Concept Description v.3.6 January 20, 2020

KTH Center Quantum Technology Hub

Center planning team

Egor Babaev
Val Zwiller
Mats Wallin

The report was prepared together with a work group of PIs from the focus areas of the suggested center.

Table of Contents

Executive Summary

We suggest that KTH forms a center for quantum technology named QTH – Quantum Technology Hub - starting in 2020. The center will be hosted by the SCI school and is endorsed by the KTH Materials Platform, and involves research groups from SCI, CBH and EECS schools, and from Nordita. The mission is to bring together academia and industry to share and generate innovations in the expansive area of emerging quantum technology. The purpose of the center is to coordinate and catalyze world-leading research and education at KTH, create a stimulating and inclusive environment, organize seminars, target large-scale funding, interact and collaborate with other universities, industry and society.

1. Background

Modern physics including quantum mechanics was developed in the 20th century and forms the basis for most new technologies and industries. The next major step, the Second Quantum Revolution, will transform science and technology. Enormous investments in China, the USA and the EU are currently directed at university centers with this focus. KTH needs the organization and environment to participate and lead this development. We already host several excellent research groups operating in a wide range of quantum technologies including photonics, optics, biomolecular spectroscopy and imaging, material science, superconductivity, algorithms, and information theory. The QTH center brings together all interested KTH scientists active in quantum technologies within one center. Moreover, the center wishes and welcomes other partners such as Stockholm University to join this effort and co-fund it. Both local and international industry is rapidly developing activity in this area and urges KTH to form an organization for effective collaboration. We already have support from large companies such as Ericsson and Microsoft and expect small companies to spinoff from KTH and also gain from the center's activities. QTH can significantly strengthen Swedish research, education and industry.

2. Needs

Quantum technology is an emerging field of science with strong potential for new technology transformations with near future applications in the form of quantum computers, quantum encryption, quantum communication, quantum materials, quantum simulators and more. This ongoing technology transformations is expected to bring fundamental changes in everyday life of the same kind as brought by todays electronics technology. An illustration of the ongoing technology paradigm shift is the recent announcement of quantum supremacy by google where a quantum computer is demonstrated to vastly outperform ordinary computers, with quantum cryptography it is possible to share secret keys with security guaranteed by the laws of physics.

The center is needed to secure presence of KTH as a leading institution in quantum technology science, education and industrialization.

The EU is now running a one billion Euro project, the quantum flagship, to boost research and development in the field of quantum technologies across the continent over the coming decade. While some nations such as the Netherlands, the UK and Germany have already built up large national programs, activities in Sweden are currently dominated by Chalmers with its strong and organized quantum computation effort. While quantum computation is the main goal for Chalmers, KTH has strong expertise in photonics, quantum communication, quantum and topological materials, fields that are closely linked to quantum computing but are better characterized as quantum technology. Quantum sensing and computation require enabling technologies based on the development of new quantum, topological, semiconducting and superconducting materials and systems. QTH also has industrial relevance: it includes large companies such as Ericsson and Microsoft as well as new spinoff companies and builds on the large number of national and international projects KTH is currently taking part in. Support letters from Ericsson, Microsoft and Nyfors are attached in the end of the report.

3. Vision

Our vision is to form an international outstanding environment in quantum technology with profound impact on the future development of society, where Sweden and KTH shall play a leading role.

4. Aim

To give more impact to KTH participation in national and international projects, QTH will aim for synergy among research projects through discussions, interactions, boost visibility through biweekly seminars where prominent specialists will be invited to KTH, promote spinoff companies and establish a stimulating environment for young and established scientists through joint activities, seminars and common efforts to secure large research funding grants.

A center bringing together faculty from different departments will facilitate KTH's coordination and prioritization needs in research investments and hiring profiles, opportunities for research funding, and development of the undergraduate and graduate education along with building strong relations with the industrial sector. We foresee that a relatively small investment by KTH mainly to be used for coordinating, running joint seminars and building a quantum technology research community will attract important additional external funds and talent in the near and long term.
The center will catalyze increased collaborative efforts within KTH through enhanced interactions, regular seminars and joint projects where the expertise from the different groups will be combined to create added value for the research. Close collaboration among fabrication, measurements and theory groups will allow us to shape large and ambitious projects. This represents the core aim of this community building effort.

