Call for Proposals

Quantum Technologies

March 2020

<table>
<thead>
<tr>
<th>Content</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Background</td>
<td>1</td>
</tr>
<tr>
<td>2 Scope and objectives</td>
<td>2</td>
</tr>
<tr>
<td>3 Eligibility</td>
<td>4</td>
</tr>
<tr>
<td>4 Modalities</td>
<td>4</td>
</tr>
<tr>
<td>5 Official channel</td>
<td>5</td>
</tr>
<tr>
<td>6 Deadlines</td>
<td>5</td>
</tr>
<tr>
<td>7 Proposals</td>
<td>5</td>
</tr>
<tr>
<td>8 Project agency</td>
<td>6</td>
</tr>
</tbody>
</table>
1 Background

Digitalization has a significant impact on almost any application and has become a key to progress and innovation. It is based upon transformation of analogue values to digital formats and their subsequent processing and storage. However, nature is not limited to the states 0 or 1 as in digital technology. It consists of quantum and a large variety of different conditions. Quantum Technologies therefore promise significant advantages.

All technologies based upon or utilizing quantum effects are considered as Quantum Technologies. 1st generation Quantum Technologies, i.e. solid state technology, magnetic resonance imaging and laser technology, are a natural part in daily life. Here, quantum effects are only used in an indirect manner. 2nd generation Quantum Technologies will control quantum effects such as superposition, blur relation and many body effects and will exploit their technical potential.

2nd generation Quantum Technologies have been investigated for about 20 years, primarily in basic research. These days first technical applications are arising and the race for industrial implementation has started. This is confirmed by intensive R&D efforts concerning ultraprecise metrology and imaging as well as fast, reliable and safe data communication. Quantum Technologies contribute to significant progress in a wide range of application areas, resulting in high importance for science, economy and society.

The research program “Quantum Technologies“ of the Baden Württemberg Stiftung aims at supporting excellent research and existing research groups in Baden-Württemberg and at translating their results into practical applications. As the program focuses on networking only scientific cooperations between research institutes from different locations in Baden-Württemberg will be financed.
2 Scope and objectives

The research program “Quantum Technologies” addresses pre-competitive, application-oriented basic and preparatory research. It focuses on projects aiming at making basic research applicable. Projects should address the following topics:

1. **Quantum simulation / Quantum simulators**
   Quantum simulators enable research on complex and microscopically not observable systems on the basis of model systems. These model systems show similar physical behaviour but can be examined over a wide range of parameters. They offer ideal opportunities in materials science, biology, pharmacy and medicine. Research topics concerning quantum computing or quantum computers are not addressed.

2. **Quantum communication**
   Quantum technologies can ensure data communication on a very high safety level. Single quantum states can be used to encrypt information. In contrast to conventional cryptography, safety is based on physical and not on mathematical principles. Topics addressed include quantum cryptography, quantum key distribution and even post quantum cryptography.

3. **Quantum metrology sensing and imaging**
   Quantum states are extremely sensitive towards environmental influences. Quantum systems therefore are perfectly suited for measuring physical parameters such as pressure, temperature, position, times, velocity, acceleration, electrical or magnetic fields or gravity in ultrahigh precision. This call addresses basic research leading to new and interesting applications of sensors with extreme sensitivity. Other topics addressed are quantum enhanced imaging and quantum lithography.

4. **Basic technology for quantum systems**
   Industrial application of quantum technologies requires robust and reliable components and systems. In this context proposals may relate to:
   - materials research aiming at robust, reliable and practical components or systems
   - targeted control and use of quantum states
   - basic research leading to simple and robust laboratory systems

Networking of the best scientists and institutes in Baden-Württemberg is one major goal of the research program. Therefore, only scientific cooperations between at least two groups from different locations and projects that contribute to the aim of strengthening Baden-Württemberg’s leading position in quantum technologies will be financed.
3 Eligibility

Eligible for participation are universities and non-profit research institutions based in Baden Württemberg.

