

Contact

Chairperson: Frau Prof. Dr. Ulrike Woggon
ulrike.woggon@tu-berlin.de

Coordination: BOS.QT coordination office
bosqt@physik.tu-berlin.de

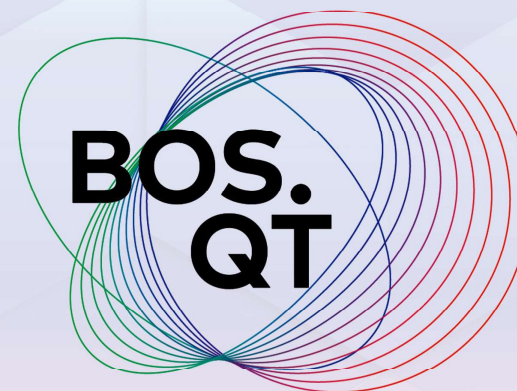
Technische Universität Berlin
Fakultät II, Institut für Optik und Atomare Physik
AG Nichtlineare Optik, ER 1-1 Straße des 17. Juni 135
10623 Berlin
Germany
Tel.: +49 30 314-22706
Website: www.tu-berlin.de/bosqt



Freie Universität Berlin



Funded by:



Berlin School of
Optical Sciences &
Quantum Technologies



Berlin School of
Optical Sciences &
Quantum Technologies

CONTENT

I. INTRODUCTION	3
WELCOME BY THE BOS.QT STEERING COMMITTEE AND COORDINATION OFFICE	3
II. BOS.QT PHD PROGRAM	5
MISSION	5
MAIN RESEARCH AREAS	6
MENTORING	7
STUDY PROGRAM	8
STATISTICS	9
III. TESTIMONIALS OF BOS.QT MEMBERS	11
BOS.QT FACULTY	11
PHD STUDENTS AND ALUMNI	15
IV. ORGANIZATIONAL STRUCTURE	19
V. BOS.QT LOCATIONS	20

IMPRINT & COPYRIGHTS

1st edition (April 1, 2021)

IMAGES:

TU Archive: P. 05, 07
HU Archive: P. 05
FU Archive: P. 05
Petra Immerz: P. 13
iStock. by Adobe P. 08, 15, 16, 17

TEXT EDITING and ARTWORK:

Anja Meyer, BOS.QT

I. Welcome by the BOS.QT Steering Committee and Faculty

The Berlin School of Optical Sciences and Quantum Technologies (BOS.QT) was founded by the Physics Institutes and Departments of the Technische Universität Berlin (TU Berlin), Freie Universität Berlin (FU Berlin) and Humboldt-Universität zu Berlin (HU Berlin) in cooperation with renowned Berlin research institutes of the Leibniz Association, the German Aerospace Center, the Fraunhofer and Max-Planck-Society.

Embedded in this exciting research landscape BOS.QT, being also part of the Berlin University Alliance (BUA), offers exceptional research conditions in fundamental and applied sciences in a highly innovative and future-oriented field.

As one of the main characteristics BOS.QT PhD students participate in a structured PhD program that can be individually designed around the actual research project.

Your

BOS.QT Steering Committee on behalf of the Faculty,

Prof. Dr. Ulrike Woggon (TU Berlin, Chairperson)
Prof. Dr. Kurt Busch (HU Berlin, MBI)
Prof. Dr. Jens Eisert (FU Berlin)
Prof. Dr. Thomas Elsässer (HU Berlin, MBI)

This brochure will provide you with more detailed information on the BOS.QT mission, key research areas and doctorate program such as its supervision concept.

Not only our statistical data but the experience of our BOS.QT faculty members from Principal Investigators to PhD students who have just started or are already alumni will give you a closer look on their research, challenges, objectives and how they approach them.

Our BOS.QT community within the city of Berlin is connected to an international network of expertise and just about to grow, generating cutting edge research.

We would very much like to welcome you to join the Berlin School of Optical Sciences and Quantum Technologies network and wish you a pleasant reading.