5. Objectives

- Inform society about research, competence, and facilities at KTH
- Maintain a QTH seminar hosting prominent scientists to trigger discussions and projects
- Coordinate new science and technology at KTH in quantum technology
- Develop strong contacts between KTH and industry
- Organize world class interdisciplinary collaborations and infrastructure at KTH
- Support publication in top ranked journals
- Target large scale funding

6. State of the research area

6.1. State of research internationally

Delft, Copenhagen and Helsinki now have quantum centers to organize and boost research efforts, both academic and industrial in quantum technologies. These centers have been able to attract massive investments from major industrial players such as Microsoft and Intel. In the USA, Google invested heavily in the group of Prof. John Martinis at UCSB to push for the first ever demonstration of quantum supremacy, IBM is also running an ambitious quantum computation project. Very recently major startups such as Rigetti and PsiQuantum have been able to raise very large investments to also develop quantum computers.

Here in Europe, major investments are being made through the European quantum flagship and corresponding investments are being made in China.

6.2. State of research nationally

Research in Sweden centers on academic efforts with Chalmers, Lund and KTH playing central roles. The Wallenberg Center for Quantum Technologies plays a central role in this development. Chalmers concentrates on quantum computation while KTH specializes in quantum communication. Joint research between Ericsson and KTH in quantum communication is a central part of this development.

6.3. Quantum technology research at KTH

The groups coming together to form this center have expertise in quantum computing, quantum materials, superconductivity, quantum optics, quantum sensing technologies, nanofabrication, quantum and topological materials, spintronics and theory. Many of the groups belong to the Department of Applied Physics (both at Albanova and Kista), but the center also includes groups from the Department of Physics and from the School of Electrical Engineering and Computer Science. With all these groups included, a solid basis of competences in quantum technologies will be formed, which will also act as nuclei for further expansion across school boundaries within KTH. Strong presence in theory of quantum materials at Nordita also contributes to the theory and modeling activities in the Center.

A sizable fraction of the researchers taking part in QTH have their field of expertise in photonics, quantum optics and quantum communication, they have already obtained substantial long-term funding from VR, KAW and from the EU. In new constellations, bringing in KTH specialists in theoretical physics and in MEMS technology, we have also obtained long-term funding from KAW and from VR as a Research Environment in Optical Quantum Sensing. Several hires have been made by KTH in recent years in the field of quantum technologies at levels ranging from professorship to researchers with additional positions to be soon opened. KTH is also substantially involved in the Wallenberg Center for Quantum Technology (WACQT) with Prof. G. Björk in charge of the quantum communication research effort.

Research groups

The research groups in the center come from three KTH schools: SCI, EECS, CBH, and Nordita.

Focus areas	SCI Physics	SCI APhys	CBH	EECS	Nordita
Sensing, nanofabrication, and communication					
Quantum computation					
Quantum phenomena in biomedical research					
Quantum Materials					

We list the PIs involved so far with their main area of interest in quantum technology. The list constitutes a healthy mixture of experimentalists and theorists as well as of Kista, Albanova, and KTH main campus based research groups.

SCI Physics

- Egor Babaev, Professor, Condensed matter theory.
- Jens Bardarson, Lektor, Condensed matter theory.

- Jack Lidmar, Lektor, Condensed matter theory.
- Mats Wallin, Professor, Condensed matter theory.

SCI Applied Physics
- Gunnar Björk, Professor, quantum physics, laser physics.
- Anna Delin, Professor, theory of quantum materials.
- Katia Gallo, Professor, nonlinear quantum photonics.
- David Haviland, Professor, nanophysics.
- Vlad Korenivski, Professor, nanophysics.
- Oscar Tjernberg, Professor, electronic structure of quantum materials.
- Jonas Weissenrieder, Professor, surface physics.
- Jerker Widengren, Professor, fluorescence correlation and single molecule spectroscopy.
- Val Zwiller, Professor, nanofabrication, quantum optics and cryogenic experiments.

CBH
- Patrick Norman, Professor, quantum chemistry.
- Hans Ågren, Professor, quantum chemistry.

EECS
- Erik Aurell, Professor, theory of open quantum systems and quantum thermodynamics.
- Kristinn Gylfason, Lektor, integrated optical devices.
- Mattias Hammar, Professor, Division of electronics
- Frank Niklaus, Professor, electron tunneling sensors for biomolecule detection and sequencing.
- Mikael Skoglund, Professor, quantum information theory.
- Göran Stemme, Professor, electron tunneling sensors for biomolecule detection and sequencing.

