FAQ

Fabrication Facilities for Advanced Solid-State Quantum Devices

Programm / Ausschreibung	Quantum Austria 1. Ausschreibung (2022)	**Status**	laufend
Projektstart	01.10.2022	**Projektende**	31.12.2025
Zeitraum	2022 - 2025	**Projektlaufzeit**	39 Monate
Keywords	Solid State Quantum Phyiscs, Photonics, Superconducting circuits, integrated optics, Quantum dots, Quatnum communicaiton, quantum computation		

Projektbeschreibung

In diesem Projekt werden die Reinarum Infrastruktur in Linz und Innsbruck and den aktuellen Stand der Technik angepasst. Damit werden Micro und Nano-Strukutren für die Forschung an Supraleitenden Schaltkreisen, Quanten Punkten und integrierten Photonischen Schaltkreisen hergestellt werden

Abstract

Initial situation: FAQ focuses on the acquisition of infrastructure for the fabrication of solid-state devices for quantum science and technology and brings together 3 research teams, each with leading expertise in the fields of semiconductor-based platforms for quantum information (Weihs - UIBK, Rastelli - JKU) and superconducting circuits (Kirchmair - UIBK).

The devices that will be fabricated with this infrastructure have the potential of large-scale integration for quantum computation (Kirchmair) and scalable sources of quantum light for quantum communication (Weihs, Rastelli/Brehm/Fromherz), offer flexibility for fundamental research and are complementary to other platforms for quantum science and technology explored in Austria like Ions and Atoms. The teams have been collaborating within joint initiatives (SFB, FG5, HRSM, CoE...). for the past years.

Steady progress and breakthroughs in device quality rely on continuously refined and improved methods. In turn, this constant demand for improved processes requires that cleanroom facilities are regularly updated to remain state-of-the-art.

The infrastructure addressed by FAQ is indispensable for research related to solid state systems and will allow the universities involved in the project to maintain and strengthen their leadership in the national and international landscape and address new cutting-edge scientific and technological questions.

Planned acquisition of infrastructure: The requested funding will be used to expand the capabilities of optical and electron

beam lithography to make the processes faster, more reliable or enable smaller feature sizes. Furthermore, the upgrade of an existing molecular beam epitaxy system and an evaporation tool will improve the quality of deposited semiconductor and superconducting materials. Furthermore, the infrastructure for wet chemistry has to be adapted to accommodate additional wet etching processes and will be complemented by an annealing oven to improve the surface quality. The acquisition of an atomic force microscope completes the acquired infrastructure and will allow us to analyse the surface quality of the devices fabricated with the new machines and procedures.

Planned use of infrastructure: The two facilities are set up in a way that there is on the one hand complementarity in the existing machines to ensure a wide range of accessible processes in Austria and on the other hand the capability to ensure that in case of major equipment failure and long repair times the respective other institution can provide support. The main users of the facility will be the researchers at JKU and UIBK within the FAQ proposal but also other groups located at these institutions. The infrastructure acquired in this project as well as the cleanrooms at JKU and UIBK are accessible to external users like collaborators of the respective groups as well as companies and start-ups.

Projektkoordinator

- Universität Innsbruck

Projektpartner

- Universität Linz