Jun. Prof. Dr. Janik Wolters (TU Berlin, DLR, ECDF)

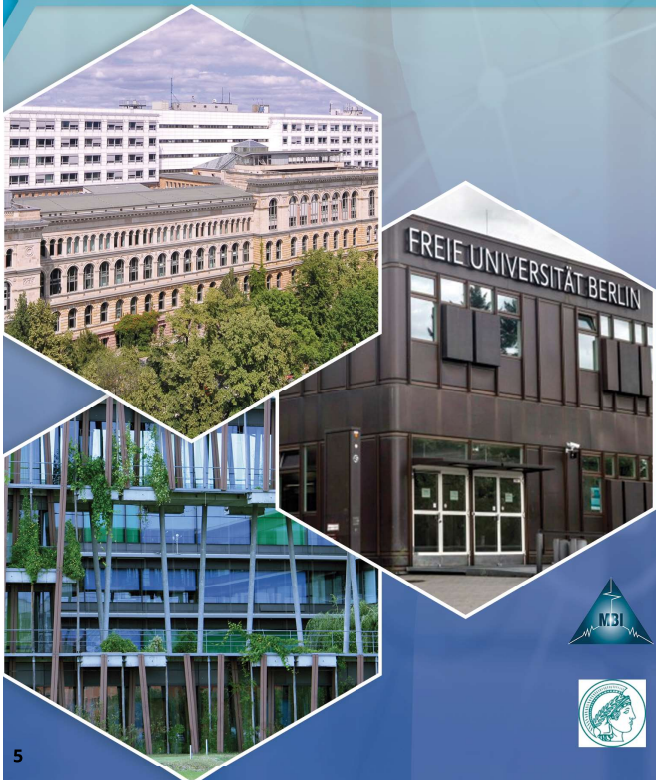
PhD spokespersons
Laura Orphal-Kobin (HU Berlin)
Lucas Rickert (TU Berlin)

and Coordination Office
Anja Meyer (M.A.)

II. BOS.QT PhD Program

Mission

The Berlin School of Optical Sciences and Quantum Technologies (BOS.QT) aims to provide young researchers with fascinating science and creative leeway to initiate unusual scientific questions, enable original solutions and to acquire skills beyond scientific education within the areas of optical sciences, photonics and quantum technologies at Berlin's allied universities: Technische Universität Berlin (TU Berlin), Freie Universität Berlin (FU Berlin) and Humboldt-Universität zu Berlin (HU Berlin) in partnership with the Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy (MBI) and the Ferdinand-Braun-Institute (FBH) of the Leibniz Association, the Fraunhofer Institute for Telecommunications (Heinrich Hertz Institute HHI), the Fritz-Haber-Institute of the Max-Planck-Society (FHI), the German Aerospace Center (DLR) and the Einstein Center for Digital Future (ECDF). In addition, we are cooperating with the Berlin University Alliance (BUA).



Main research areas

Nonlinear light-matter interactions and ultrafast dynamics:

Elementary excitations of matter up to the nonperturbative regime, nonlinear charge transport, quantum coherences and optical control, atto- and femtosecond processes and spectroscopy, ultrafast dynamics and structural analysis with X-rays.

Quantum optics and quantum devices:

Ultracold quantum gases, fluctuation-induced phenomena, precision elements on fundamental physical quantities, single photon sources, heterogeneous quantum systems, quantum communication and quantum networks.

Nanophotonics and photonic systems:

Nanophotonics, nanoprobe and nanoplasmonics, 2D-quantum materials, hybrid systems, microresonators, and photonic crystals, topological photonics, optoelectronic devices and photonic systems.

Light sources and detector technologies:

Lasers and light sources in the range from terahertz to hard X-rays, advanced detector technologies including components for space experiments, Fourier-Transform (FT)-signal analysis, X-ray imaging.