Nordita
- Alexander Balatsky, Professor, theory of quantum materials.

6.4. Collaboration needs and opportunities

WACQT has a very strong focus on interaction with industry and society, being funded by KAW. Part of this ambition is an already started industrial PhD program where KTH has already been offered to host several such students and to organize courses in quantum technology for industry employees. Interaction with industry will be facilitated by a center providing a clear contact point with a broad access to the academic faculty.

Beyond WACQT, KTH, Ericsson and Nortel collaborate on the development and implementation of quantum communication systems where a deployed optical fiber linking Albanova and

the Ericsson research lab in Kista is now used to demonstrate quantum communication. A recently started European project (Eurostars) bringing together KTH and Nyfors will develop a new process to coupled quantum chips. These new collaborations with industry open new opportunities for joint research.

6.5. Collaboration with education

QTH coordinates well with engineering education at KTH and stands behind the master program in quantum technology started in 2019. The formation of QTH will influence the development of this master track and its potential to attract excellent students and teachers. The center will also be important for PhD education by providing a bigger research environment for PhD students with joint collaborative research efforts, seminars, summer schools, and a mentor program for female students.

7. Research agenda

The strategy is to form a common platform for quantum technologies at KTH to:

- Identify joint interests: form a KTH network to identify common interest and generate collaboration among different schools, units and disciplines.
- Coordinate research: supply the organization needed to apply for large funding, coordinate research projects, and facilitate industrial collaborations.
- Communication and education: compile and spread information about key competences at KTH and coordinate education efforts on all levels
  Identify four focus areas: Quantum sensing and communication, quantum computation, quantum phenomena in biomedical research and quantum materials.

7.1. Research area

Our strategy is to create the best conditions to foster world class research by bringing together existing excellent research groups at KTH. The projects are described below. The center initiative intends to initiate new collaborations between existing excellent KTH research groups by bringing research groups together to meet on a regular basis. These frequent interactions are crucial for connecting connections and collaborations, we see them as a main motivation for the center creation. Furthermore, the center will form an integrated and stimulating research environment that will benefit and support international top recruitments and education programs. A central aspect is to form a strategic interface to industrial initiatives in quantum technology and to spread information about KTH competence to society.

7.1.1. Focus area: Quantum sensing, nanofabrication, and communication

Quantum sensing and communication are already very active fields of research at KTH. These activities are based on the nanofabrication of quantum devices using the clean room facilities at Albanova. For quantum sensing, new schemes to perform measurements at the physical limit will be explored and new devices operating at the single photon level will be developed. In quantum communication, a quantum network was recently unveiled at KTH linking Albanova with Ericsson research labs. This is now under expansion and will turn into a testbed for quantum communication devices and protocols. Quantum sensing also offers opportunities in environmental monitoring where pollution could be measured precisely in real time with high spatial resolution, as well as in cellular and molecular imaging and spectroscopy. This focus area combines nanofabrication efforts with optical measurements and theoretical work. One central topic is to develop theoretical understanding of the detection process in superconducting detectors.

This focus area will result in new devices, in the demonstration of quantum networks and new sensing technologies along with a better understanding of the processes at work in quantum detectors. Key partners are Ericsson and KTH spinoff companies.

Zwiller, Björk, Gallo, Korenivski, Haviland, Widengren SCI Applied Physics
Babaev, Lidmar, Wallin, SCI Physics
Aurell, EECS Computational Science and technology
Skoglund, EECS Intelligent Systems
Gylfason, Stemme, EECS Micro and Nano systems

7.1.2. Focus area: Quantum computation

In this area our strategy is to create a broad research program on quantum computing and quantum information at KTH. One way to accomplish it will be to scale up the existing collaboration between the Babaev group at KTH and Microsoft research centers in Seattle and Santa Barbara. The existing collaboration is focused on precision calculations for future quantum computation devices. However, a collaborative effort is required, and it would be of great benefit if more KTH researchers will be involved. QTH will expand the quantum computation activity to create a local environment that addresses much broader questions including other quantum devices such as superconducting single-photon detectors that also have potentials for quantum computation schemes.

