Shui Yu VLIoT 2022. For more details about his academic career, visit https://www.ifis.uni-luebeck.de/~groppe.

Jiaheng Lu is a Professor at the University of Helsinki, Finland. His current research interests focus on multi-model databases and quantum computing for database applications. He has written four books on Hadoop and NoSQL databases, and more than 130 journal and conference papers published in SIGMOD, VLDB, TODS, etc. He was the workshop co-chair of Keyword search and data exploratory with ICDE 2016, Keyword search on structured data with SIGMOD 2012, and Cloud databases with CIKM 2010.

Wolfgang Mauerer is a Professor at the Technical University of Applied Sciences Regensburg, and a Senior Research Scientist at Siemens Technology. His interests focus on software/systems engineering, and quantum computing. He has published strongly multi-disciplinary work in venues and journals from Nature Photonics and PRL via ICSE and TSE to SIGMOD, and is the author of three books. His organization experience includes industrial and open-source conferences with hundreds of attendees. For more details, see https://lfdr.de/.

Le Gruenwald is a Professor, Dr. David W. Franke Professor, and Samuel Roberts Noble Foundation Presidential Professor in the School of Computer Science at The University of Oklahoma, U.S.A. She also worked for National Science Foundation (NSF) in the Directorate for Computer & Information Science & Engineering (CISE) as a Cluster Lead and Program Director of the Information Integration and Informatics cluster and a Program Director of the Cyber Trust program. Her major research interests include Machine Learning Enabled Cloud Data Management, Quantum Data Management and Mining, Semantic Web, Data Stream Management and Mining, and Mobile Data Management. She has published more than 200 technical articles in journals, books, and conference proceedings.

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Workshop's topic and its Goals

The field of quantum computing has experienced remarkable progress after decades of research and development. Prototypes of quantum computers already exist and have been made available to users through cloud services (e.g., IBM Q experience, Google quantum AI, or Xanadu quantum cloud). While fault-tolerant and large-scale quantum computers are not available yet, the potential of this new technology is undeniable. Quantum algorithms have the proven ability to either outperform classical approaches for various tasks or are impossible to be efficiently simulated by classical means under reasonable complexity-theoretic assumptions. Even imperfect current-day technology is speculated to exhibit computational advantages over classical systems.

For most database researchers, quantum computing and quantum machine learning are still new

research fields. The goal of this workshop is to bring together academic researchers and industry practitioners from multiple disciplines (e.g., database, AI, software, physics, etc.) to discuss the challenges, solutions, and applications of quantum computing and quantum machine learning that have the potential to advance the state of the art of data science and data management technologies. Our purpose is to foster the interaction between database researchers and more traditional quantum disciplines, as well as industrial users. The workshop serves as a forum for the growing quantum computing community to connect with database researchers to discuss the wider questions and applications of how quantum resources can benefit data science and data management tasks, and how quantum software can support this endeavor.

We believe that many unsolved and interesting issues can be found at boundaries and intersections between different fields and that there are insufficient venues to publish such cross-disciplinary results. We also believe that an important aspect of future quantum computing will concern issues of handling data in one way or another. This workshop will serve as a venue not only to discuss early, experimental results in research, but also to feature a demonstration part with the intention of providing attendees with first-hand experience in using novel quantum computing techniques that go beyond the simple examples offered by various web services. This will give researchers a realistic intuition about quantum computing for data science and data management tasks.

Types of Papers

The workshop solicits papers of the following categories:

- **Research Papers** propose new approaches, theories or techniques related to quantum data science and management including new data structures, protocols and algorithms. They should make substantial theoretical and empirical contributions to the research field.
- **System Papers** describe new systems and whole frameworks for enabling quantum data science and management.
- **Experiments and Analysis Papers** focus on the experimental evaluation of existing approaches including data structures and algorithms for quantum data science and management and bring new insights through the analysis of these experiments. Results of Experiments and Analysis Papers can be, for example, showing the benefits of well-known approaches in new settings and environments, opening new research problems by demonstrating unexpected behavior or phenomena, or comparing a set of traditional approaches in an experimental survey.
- **Application Papers** report practical experiences on applications of quantum data science and management. Application Papers might describe how to apply quantum technologies to specific application domains.
- **Vision Papers** identify emerging new or future research issues and directions and describe new research visions for quantum data science and management. The new visions will potentially have significant impacts on society.
- **Demo Papers** deal with innovative approaches and applications for quantum data science and management. These papers describe a showcase of the proposed approach/application. We are especially interested in demonstrations having a WOW-effect.