4 Modalities

Research will be conducted on behalf of Baden-Württemberg Stiftung GmbH on the basis of a contract concluded with the research institution (contract research). All exploitation rights resulting from a project are owned by Baden-Württemberg Stiftung gGmbH.

Personal and materials costs will be financed, investment costs only in well justified exceptional cases. The reimbursement of Investment costs is limited to depreciation costs in the project duration.

Each network project has to appoint a coordinator as contact person for Baden-Württemberg Stiftung. This coordinator will be responsible for the overall management and coordination of the project in accordance with the Baden-Württemberg Stiftung.

A one-step application process is intended. Proposals submitted before deadline defined will be evaluated by independent experts from outside Baden-Württemberg. Decisive evaluation criteria are as follows:

- Scientific quality and level of innovation
- Progress compared to international state of the art
- Expertise of the consortium
- Relevance for practical application
- Quality of the network cooperation

There is no entitlement to financing projects. Rejected proposers will not receive any detailed feedback or justification. By submitting an application, proposers agree to these modalities.

Duration of projects should be 3 years according to networking concept of the research program.

The research program “Quantum Technologies“ of Baden-Württemberg Stiftung is limited to 5 Mio € in total.
5 Official channel

Applications of universities must be submitted by their rectorates. Applications of non-university research institutes must be submitted by their management.

6 Deadlines

Proposals in German or English language (including German abstract) must be submitted by 12 June 2020 (Deadline) electronically to VDI Technologiezentrum GmbH Düsseldorf.

7 Proposals

Proposals (including title page and list of references) must not exceed 20 pages (DIN A 4, font page 12pt). Structure required:

1. General information (applicant, institute, title and acronym of proposal, project manager and coordinator, legally binding signature)
2. Summary, comprehensive and generally understandable description of the proposal
3. State of research and demarcation of actual state, patent situation (if applicable)
4. Detailed description of project: objective, scientific use, potential for improvement, work program, methods and potential for practical application
5. Own related previous work and publications (last 5 years) with respect to proposal, related patent applications, if any
6. Work and time schedule including semi-annual milestones of each partner
7. Information concerning personal and equipment available
8. Finance plan: list of net amounts of personal and material costs and invest for each partner shown separately (table)

**Note:** VAT must be shown. If VAT is not explicitly shown, Baden-Württemberg Stiftung considers finance plan including VAT.

- **Personal costs** will be granted based on flatrates. Personal costs must be classified by qualification, employment time and proportion concerning proposal. The following flat rates will be applied (full time equivalents):
  - Postdoc 74.100 € plus VAT
  - PhD Student 68.400 € plus VAT
  - Non-scientific stuff 51.000 € plus VAT.

- **Material costs** include small appliances up to 5.000 €, consumables, travel expenses, costs of scientific assistants and other project costs.
• **Investment costs** will be financed only by exception. Only totally new investments (> 5,000 €) can be considered only by way of depreciation for the period of use during the project (AfA table).

• Total cost overview

• Finance plan must provide information on allocation of each single cost item to individual partners.

---

### 8 Project agency

Baden-Württemberg Stiftung GmbH has appointed VDI Technologiezentrum GmbH Düsseldorf as project agency. VDI Technologiezentrum GmbH is responsible for the program and acts as central contract for applicants.

Proposals (pdf- and word-documents) must be submitted electronically through the internet portal [https://www.projekt-portal-vditz.de/bekanntmachung/Quantentechnologien](https://www.projekt-portal-vditz.de/bekanntmachung/Quantentechnologien). Contact:

VDI Technologiezentrum GmbH
Schlüsseltechnologien - Quantensysteme
VDI-Platz 1
40468 Düsseldorf

Dr. Joachim Fröhlingsdorf  
Tel.: 0211 / 6214-508  
E-Mail: froehlingsdorf_j@vdi.de

Dr. Claudius Klein  
Tel.: 0211 / 6214-903  
E-Mail: klein_c@vdi.de