The expertise at the Condensed matter theory division of the Physics department on computational modeling of quantum devices will yield synergies with strong numerical experts at other departments at KTH, e.g., Mathematics department as well as within the Swedish E-science center (SERC). Integration with other experts in Sweden will firmly establish Stockholm's long-

term international leadership in numerical modeling of superconducting material-based quantum devices. The problem of superconducting nanoscale devices presents an interesting mix of unresolved theoretical and computational challenges that requires a mix of experimental and theoretical expertise that will be merged within the QTH environment. We envisage also a great potential for creation quantum technology startups synergistic with this area.

Babaev, Wallin, Lidmar, SCI Physics
Egor Babaev's group is an official part of the Microsoft-led project on quantum computing (see popular background information e.g., at https://www.nytimes.com/2016/11/21/technology/microsoft-spends-big-to-build-quantum-computer.html.

7.1.3. Focus area: Quantum phenomena in biomedical research

Exploitation of quantum phenomena in biomedical research, as well as the development and use of quantum technologies within the biomedical field represent a strongly developing research area with huge potential. QTH gathers a strong constellation of research groups in this area, including groups developing new single-photon detectors and sources, micro-, nano- and spectroscopic techniques based on new ways to exploit transitions between quantum states in reporter molecules, and theoretical groups with expertise in simulations and modelling of the underlying quantum phenomena in the devices, in the reporter molecules, as well as of the biomolecular dynamics and interactions which can be studied by these techniques. Given the interdisciplinary complementarity of our expertise, QTH will form an excellent forum for close interaction, to further push the borders for the sensitivity and resolution by which biomolecules and their interactions can be studied, in turn contributing with fundamental knowledge and new diagnostics.

Widengren, Zwiller, SCI Physics
Niklaus, EECS Micro and Nano systems
Ågren, Norman, CBH Theoretical Chemistry and Biology

7.1.4. Focus area: Quantum materials

The main goal of the research performed within quantum matter is to understand the interactions and mechanisms that are responsible for the fascinating macroscopic quantum properties that some materials display. This can for example be the extreme sensitivity to an external parameter as in the case of temperature and magnetic field driven metal to insulator transitions, the occurrence of superconductivity at elevated temperatures or the existence of topologically protected states that exist on the surface or edge of certain three- and two-dimensional systems. The work within this area is also targeted towards the discovery of new states of matter as well as the dynamics and control of quantum matter i.e. properties on demand.

Tjernberg, Delin, Weissenrieder SCI Applied Physics
Babaev, Bardarson, Lidmar, Wallin, SCI Physics
Balatsky, Nordita
Hammar, EECS

7.2. Impact and scientific outreach

QTH will build an environment optimized to carry out ambitious, interdisciplinary projects in quantum technology. Organization of seminars and joint discussions will enable us to test and mature new ideas before turning them into projects. Our research will bridge fundamental science with applications, and link KTH to major companies and to spinoffs to explore new applications for quantum technology.

In the long term, quantum technologies will be at the heart of communication, computation and sensing technologies. The Stockholm Quantum Network linking KTH with Ericsson is a testbed for new quantum communication technologies that will enable both parties to test and validate quantum communication technologies and protocols. Besides collaborations with large companies, QTH will create an environment supportive of startups to bring the latest innovations in quantum technologies to the market.

7.3. Education

QTH will provide an environment and contact point to develop and teach new courses, offer advanced teaching laboratories, and attract top students in an inclusive research environment. The center will help attract local and international young talents interested in the field, provide a fertile environment to develop new courses to be taught by the faculty involved in QTH, offer advanced teaching laboratories through the participating research groups, and involve students in an inclusive research environment at both Master and PhD level.

The theoretical track in the engineering physics MSc program at KTH centers on solid state and condensed matter physics. Moreover, the biological and biomedical physics track in the same MSc program offers courses in biomolecular spectroscopy, and on applications of quantum sensing technologies in the biomedical field. Our center will be a natural framework to integrate all these cross-multidisciplinary educational efforts.

7.4. Initial goals and Key Performance Indicator

We set initial goals to be reached within the first two years.

