



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 10 weeks in the summer of 2024 for selected undergraduates with our international partner at the **National Institute for Materials Science (NIMS)** in Tsukuba, Japan. 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. Outcomes from our previous program held in the summer of 2022/3 can be found [here](#). IRTE is built on a similar program for undergraduates that has been conducted for over 10 years within the National Nanotechnology Coordinated Infrastructure (NNCI).

NIMS is the largest research center for Materials Science in Japan, with a broad technical program spanning structural materials, electronic materials, biotechnology, and chemistry. Tsukuba, located about 50 km north of Tokyo, is the “Science City” where most of Japan’s national laboratories are located. NIMS has world-class facilities for materials research.

Each participant will undertake a separate independent research project as part of the NIMS research program, under the direction of a NIMS senior scientist, 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 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, and these students will be joined by any additional cohort supported by a similar program through Cornell University. 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 NIMS like? NIMS is a major national laboratory, with over 1500 employees across three sites within Tsukuba. It is a world-class research facility. Operationally, it feels very “academic-like”. Each senior scientist oversees a research group of a dozen or so junior researchers, postdocs, and graduate students (many senior scientists have joint academic appointments elsewhere). The atmosphere is fairly informal.

What about housing? Because of the large number of government research centers and visiting scientists in Tsukuba, the Japanese government provides excellent housing. Participants will stay in single or double-occupancy apartments at Ninomiya House, only a few hundred yards from the main NIMS site. Housing will be paid for directly by the program.

What about travel to Japan? We expect the group will travel together to Tsukuba, 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 Japanese! Fortunately for us, English is the common language of science throughout most of the world. Almost all senior scientists at NIMS speak excellent English. Many groups are multinational with participants from throughout Asia and Europe. English is often the only 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 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 2024 program as planned.

Can I visit other parts of Japan? Our partners in Japan are proud of their country and culture and encourage exploration. You are expected at NIMS, 5 days a week M-F, but you will be free to travel on weekends and holidays. Japan has an amazing public transit system that will take you to most places in Japan in less than 5 hours. You could spend every weekend exploring Tokyo or explore a different prefecture every weekend, and still be back in Tsukuba by

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Monday morning! We may also arrange group “field trips” to other universities and research facilities.

What is the schedule? The program will last ~10 weeks, typically from the last week in May to mid-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 payments, 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 NIMS for the purposes of exploring collaboration opportunities, with the condition that they also provide assistance in supervising the undergraduate cohort. Travel and housing are 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. Your apartment will have a simple kitchen, there is a cafeteria at NIMS where most people eat lunch, and there are many options for dinner. Just be flexible. Most food is reasonably priced. You won't find any big cuts of meat. On the other hand, it is difficult to be a strict vegetarian in Japan unless you prepare your own.

What can I accomplish, scientifically, in 10 weeks? We, as well as your hosts, have considerable experience in “right-sizing” projects for the 10-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.

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

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documents early!

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



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