Technologieentwicklung und -unterstützung für Ionenfallenbasierte-Quantencomputer (TeufIQ)

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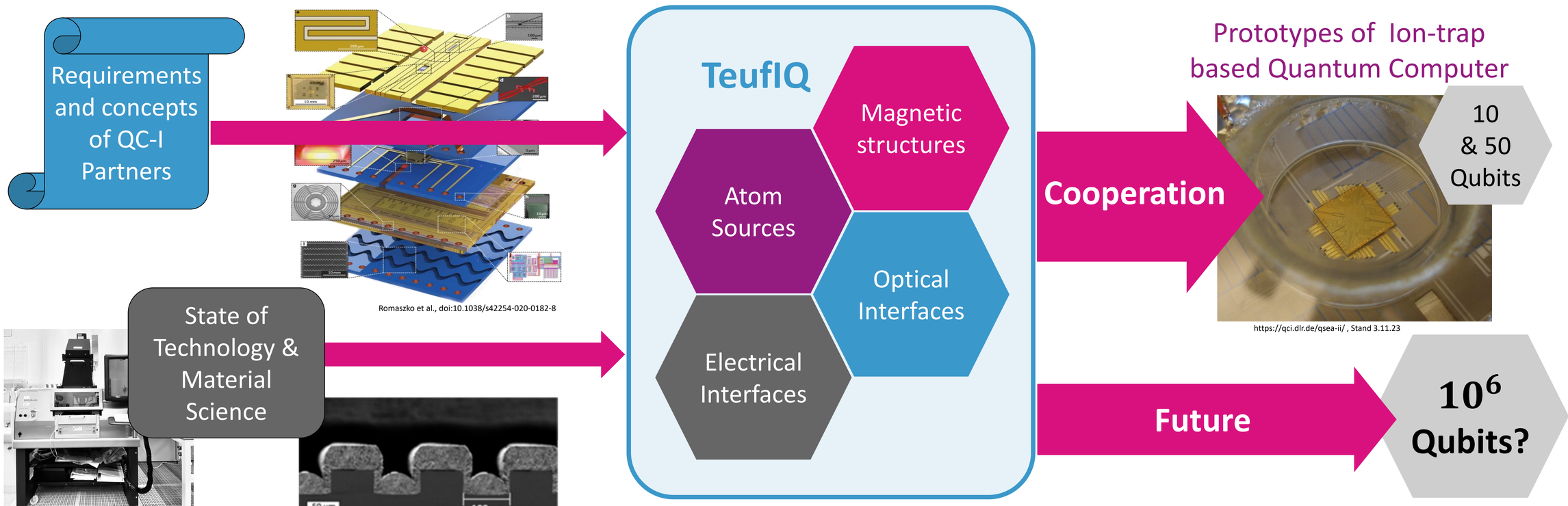

Fig. 1: Overview of TeufIQ project scope

Abstract

Purpose of the TeufIQ project is to support the industrial partners of QC-I in developing and manufacturing prototypes of ion-trap based quantum computers. The project framework encompasses a wide range of research services for the QC-I partners placed at the Innovation Center Hamburg (IZHH). The project's foundation is the expertise and the experience in micro- and nanotechnology of the DLR division QT-IMN in Ulm. We particularly address close collaboration working on open research questions and the development of related technological solutions to facilitate the production of ion-trap based quantum computers in future.

Goal of Project TeufIQ

Next to the explicit goals of the QC-I-Industry-Projects to build prototypes of quantum computers, there still remains unsolved problems regarding the production. This "day after tomorrow problems" are the scope for this project.
As part of the QC-I program TeufIQ will get in touch to QC-I project partners and search for topics in the domain of microsystem technology where no solution is available or is out of scope. The type of cooperation strongly depends on the requisites of the partners and ranges from close collaboration in technological facilities over scientific discussions to easy specification issuing. TeufIQ provides a group leader, three scientists and a technician at the IZHH, a clean room in the facility of NXP Hamburg with latest microsystem technology machines and knowledge-based support from QT-IMN in Ulm.