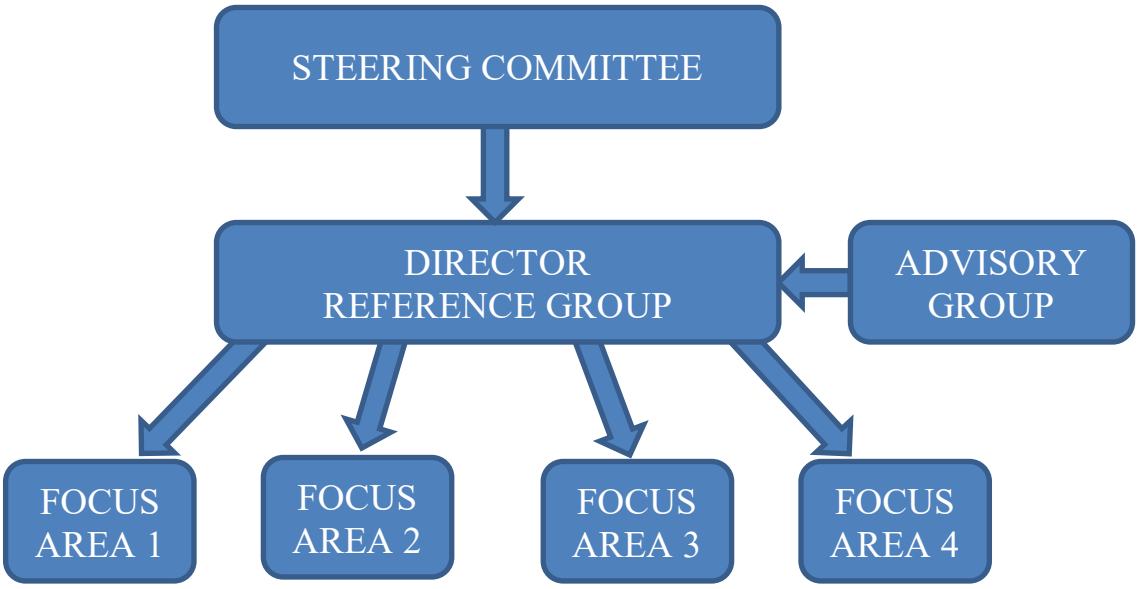
- Generate specialists in emerging quantum technologies: training of outstanding PhD students, master students and postdocs.

- Transfer knowledge from academia to industry through direct collaborations in optics and materials sectors and in forming spinoff companies.
- Host international top specialist visits.
- Outreach: the center will organize communication channels about our activities.
- Create conditions for further growth: our activities will form a starting point for future national and European projects in the emerging field of quantum technologies.

8. Stakeholders, organization and funding

8.1. Organization

The center will be hosted by the SCI school and will be managed by the center Director and led by a Steering committee. The Steering committee will consist of a chairperson, a vice chairperson and 6 additional board members. The Steering committee and the Director is appointed by the KTH Rector. The Steering committee makes decisions about the center strategy, activity plan and budget.



The advisory group is appointed by the Steering committee and supports the decisions about strategy and aims for the center. The director manages the operation of the center, implements board decisions and reports to the Steering committee.
A reference group is appointed by Steering committee to support the director with managing the work in the focus areas and coordinate research proposals.

8.2. Stakeholders

Collaborations with industry is an important mission for the center. Discussions have been held with Ericsson and Microsoft about collaborations within the suggested center on fabrication and quantum computation (see letters of support in the appendix). The collaboration with Microsoft already exists but could be dramatically enhanced with the creation of the center. The aim is that the center shall lead to increased contacts with industry in the future and lead to the creation of the next generation of technology by interacting both with very large companies and spinoff companies.

Relations with industry form a crucial pillar that will be pursued through the development of start-up activities based on results obtained within QTH along with interaction with large, well established companies. So far discussions have been held with Microsoft and Ericsson. Support letters from them are included in the appendix.

8.3. Financing

Financial support for running the center is obtained from KTH and from the participating KTH schools and industrial companies. The budget is specified in Appendix 4.

The center will start with several already running joint projects: VR excellent research environment, KAW project. Several groups taking part in QTH have been offered funding from WACQT. Additional funding from large scale projects will be applied for within QTH.