II. BOS.QT PhD Program

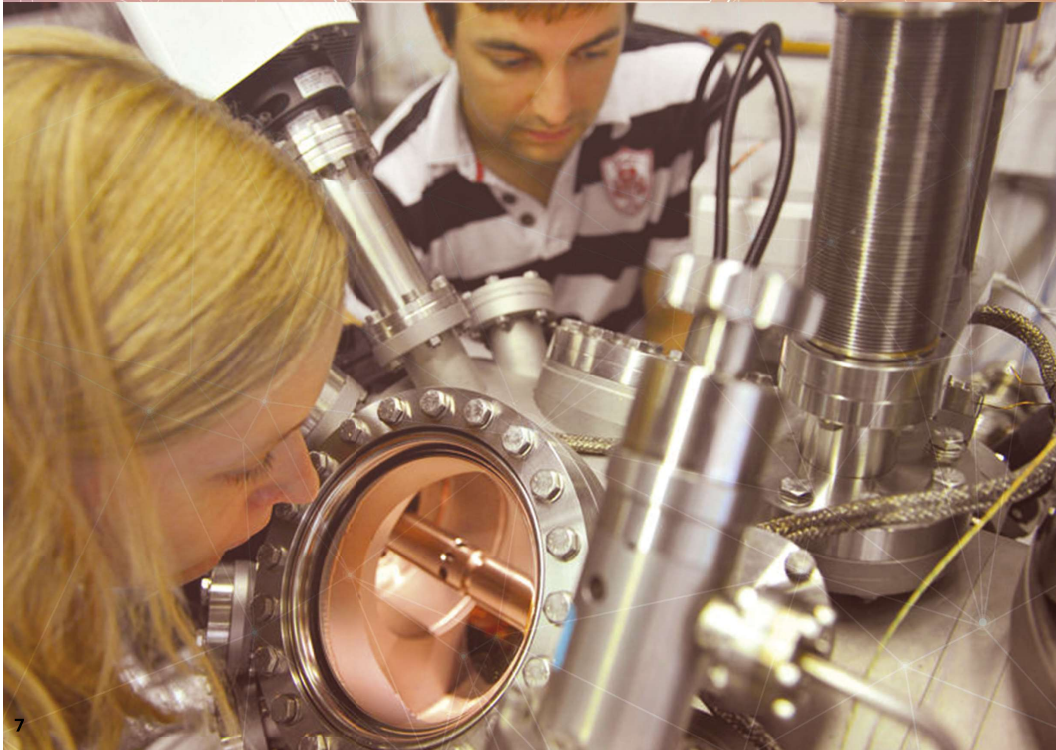
Mentoring

The BOS.QT concept of supervision provides for a tandem of supervision and mentoring by BOS.QT faculty members.

The tandem consists of:

A supervisor to assist in scientific, administrative and technical issues and

a mentor as a supplementary scientific and content-related advisory support to give advice regarding career perspectives and inspirations from another perspective.



Study Program

The BOS.QT structured PhD study program complements the individual PhD research project. BOS.QT PhD students have the option to individually design their schedule.

The elements to choose are in between:

A compulsory monthly PhD seminar organized by the PhD students on their own responsibility and a variety of further activities out of the formats:

Fundamental courses, PhD compact courses, Advanced lectures and Transferrable skills (See BOS.QT Regulations).

All BOS.QT courses are designed to be conducted in English.

Joint Events and an annual BOS.QT Retreat are additional offers to network and further strengthen the exchange within the scientific community.



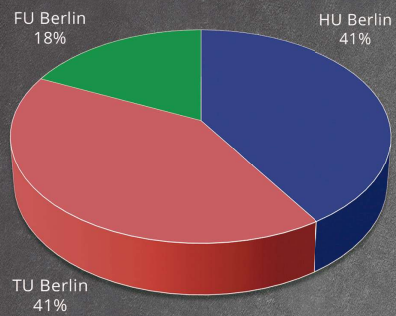
II. BOS.QT PhD Program

Statistics (SS 2021)

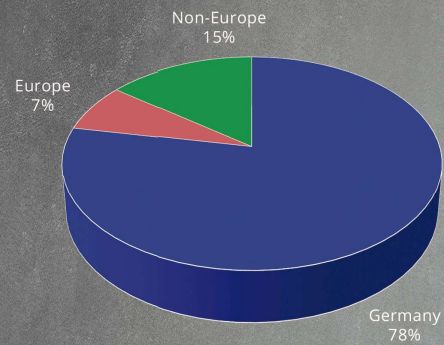
The BOS.QT Faculty at a glance:

69 BOS.QT members
21 Faculty Principal Investigators
7 Junior Faculty Members
41 PhD students (85% in groups at universities, 15% in groups of Berlin research institutes)

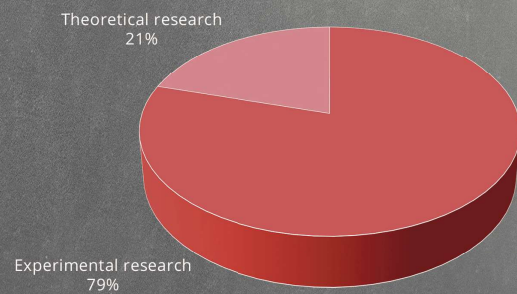
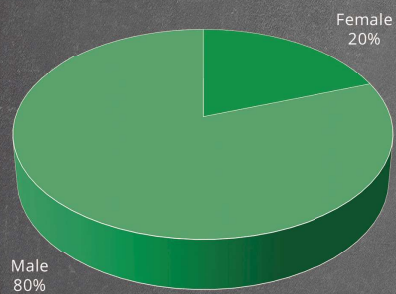
BOS.QT Supervisors divided after universities:



Internationality PhD students:



PhD students divided by gender and research focus:



Impressions

BOS.QT Opening Ceremony



Retreat at Campus Adlershof

Lab Work



III. Testimonials of BOS.QT Members



Prof. Dr. Stephan Reitzenstein
TU Berlin

"I like to give students the freedom to try out on their own ideas and arouse their curiosity in order to explore new scientific paths together."