Topics of Interest

We are interested in all issues concerning quantum data science and management such as the following:

- Quantum Computing for problems related to Data Science and Management
- Quantum Data Science
  - Quantum Computing for Data Science
  - Data Science for Quantum Computing
- Quantum Data Management
  - Quantum Computing for Data Management
  - Data Management for Quantum Computing
- Quantum Machine Learning
  - Quantum Machine Learning Enabled Databases
  - Quantum Data Management to Support Machine Learning
  - New approaches to Quantum Machine Learning

- Applications for
  - Quantum Data Science
  - Quantum Data Management
  - Quantum Machine Learning
- Quantum Algorithms with applications in Quantum Data Science and Management
- Quantum Software Tools for Quantum Data Science and Management
  - Frameworks and APIs
  - Programming Languages
  - Optimizers of Quantum Programs and Circuits
- Quantum Cryptography and Security for Data Science and Management

RELATION TO OTHER EVENTS

Our workshop complements the events of VLDB, as the topic Quantum Computing is not covered in other VLDB workshops. Our workshop highlights the important quantum computing topic for the main conference and will also attract more submissions to the main conference addressing this topic.

There are some conferences and workshops having a similar area of interest as QDSM. We enumerate these events in the following (not exhaustive) list:

- Workshop on Quantum Software and Applications 2022 in conjunction with INFORMATIK
- International Workshop on Quantum Software 2022 in conjunction with The International Conference on High Performance Computing, Networking, Storage, and Analysis SC22
- Quantum Artificial Intelligent Workshop in conjunction with IEEE International Conference on Quantum Computing and Engineering QCE22
- Quantum Machine Learning Workshop: Theory, Algorithms and Applications in conjunction with European Conference on Machine Learning Principles and Practice of Knowledge Discovery in Databases ECML-PKDD 2022
- Quantum Processing of Big Data: from quantum computing to earth observation in conjunction with The Quantum Information and Measurement V Conference QIM 2019
- 3rd International Workshop on Quantum Software Engineering Q-SE 2022 in conjunction with IEEE International Conference on Software Engineering ICSE 2022
- The First ACM/IEEE International Workshop on Quantum Computing in conjunction with The Seventh ACM/IEEE Symposium on Edge Computing SEC 2022

There are only a few conferences and workshops addressing QDSM topics, such that there is a need for this kind of workshop at a top conference like VLDB. As most deadlines of these conferences and workshops do not overlap with our planned important dates, we are confident that QDSM will also be attractive to researchers of these communities in addition to the VLDB community. Furthermore, in contrast to all of the listed events, our workshop has a strong focus on the intersection of quantum computing and data science and management.

DESIRED WORKSHOP FORMAT

We plan a full-day workshop in order to have enough time for demo sessions, tutorials and a discussion session about the workshop's results and open challenges besides paper presentations and keynotes. We prefer Monday, August 28th, but also Friday, September 1st, is fine with us.

REVIEW PROCESS

We will enforce a rigorous peer and single-anonymous review process with the option for authors of a double-anonymous review process. All manuscripts submitted to our workshop will be reviewed by at least three PC members. To verify the originality of submissions, we will use Plagiarism Detection Tools to check the content of the submitted manuscripts against previous publications.

Papers will be evaluated according to the following aspects:

- Relevance to the Workshop

- Novelty and Practical Impact
- Technical Soundness
- Appropriateness and Adequacy of
  - Literature Review
  - Background Discussion
  - Analysis of Issues
- Presentation, including
  - Overall Organization
  - English
  - Readability

Handling of Conflicts of Interest

We follow the conflict of interest policy for ACM publications, which is available at https://www.acm.org/publications/policies/conflict-of-interest. This policy includes a clear definition of what constitutes a conflict of interest.

Concreting the conflict of interest policy, we will avoid conflicts of interest by taking the following actions:

- We will *not* assign reviewers to papers whose authors have conflicts of interest with reviewers.
- Authors will declare conflicts of interest at the time of submission.
- Reviewers will declare conflicts of interest during the review process.
- The review process of submissions by one of the chairs or their colleagues will be completely handled by another chair. These submissions must be submitted for double-anonymous review. Effectively, this implements a triple-anonymous review process.

Important Dates of the Workshop

We plan the following important dates for our workshop:

Submission:	April 3, 2023
Notification:	May 31, 2023
Workshop:	August 28 (Monday, our preferred choice) or September 1 (Friday), 2023

Plans for Publicity

We will use related portals and mailing lists during our publicity efforts for the workshop to ensure maximum visibility in the research community.

We will submit our Call-for-Papers to several portals, for instance, CFPList, WikiCFP, PapersInvited, eventseer, ACM conferences, OpenResearch and ourglocal.com.

We will distribute our Call-for-Papers among several mailing lists like DBWorld, quantum-announcements-join@cs.ox.ac.uk, fg-db, qipc.spain@listas.csic.es, ACM SIGCOMM, qci-external@elist.ornl.gov, MyColleagues, SIG-IRList, Multimedia Knowledge Management Network (MMKM) and distributed-computing-announce. Also, we will post our announcement to the relevant national societies and interest groups, for instance the German Gesellschaft für Informatik and their working groups on databases and quantum computer science.