The scientists involved have strong, external, joint financing for our current activities. Examples:

- KAW project Quantum Sensing, 34.8 MSEK over five years started in January 2018. PIs: Björk, Gallo, Lidmar, Wallin, Widengren, Zwiller (Coordinator).
- VR excellent research environment Optical quantum sensing for biomolecular and environmental studies, 24 MSEK over six years started in January 2017. PIs: Babaev, Widengren, Zwiller, Gallo (Coordinator).
- KAW project 2014.0069 – Quantum states of protons and relativistic physics on a chip. With Chalmers 12.850 kSEK to PI Haviland.
- WACQT, The Wallenberg Center in Quantum Technology, overall 600 MSEK over ten years. WACQT will currently fund four full Ph.D. or postdoc positions and three faculty positions partly. Started in January 2018. Prof. Gunnar Björk heads the Quantum Communication node of this national project.
- KAW project 2013-0096 Functional Dirac Materials, 36MSEK – PI A. Balatsky, This project funds PhD students in quantum materials at KTH Applied Phys, Chalmers and UU.
- Villum Center for Dirac Materials 2017-2021, with Aarhus U, 10 MSEK to Nordita, A. Balatsky.

- KAW project Dynamic Quantum Matter starts in 2020. PI Balatsky, Bardarson together with SU and Uppsala.
- EUROSTRARs project 'FIFU' starts 2020, PI Zwiller, with Nyfors and Single Quantum.

We recently secured further funding from the EU, in the first project call in the EU Quantum Technology Flagship. The EU will invest 500 MEuro in Quantum Technologies, industry and private funds are expected to invest at least the same amount through a public private partnership. KTH is well positioned to attract such funding and thanks to the center will be well prepared to coordinate synergetic efforts in this direction.
In addition, all involved researchers have individual grants and lead projects directed towards Quantum Technology.

The center aims directly at substantial funding opportunities opened by the European quantum flagship project. A center structure is a prerequisite to effectively compete in large funding calls where impact, research valorization, organization, outreach and data management can be developed strongly within a center.

Appendix 1: Suggested organisation, Steering committee and Director

Nominations to be further discussed. The following members are anticipated:

- Director,
- School representative,
- Physics and Applied physics department representatives,
- Coordinators from the four focus areas.

In addition, an advisory group composed of international experts with a range of specialties covering the interest of the center is suggested. This group will be appointed by the board.

Appendix 2: Timeline

Year 1
Startup and development of the work in the focus areas including research projects, contribution to buildup of education programs, and run the already existing quantum seminar and visitor program. Applications for external funding for collaborations within the center.

Year 2
Continued development of the collaborations in the center. Potentially expand the center by expanding the KTH participation, investigating mergers with centers at other universities, and identifying additional stakeholders and startups.
After an evaluation of the center following the initial period the long-term efforts to turn the center to a major European center and attract large scale to KTH funding will continue.

Appendix 3: Activity plan 2020

- Initiate steering committee work.
- Start work package activities.
- Organize large proposals.
- Run seminar and visits.

Appendix 4: Budget 2020

The yearly expenses for the center will include administrative support (350 kSEK), running seminars (150 kSEK), hosting top specialists (300 kSEK), assist with research proposal preparation (200 kSEK), board and steering committee, support student travels to conferences (200 kSEK), organize winter and summer schools (300 kSEK), 30% of the director (500 kSEK).

Financial support from the center will come from KTH funding of 200 kSEK/year, Physics and Applied physics departments of 200 kSEK/year each, and from participaring partners of at least 50 kSEK/year.

Appendix 5: Support letters from Ericsson, Microsoft and Nyfors

ERICSSON

Date: 2019-03-27
Attending to this matter: Azimeh Sefidcon

KTH

Letter of Support for Ericsson AB interest of the Quantum Technology Hub

This document is a declaration of support for Ericsson AB participating in KTH Internal application "Quantum Technology Hub" ("Hub") by Prof. Zwiller from the Quantum Nano Photonics group at School of Engineering Sciences, KTH. If the funding application is approved, Ericsson AB intends to be part of the Hub. The proposed application is found to be of interest and relevant for our industry.

The goal of the Hub is to bring together research groups involved in quantum technologies to create a quantum community at KTH. The Hub opens for many collaboration opportunities between different groups at different universities with the common goal of advancing the quantum technology, knowledge and attract young talented researchers that are interested in this area.
The Hub will be open to other institutions and Industries to join. It will host prominent specialists, drive new teaching activities in quantum technology, will foster an entrepreneurial environment in quantum technologies and it will strengthen the opportunities to increase competitiveness for the academic community in Stockholm in the quantum technology.
A hub such the one that is proposed by Prof. Zwiller would allow Ericsson to easily get in contact with experts in the area and would accelerate the academia-industry knowledge and competence transfer.