Prof. Dr. Christiane Koch
FU Berlin

"Despite 100+ years of history, quantum mechanics continues to fascinate us with new surprises."



Prof. Dr. Oliver Benson
HU Berlin

"An experiment is a direct question to nature. Sometimes she answers differently than we thought. For me it is one of the most exciting moments in physics. If we then have the courage to give up our old ideas, we gain a deeper understanding of our world."

Research Topics:

Quantum Nanophotonics, 3D Nanoprocessing, Optoelectronics & Quantum Devices, Quantum Communication Systems

Why choose the BOS.QT?

PhD students learn about current topics and technologies in optics and quantum photonics and have the networking and information exchange with other doctoral students working on similar topics in photonics.

The most exciting part of my research:

To combine principles of quantum mechanics and nanophotonic device processing for implementing quantum communication networks & quantum computation systems.

What's next?:

My ultimate research goal is to develop fully functional onchip photonic quantum processors in a scalable nanophotonics platform using semiconductor quantum dots as single-photon emitters. The next step in quantum technology is to develop modular, fiber-coupled quantum devices that can be used to implement large quantum networks.

Research Topics:

Quantum Control in AMO Physics and Quantum Information Science, Cold Matter, Ultrafast Science, Chiral Molecules

Why choose the BOS.QT?

It is a network of fellow students beyond the individual research group for learning from each other - and even more importantly - sharing the experience of what it means to be a PhD student.

The most exciting part of my research:

The challenge of manipulating nature at the quantum level has an enormous potential for advancing our basic understanding of physical processes as well as for practical applications. We have only just begun to explore opportunities offered by quantum control.

What's next?:

I would like to understand how much control is attainable for open quantum systems and identify general design principles for quantum control in AMO physics and quantum information science. We need to find ways to scale up the size of quantum devices despite a limited amount of external controls.

Research Topics:

Quantum Optics and Nanooptics with Atoms, Molecules, and Solid-State Systems, Optics of Single Excitations, Quantum Information, Quantum Enhanced Sensing

Why choose BOS.QT?

Fresh ideas arise from discussions with others. Students have the opportunity to interact, to think outside the box, and to acquire skills that go beyond purely scientific specialist knowledge.

The most exciting part of my research:

Seeing with relatively manageable, sometimes even rather simple experimental setups how our classical view of the world is completely wrong. And then to be impressed with how accurately quantum physics describes the real world.

What's next?:

We want to gain control over ever larger quantum states. In a bottom-up approach, we hope to investigate fundamental phenomena in the field of mesoscopic quantum physics and to propose them for novel applications.

III. Testimonials of BOS.QT Members



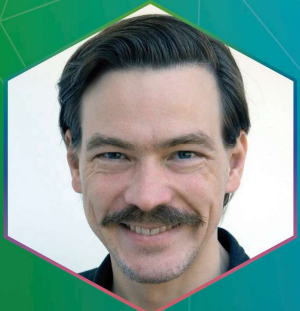
Jun. Prof. Dr. Janik Wolters
TU Berlin,
DLR and ECDF*

“ We will generate new knowledge by combining the ideas of our predecessors with our own creativity. ”



Dr. Anna Pappa
Emmy Noether Junior Group
Leader at TU Berlin

“ What drives my research is posing interesting conceptual problems and solving them using novel approaches and ideas. ”



Dr. Tim Schröder
Group Leader at HU Berlin

“ Science is a collaborative effort - as a team we develop ideas and put them into action. ”

*DLR: Deutsches Zentrum für Luft- und Raumfahrttechnik,
German Aerospace Center

Research Topics:

Quantum Communications,
Physical Foundations of IT
Security, Optical Postdigital
Computers

Why choose the BOS.QT?

To take a look beyond the ends of the own nose and to be part of the strong community in optical research in Berlin.

The most exciting part of my research:

Our main research interest is in fundamental methods and technologies as well as for applications for optical quantum technologies. The most exciting part of it is the chance to combine knowledge from various research fields for bringing ultimate quantum security and post-digital computers closer to reality.