Interposer-Technology for Ion-trap QC

- Development of optical interfaces, e.g.
  - ➢ Waveguides und LASERs
- Development electrical interfaces

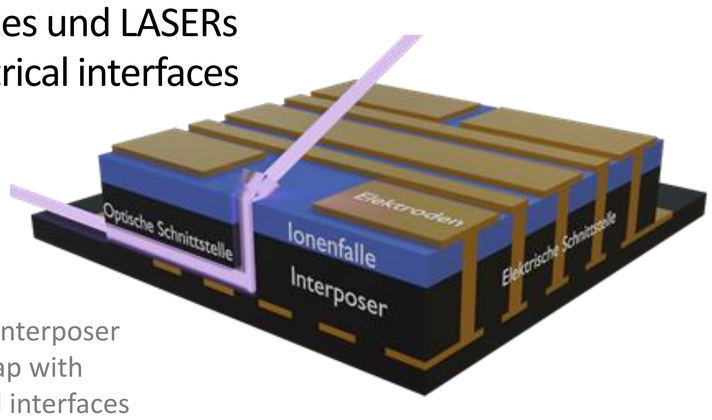

Fig. 2: Schematic of interposer for planar surface trap with electrical and optical interfaces

Atom sources for Ion-trap QC

- Development of atom sources
- Ion reservoir and controlled trap loading for high density surface traps

Magnetic structures for Ion-trap QC

- Development of on-chip magnetic microstructures
- Magnetic fields exhibiting strong gradients
- Coupling of ion states

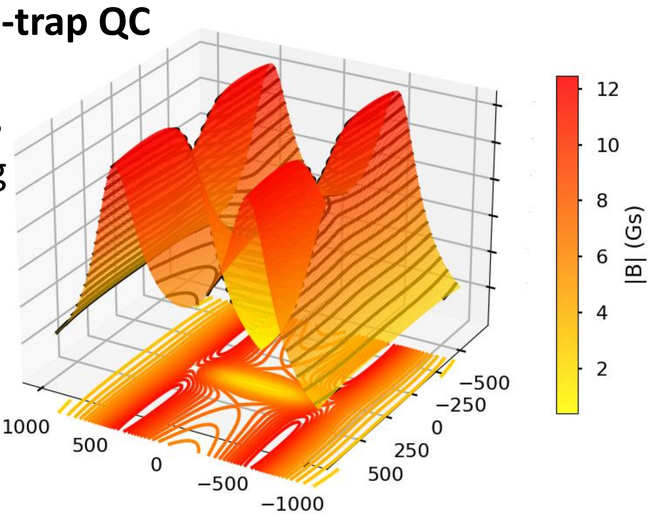

Fig. 3: Simulated magnetic field for addressing ion quantum states

Goal of Division QT-IMN

The research of the department "Integration of Micro- and Nanosystems" (IMN) is mainly focused on the miniaturization and implementation of quantum physical systems. Herein, the crucial steps are the technological integration and process development (so called "enabling technologies") bringing these concepts into real world applications. Therefore QT-IMN is an important player in the goal to commercialize quantum-technology.

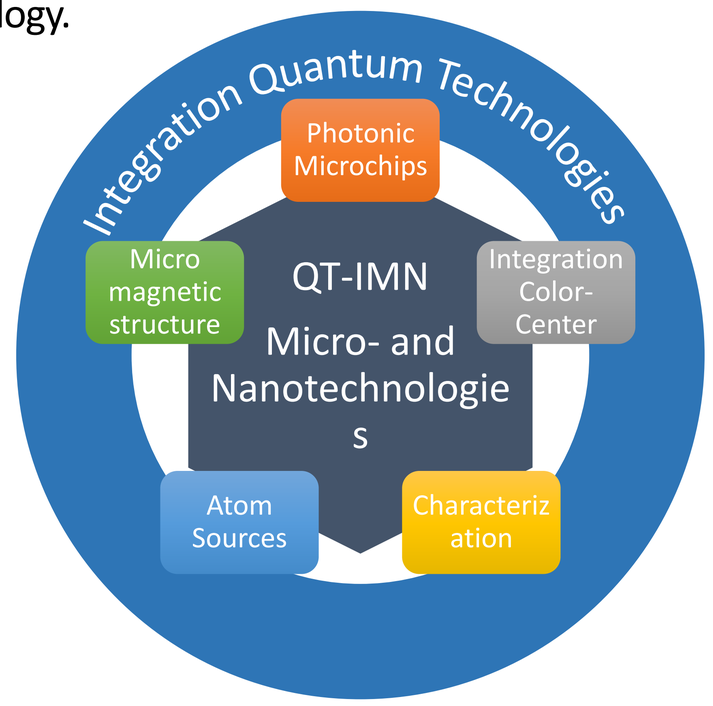

Fig. 4: Scope of division QT-IMN: Integration and miniaturisation of quantum technologies

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