The company
Ericsson AB, reg. no. 556056-6258 ("Ericsson"), is part of the Ericsson group, the world's leading provider of technology and services to telecom operators. We are enabling the Networked Society with efficient real-time solutions that allow us all to study, work and live our lives more freely, in sustainable societies around the world. Our offering comprises services, software and infrastructure within Information and Communications Technology for telecom operators and other industries. Today more than 40 percent of the world's mobile traffic goes through Ericsson networks and we support customers' networks servicing more than 2.5 billion subscribers. We operate in 180 countries and employ more than 115,000 people. Founded in 1876, Ericsson is headquartered in Stockholm, Sweden.

The undersigned intends to, but is not bound to, to participate and contribute to the Hub as described by their roles in the final proposal such as but not limited to:

- Discussing relevant industrial use cases and research challenges
- Joint workshops

Terms
This Letter of Support is non-binding and the cooperation is subject to relevant agreements being entered between the parties involved. No press release or other public statement will be issued by any Party with respect to this Letter of Support or the dealings hereunder without the prior written approval from the other Party. If not otherwise specifically agreed in writing, the Parties will bear all their own costs and expenses during the period of negotiations.

This Letter of Support shall be governed by and construed in accordance with the substantive laws of Sweden. Any dispute, controversy or claim arising out of or in connection with this Letter of Support, or the breach, termination or invalidity thereof, shall be settled by arbitration in accordance with the Rules of the Arbitration Institute of the Stockholm Chamber of Commerce, by three (3) arbitrators appointed in accordance with the said rules. The place of arbitration shall be Stockholm. The language to be used in the arbitral proceeding shall be English.

For and behalf of

Place and date: Kista, 31 March 2019

ERICSSON AB

DocuSigned by:
By: Magnus Frodigh
60A343FBCDFF4DB...
Name: Magnus Frodigh
Title: VP & Head of Ericsson Research

Ericsson AB
Ericsson Research
SE-164 80 Stockholm
SWEDEN
Tel: +46 10 719 00 00
Fax: +46 10 719 95 27
VAT: SE556056625801
Reg no: 556056-6258
Visiting address
Torshamnsgatan 23 (Kista)

Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399

Tel 425 882 8080
Fax 425 936 7329
http://www.microsoft.com/

Microsoft

29 July 2019

Rektor Sigbritt Karlsson
KTH Royal Institute of Technology
SE-100 44 Stockholm
Sweden

Dear Rektor Karlsson,

It is my great pleasure today to confirm our enthusiasm for your proposed center on quantum technologies at the Royal Institute of Technology. We are excited about your plans to bring together researchers working in the field of quantum technology, especially on quantum computing and single quantum detectors. The fact that the European Union invests 1 billion Euros into the quantum flagship and the growing interest by industry attests to the importance of this future for future technologies and the economy. At Microsoft we are also heavily investing into this area and have interest in the work of Prof. Egor Babaev and others at KTH, whose research is relevant for our quantum computing project. The creation of the center that will bring new expertise, attract talented students, and create new opportunities for collaboration between academia and industry. We look forward to your plans becoming reality.

Sincerely,

Prof. Dr. Matthias Troyer
Partner Research Manager
Director of Quantum Customer Solutions, Microsoft Quantum

Erik Böttcher via relay.sys.kth.se Mon, Dec 23, 2019, 12:01 PM

to Val

Hi Val,

Thanks a lot for the below. Yes of course I be interested! I also do not see an issue with the 50.000 SEK.

Is there a formal process like a board that is put together or how does this work?

How do we move forward from here?

Look forward hearing back from you!

Best wishes,

Erik

Från: Val Zwiller [mailto:zwiller@kth.se]
Skickat: den 20 december 2019 16:47
Till: Erik Böttcher
Ämne: Quantum Technology Hub

Hej Erik,

We have a quantum technology hub (QTH) taking shape here at KTH. Its mission is to spawn innovation in quantum technologies.

Considering our recent success with projects in the field, we would like to have you to be industry representative of the board of the Quantum Technology Hub.

if possible, a contribution of 50.000 kr a year would be highly appreciated to demonstrate active industrial involvement and will allow to develop new common research projects with Nyfors.

Merry Christmas, Happy new year and see you soon, Val