



An International Research Program in Quantum Materials and Devices for Undergraduate Students

Program Description

Global Quantum Leap (GQL), funded under the National Science Foundation AccelNet program, seeks to advance the state of **quantum information technology** by forging linkages between international research networks on quantum computing and nanoscale science and engineering. GQL has established linkages to quantum and nanofabrication networks in both Asia and Europe. GQL activities focus on promoting collaborative research and on various training activities for young researchers.

This **International Research and Training Experience (IRTE)** is a structured research experience lasting approximately up to 12 weeks in the summer of 2024 for selected undergraduates with our international partner, **Matter and Light for Quantum Computing (ML4Q)**, which is led by RWTH Aachen, in Aachen, Germany. This is a cohort program; a small group of participants will travel together to one site, working on separate but related projects, and support each other in this technical and cultural adventure. IRTE is built on a similar program for undergraduates that has been conducted for over 10 years within the National Nanotechnology Coordinated Infrastructure (NNCI).

RWTH Aachen is a public research university located in Aachen, North Rhine-Westphalia, Germany. Aachen is located in the far western portion of Germany, within walking distance of the tri-country point where Germany, Belgium and the Netherlands meet.

Each participant will undertake a separate independent research project as part of the ML4Q research program, under the direction of a senior scientist or faculty member at RWTH Aachen, but typically working closely with a graduate student or postdoc. It is thus very much like an international version of an NSF research experience for undergraduates (REU) program.

This program is primarily open to **advanced undergraduate students** with interest/experience in Materials and Devices for Quantum Information Systems. We expect there will be a broad selection of quantum materials projects to choose from. Graduate students, postdocs and faculty may participate in supervisory roles or to explore collaboration opportunities (see more information below.)

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Applications will be **available by request from jschwed@umn.edu in October 2023** with participant selections made by December 2023. Applicants will be able to view available projects, rank order them according to interest, and apply via a simple application. We anticipate selecting a cohort of 4 students for this program. We believe that a diverse cohort of participants, including students at various levels of education and ability, will enhance the effectiveness of the program.

However, undergraduates should have prior research experience (e.g. REU) and an interest in quantum information systems and devices in order to participate in the program.

Opportunities for graduate students, postdocs, and faculty to participate in certain circumstances are also available (please see the program descriptions for more details).

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FAQs

What is RWTH Aachen like? With more than 47,000 students enrolled in 144 study programs, it is the largest technical university in Germany. It is a world-class research university and one of the leading research universities in Germany. The research groups run similar to those in the U.S., though usually with slightly larger groups under one professor, with several postdocs and research scientists, who then mentor and supervise graduate students. Aachen has a population of 250,000, of which 50,000 are RWTH Aachen students, but has a small-town feel with a very walkable center city. It has a long history as the previous seat of the Holy Roman Empire and you will see many statues and monuments of Charlemagne around the city.

What about housing? We will arrange housing in the university region on the north side of Aachen. Participants will stay in apartments with shared kitchen/bathroom and private bedrooms within walking distance of RWTH Aachen. Housing will be paid for directly by the program.

What about travel to Germany? We expect the group will travel together to Aachen, typically in late May. The group will be accompanied by an NNCI staff member who will return to the U.S. after a week. The program will book and pay for travel directly.

What preparation will I receive prior to the program? GQL will develop a series of webinars, video calls, and interactive exercises during the spring to assure that participants are well-prepared for their adventure and prepared to get the most out of their intercultural experience. Participation (a few hours a month) will be required.

But I don't speak German! Fortunately for us, English is the common language of science throughout most of the world. Scientists and faculty members at RWTH Aachen speak English, and since many groups are multinational with participants from throughout Asia and Europe. English is often the common language within a research group. We have found that language is not a barrier to research or socialization.

What about COVID? While COVID was an obstacle in 2020-21, our 2022/3 summer IRTE programs moved forward with only minimal disruptions, and while we cannot tell with the future will bring, we are optimistic that we will be able to hold the summer 2023 program as planned.

Can I visit other parts of Germany or Europe? Our partners in Germany are proud of their country and culture and encourage exploration. You are expected to work at RWTH Aachen, 5 days a week M-F, but you will be free to travel on weekends and holidays. Germany has an

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excellent train system that will take you to most places in Germany in a few hours, as well as travel to major cities in France, Belgium, and the Netherlands. We may also arrange group “field trips” to other universities and research facilities, including Research Center Jülich and IMEC.

What is the schedule? The program will last up to 12 weeks, typically from the last week in May to the end of August.

I am a graduate student, postdoc or faculty. Can I apply? In certain circumstances, yes. Graduate students or postdocs may apply if they have a current collaboration with an associated project leader AND if they agree to help to provide coordination and supervision of the participating undergraduate students.

What about a stipend?

Undergraduates: In addition to travel and housing payment, the program will pay undergraduate participants a generous stipend (details to follow, but similar to REU programs).

Graduated seniors who are accepted to graduate school but have not yet begun: Same as above (undergraduates). Graduated seniors who will not enroll in graduate school in the fall are not eligible.

Graduate Students, Postdocs and Faculty: We will entertain applications from graduate students, postdocs and faculty to travel with the team to RWTH Aachen for the purposes of exploring collaboration opportunities, with the condition that they also provide assistance in supervising the undergraduate cohort. Travel and housing only provided. Please send us an e-mail for additional information.

What about food? Interesting food is an enjoyable part of the adventure and an important part of socialization. There is a cafeteria at RWTH Aachen where many students eat lunch, and there are numerous cafés and restaurants in the RWTH Aachen area, particularly in the Pontstraße area. Most food is reasonably priced. You can also find vegetarian and vegan options for dining.

What can I accomplish, scientifically, in 12 weeks? Your host have considerable experience in “right-sizing” projects for the 12-week period. You will have a distinct part of an ongoing research project where you can make an individual intellectual contribution. This program is built on a previous undergraduate program through the NNCI in which 81 projects over 12 years produced approximately 30 co-authored publications.

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What are the passport/visa requirements? Participants are expected to ensure they have the proper passports and visa in order to participate. Please make sure to arrange to have your documents early!

Can I participate remotely? No, this is an in-person, hands-on research experience, so travel to Aachen will be required to participate.

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