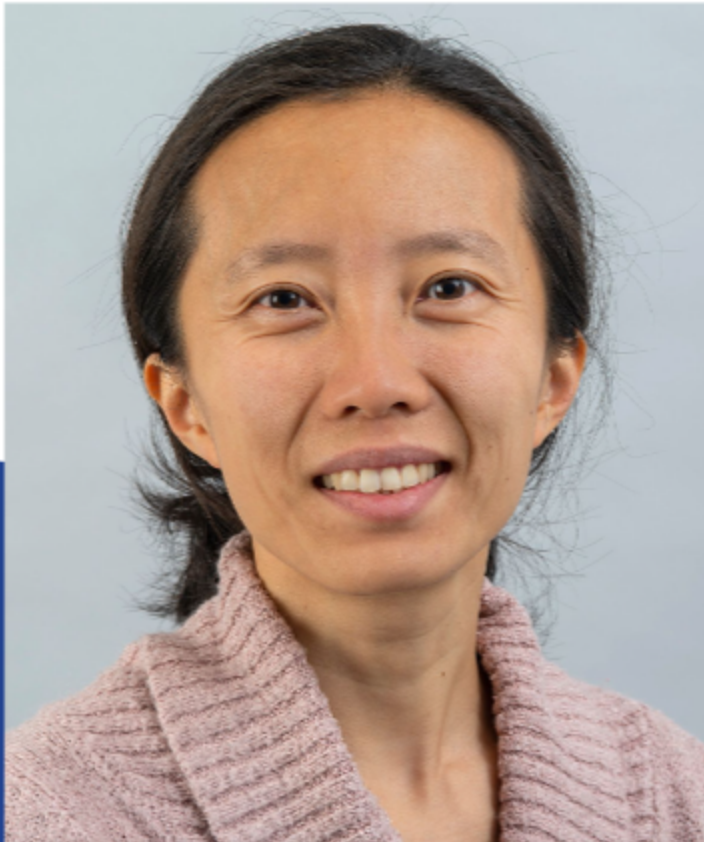


Interview with **YIWEN CHU**
Coordinator of the **MQSens Project**:
*Quantum sensing with nonclassical
mechanical oscillators*

QuantERA co-funded Project in the 2021 call



Yiwen Chu:

"The QUANTUM field allows experiments that are very hands-on. They happen in the lab and you can see and touch everything [...] I think QUANTUM mechanics was one of the really fascinating topics in physics that I encountered during my studies".

Lydia González Orta: *Why choose the quantum field. Who or what provides inspiration:*

Yiwen Chu: *I think there are a few reasons. During my Bachelor's, I knew I wanted to study physics but I wasn't sure in which field I wanted to do research in the future. Observing what kind of day-to-day tasks people do in different areas was very helpful for me at that time. I realised that experiments performed in the quantum field allow you to touch and see everything by yourself, which I liked a lot. Being able to understand each part of the experiment was very precious.*

I guess quantum mechanics was one of the really fascinating topics in physics that I encountered during my studies. My first experience with quantum physics was connected with writing a Bachelor's thesis. At the time I was working with a professor who inspired me with plenty of ideas and concepts I'd never heard of before. Also the simple and clear way he talked about those topics with postdocs and bachelor students was very encouraging. I think this also played a role.

L.G.O.: The reasons to take part in the QuantERA call?

Y.C.: *Actually, I started my own group just a few years ago and this is my first collaborative grant. Since I did all my education in the US, the one thing I definitely wanted to do was to extend my work in Europe and work with other researchers there. In the past I had a chance to get to know European researchers, however, the opportunity to create something together was a totally different thing. It was a new experience for me being a part of this consortia, especially after covid. Having this exchange with other researchers is super important.*

L.G.O.: The content of the funded research project for non-specialised audiences including impacts on technology and society?

Y.C.: *The general idea is to use mechanical objects and their motion to detect different kind of things, such as forces, or masses, or other kinds of properties, which is done very regularly in our daily lives. There are many sensors that are based on moving objects. However, what we want to do is to use the fact that even these kinds of objects have also been described by quantum mechanics and work within its laws. It turns out that in other quantum systems, for example atoms or electrons, if we use quantum mechanics, you can build a better sensor in some cases. Being able to really see and control the quantum mechanical behaviour of a massive object is something that is only reasonably possible as long as you ask the question: **for these kinds of sensors, would it also be possible to use quantum mechanics to make them perform even better?***

These objects that I'm talking about are real, massive objects, that move. For example, one of my project partners is working with what essentially are very small drumheads. Another one is working with a very small string. And our group works with sound waves. We also have theory collaborators who will help us think about these different concepts.