What's next?:

Our ultimate research goal is to demonstrate working compound quantum systems that outperform their individual constituents for scalable (quantum) information processing. Our next step in quantum technology is to develop efficient and modular quantum memories that can be used to demonstrate quantum repeater networks.

Research Topics:

Quantum Communications
and Cryptography,
Theoretical Computer
Science

Why choose the BOS.QT?

To have a choice of a second advisor within the school provides students with an excellent opportunity to gain knowledge from complementary fields, collaborate with other research groups and to obtain a broad view of quantum technologies.

The most exciting part of my research:

I am specifically working on protocol security for future quantum networks, ranging from the well-known key distribution setting to more general multiparty protocols. I am also interested in routing and verification of quantum resources.

What's next?:

It is a field that is still in its (relative) infancy, and therefore a lot of open questions remain unanswered. In a nutshell to discover use cases where quantum advantage can be meaningfully exploited. Therefore, it is essential to collaborate with experimental groups to implement quantum communication protocols using optical setups.

Research Topics:

Integrated Quantum
Photonics,
Quantum Information
Processing

Why choose the BOS.QT?

BOS.QT brings together excellent students from different research areas to stimulate each other, to think outside the box, and to build personal science networks.

The most exciting part of my research:

Optical solid-state quantum physics and technology — we investigate fundamental quantum optics phenomena and aim to develop optical quantum communication and quantum information processing systems.

What's next?:

Our ultimate goal is to contribute to an optical quantum processor — one of the many future applications of quantum technology.



Luisa Esguerra Rodriguez
PhD student 2nd year

Research topics:

Quantum communication and quantum information processing

“ I like to take part in interesting and meaningful research to contribute to the further development of quantum technologies and I enjoy working together with different people in and outside the field to keep expanding our knowledge and understanding. I also enjoy taking part in outreach activities in order to bring quantum technologies closer to external people.”

Why did you decide to do your doctorate at the Berlin School of Optics and Quantum Technologies?

BOS.QT combines a wide range of academic excellence from all three universities and other research institutes in Berlin and is great for early networking. Furthermore, its curriculum gives exceptional opportunities to improve on a scientific level as well as for soft skills. The large number of contributing junior researchers gives ample possibilities to learn how to start an academic career. (Lucas Rickert)

The BOS.QT is an excellent chance of connecting to related fields, research institutions in Berlin and, most importantly, kindred spirits working on the melange of optics and quantum technologies. The network with its resources, training opportunities and active support shows to be an inspiring habitat for scientific as well as for personal growth. (Daniel Reiche)



Dr. Daniel Reiche
BOS.QT Alumnus

Research topics:

Quantum optical fluctuation-induced phenomena, statistical physics, quantum field theory, solid-state and material physics

“ The ambition is and always was, to interact with inspiring people and to join the endeavour of learning from nature.”

What is the most exciting part of your research?

I am researching in the field of quantum communication and quantum information processing and we are currently working on improving quantum memories for the use in future quantum repeaters based on satellites. It is very exciting to take part in the research that will lead to a revolution in our way of understanding communication and computation. (Luisa Esguerra Rodriguez)

Together with Kurt Busch and Francesco Intravaia we explore the quantum optical fluctuation induced phenomena in both equilibrium and nonequilibrium situations. Always aiming for experimental realizations of our theoretical predictions, we develop novel analytical as well as numerical methods at the interface of various physical disciplines - ranging from statistical physics, over quantum field theory, all the way down to solid-state and material physics. It is most exciting how the laws of nature substantially change at smaller and smaller lengths scales way beyond the limitations of the intuitive thinking. For example, the effects we are investigating make it possible for geckos and beetles to walk on walls. (Daniel Reiche)

III. Testimonials: PHD STUDENTS and ALUMNI



Lucas Rickert
PhD student 3rd year

Research topics:

Modularized quantum key distribution systems for secure communication immune to eavesdropping

“Quantum Technologies are emerging already now and the gap between fundamental research and application becomes smaller. I want to be part of this exciting development. A major catalyst will be more reliable, robust experimental systems and technologies, which are less dependant on highly specialized lab equipment and staff to use them. The development of such modularized components for quantum communication is a major part of my PhD.”

What do you like about Berlin and its vibrant research landscape?