We will post our Call-for-Papers on several social media platforms like linkedIn and Xing.

Furthermore, we will contact researchers of the quantum computing, data science, and data management communities directly to invite them to submit their recent research results to our event.

Proceedings

We will publish our proceedings in the CEUR Workshop Proceedings (CEUR-WS.org), which provides free open-access proceedings for computer science workshops. CEUR papers are indexed in Scopus,

DBLP, SJR and other bibliographic databases. Altogether this ensures maximum visibility to all who are interested in the topics of our QDSM workshop.

PROGRAM COMMITTEE

Our program committee consists of the following experts (already confirmed):

- Umut Çalikyilmaz, University of Lübeck, Germany
- Prasanna Date, Oak Ridge National Laboratory, USA
- Maja Franz, OTH Regensburg, Germany
- Srinjoy Ganguly, Woxsen University, India
- Jan Lellmann, University of Lübeck, Germany
- Jukka Nurminen, University of Helsinki, Finland
- Natacha Kuete Meli, University of Lübeck, Germany
- Nitin Nayak, University of Lübeck, Germany
- Stefan Prestel, Quantum Brilliance GmbH, Germany
- Manuel Schönberger, OTH Regensburg, Germany
- IIya Safro, University of Delaware, USA
- Ghanshyam Singh, Malaviya National Institute of Technology Jaipur (MNIT), India
- Valter Uotila, University of Helsinki, Finland
- Sanjay Vishwakarma, IBM Quantum, IBM Research - Almaden, USA
- Tobias Winker, University of Lübeck, Germany
- Zhengtong Yan, University of Helsinki, Finland

RATIONALE ABOUT RECRUITING THE CHAIRS AND PROGRAM COMMITTEE WITH SPECIAL REGARD TO DIVERSITY CONSIDERATIONS

The PC chairs of the proposed QDSM workshop are coming from two continents, Europe and North America, which would attract an international community. One of the PC chairs is female (25%). The h-index of the PC chairs are ranging between 19 and 40[1].

We have currently recruited 20 PC members (inclusive chairs) listed in the previous section who are experts in the topics of interest of our proposed workshop. All PC members already confirmed their membership. Our PC represents a good mixture of different experiences, not only in terms of research areas but also in terms of levels of research experience. While most PC members are from academia, we also have two experts from industry and one expert from a national research laboratory. We also plan to invite additional female PC members as well as PC members from industry to further increase diversity (thanks to a large number of collaboration partners, contacts from prior conference and workshop endeavors, and good connections to industrial research partners).

INVITED SPEAKERS AND KEYNOTES

We will invite well-known experts for one-hour talks. We aim for persons focusing in the area of quantum computing, data science and management, but will also invite highly reputed experts from outside the database and data management community to highlight the interdisciplinary nature of the workshop. This includes, for instance, leaders and technical heads of quantum computer vendors. Possible candidates for keynote speakers include:

- Prof. Dr. Rainer Blatt, University of Innsbruck, Austria
- Dr. Sebastian Luber, Senior Director Technology & Innovation, Infineon AG
- Dr. Jan Goetz, CEO and co-founder of quantum computing vendor IQM
- Prof. Dr. Florian Neukart, Member of the Board of Management for Product, Terra Quantum AG
- Dr. Heike Riel, IBM Fellow, Lead IBM Research Quantum Europe
- Dr. Mira Wolf-Bauwens, Responsible Quantum Computing Lead IBM Deutschland GmbH
- Manfred Rieck, DB Systel GmbH, VP Individual Solution Development (and member of the quantum computing leadership team at Bitkom)

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[1] according to google scholar and scopus

- Prof. Dr. Immanuel Trummer, Cornell University (author of one of the first papers using quantum annealers to solve database-related issues)

Sponsorship plans

The workshop has secured sponsorship from our industry partner, Quantum Brilliance GmbH. Quantum Brilliance develops quantum processing units which can operate at room temperature, in large data centers, and at the edge as part of the heterogeneous computing landscape. Our industry partner will support the registration of early career researchers and students, preferably from underrepresented countries and communities, at the discretion of the program committee, and up to a maximum total amount of approximately $1000. Quantum Brilliance will further contribute useful merchandise to the in-person participants of the workshop.

We will try to secure more sponsors and extend our sponsored activities to travel grants for students and sponsored meals in order to increase the attractiveness and credibility of our workshop.

History of the event

The event has not been held previously. We want to offer an attractive program with keynotes, paper presentations, panels, demos, and tutorials for beginners. Furthermore, the topics of our proposed workshop are hot topics, and considering the recent publicity of quantum computing, we expect a high interest in our QDSM workshop. We estimate the number of participants to be about 50. We expect to receive about 20 submissions.