It is a great benefit for my PhD research project to have a graduate school combining the excellency of several universities and other top notch research institutes across the German capital.
(Lucas Rickert)

Berlin offers excellent scientific infrastructure: Three universities with many quantum optics groups, a lot of research institutes, companies focusing on quantum optics applications and many start-ups.
It is an outstanding place for music, art, culture and diversity. I have a deep connection with Berlin- It's my hometown!
(Laura Orphal-Kobin)

INNOVATION



Laura Orphal-Kobin
PhD student 2nd year

Research topics:

Experimental solid-state quantum optics, quantum control: NV defect centers in diamond for quantum information processing applications

“My ambition is the curiosity and the joy of learning and figuring things out which implies searching for questions and answers of fundamental problems. I am keen to explore new frontiers and investigate phenomena and processes in-depths while also contributing to new insights in the larger context of science and technology.”

Where do you see your future after completing your studies at BOS.QT?

My research area holds the potential to revolutionize areas including computation, communication and metrology. Therefore, I could see myself in a dynamic working environment focusing on the development of quantum technologies, e.g., in science or in a young company. Through the BOS.QT network I will be connected to key persons in the area and informed on career perspectives national and internationally wide.
(Laura Orphal-Kobin)

I could see myself going abroad for a PostDoc for a while and see where it takes me. I would fancy working for new companies in the growing field of quantum technologies as well as communicating science to bring our research closer to the public and the relevant stakeholders. Additionally, I want to motivate more girls and women to study scientific careers.
(Luisa Esguerra Rodriguez)

IV. ORGANIZATIONAL STRUCTURE

BOS.QT Steering Committee:

Chairperson:	
Prof. Dr. Ulrike Woggon	(TU Berlin)
Vice-chairpersons:	
Prof. Dr. Kurt Busch	(HU Berlin, MBI)
Prof. Dr. Jens Eisert	(FU Berlin)
Prof. Dr. Thomas Elsässer	(HU Berlin, MBI)

BOS.QT Senior Faculty Members:

Prof. Dr. Oliver Benson	(HU Berlin)
Prof. Dr. Kirill Bolotin	(FU Berlin)
Prof. Dr. Kurt Busch	(HU Berlin, MBI)
Prof. Dr. Stefan Eisebitt	(TU Berlin, MBI)
Prof. Dr. Jens Eisert	(FU Berlin)
Prof. Dr. Thomas Elsässer	(HU Berlin, MBI)
Prof. Dr. Ralph Ernstorfer	(TU Berlin, FHI)
Prof. Dr. Michael Gensch	(TU Berlin, DLR)
Prof. Dr. Heinz-Wilhelm Hübers	(HU Berlin, DLR)
Prof. Dr. Tobias Kampfraith	(FU Berlin)
Prof. Dr. Michael Kneissl	(TU Berlin)
Prof. Dr. Andreas Knorr	(TU Berlin)
Prof. Dr. Christiane Koch	(FU Berlin)
Prof. Dr. Achim Peters	(HU Berlin)
Prof. Dr. Arno Rauschenbeutel	(HU Berlin)
Prof. Dr. Stephanie Reich	(FU Berlin)
Prof. Dr. Stephan Reitzenstein	(TU Berlin)
Prof. Dr. Alejandro Saenz	(HU Berlin)
Prof. Dr. Martin Schell	(TU Berlin, Fraunhofer HHI)
Prof. Dr. Markus Wagner	(TU Berlin)
Prof. Dr. Ulrike Woggon	(TU Berlin)

BOS.QT Junior Faculty:

Dr. Tobias Heindel	(TU Berlin)
Dr. Francesco Intravaia	(HU Berlin, MBI)
Dr. Markus Krutzik	(HU Berlin, FBH)
Dr. Anna Pappa	(TU Berlin)
Dr. Sven Ramelow	(HU Berlin)
Dr. Tim Schröder	(HU Berlin, FBH)
Jun. Prof. Dr. Janik Wolters	(TU Berlin, DLR, ECDF)

V. BOS.QT Locations



Freie Universität Berlin



Humboldt Universität zu Berlin
and Campus Adlershof



Technische Universität Berlin



Einstein Center Digital Future-
ECDF



Ferdinand-Braun-Institut,
Leibniz-Institut für Höchstfrequenz-
technik- FBH



Fraunhofer Heinrich Hertz Institut-
Fraunhofer HHI



Fritz Haber Institute of the Max
Planck Society- FHI



German Aerospace Center
Deutsches Zentrum für Luft- und Raumfahrt - DLR



Max-Born-Institu: - MBI