*I think that the research we are all doing is still in some sense quite exploratory. We are not trying to build a specific device for a particular application. The question I described earlier "how do we use quantum mechanics in these objects?" is only reasonable once we have shown these objects to behave quantum mechanically. For this particular goal, that is still a pretty fundamental question. I believe at first we should ask how these objects work and how we operate them, so we can later take advantage of their quantum nature. Of course the idea eventually would be to use these very sensitive ways of measuring, for example, the presence of very small masses. But I think that the immediate focus is not on a particular device that would be useful in the real world. In terms of impact, this project can tell us something about the basic ideas of quantum physics in the sense of this question – **"how complex and how massive can an object be and still behave quantum mechanically"**. In my opinion this is actually one of the first questions in the field. One way to view this project is trying to explore that question of "how large and how massive can an object be so as to we still control it and measure it quantum mechanically", like the broader question we are trying to help to answer.*

L.G.O: *The role of coordinator: opportunities, challenges and gender issues?*

Y.C.: *This is my first time being part of a consortium for a funded project and even more – I am coordinating it. I am glad that my project partners have been so supportive. **Despite the fact that I have the youngest experience among all consortium members, I got the chance to lead the project, taking the risk and responsibility for it.** It has been really interesting, especially during the proposal writing process. I've seen that it is really important to have one person who coordinates everything and makes sure that things get done. Besides that, the project leader helps the other researchers to communicate with each other, as well as with external parties. Maintaining a website and other publication channels is also part of my job. I think **one of the challenges is really making sure that we continue to be connected throughout the course of the project.** Because of course a danger is that everyone goes on and does their own thing. Sometimes there are natural needs to stay in touch with each other; which is the reason why we wrote this collaborative project together. But still, it is important to have someone to really encourage us that this continues to happen on a regular basis.*

L.G.O: *The main challenges for more gender balance in the quantum field – QuantERA first steps, promising measures, the most popular topics in the community's discussions.*

Y.C.: *I am the only woman PI in our consortium group, which is probably quite representative of our field in general. Probably there are many other consortia that have fewer.*

I think that in general if we look at research groups, PhD students and postdocs, it is a representative ratio. For example, in my research group we are 1 to 5. I imagine the others are probably similar.

I suppose that work-life balance is a general concern nowadays. Coordinating this project is only one piece of all my duties, so it doesn't make a huge difference when looking at the whole picture. However, managing all the tasks might be challenging sometimes.

***In my opinion, to achieve a more gender-balanced research environment it is necessary to see real-life examples around us. Making women more noticeable in a quantum society could be very beneficial, especially among such groups of young researchers as PhD students.** For example, in my field there are groups with many female scientists, which consequently attract even more women. Unfortunately, there are also teams dominated by male members. **When I talked to my students, they said that joining a group seemed to them natural, just because they saw the other women members, who became kind of model role for them.** I think that applies also to the field as a whole, this kind of snowball effect.*

L.G.O.: *On the first steps taken by QuantERA to promote gender balance*

Y.C.: *I know that there are many changes occurring for that process recently, such as being more transparent about who the reviewers are and things like that.*

*I think, in terms of the other topics, what the institutions can do – and this is related to what I was saying before – is to increase the **visibility of women researchers**. And I think to some extent maybe it is even more important that they **provide ways for women researchers to be in touch with their peers so that they do not feel isolated**. Even if they are in a group where they are the only women, which was my case during my PhD, it was really nice to have a way I could talk to other peers in the same situation. I think that **even in projects and consortia like QuantERA, for example, it could be another way for people to make connections as well**. I think that's really interesting. We also plan to organise a conference and we hope to try to encourage the women researchers, students, to participate, so they can hear about the experiences of their peers.*

*I personally think it is important to **address the work-life balance as not only women's issue**. There are a lot of times you get invited to panel discussions about work-life balance or gender equality and it is only women who participate. That is perpetuating this idea that this is a problem for women. **I would like to see more encouragement for men to also be involved and talking about these issues**. On an institutional level, and in some countries, for example, there is a difference in the parental leave that men and women get, and so on. I think if these things are still not viewed as being equally important for men and women, then it is not really solving the full problem.*

L.G.O.: Facing specific challenges for being a woman in the field?

*Y.C.: As mentioned before, feeling isolated sometimes is one of the issues. I realized it is not so much even that you encounter explicit bias, at least nowadays in most institutions, it is hard to find someone that said something bad to me. It is just simply the fact that there are not so many other women who are in the same situation. At the same time, I do not want to say that I did not have other peers and friends during my PhD. **There were women from other groups and we made that connection. That was of course really valuable. But I think it is just all a little bit harder because of a lack of diversity.***

L.G.O.: On the usefulness of these visibility actions targeting women researchers

Y.C.: I really enjoyed this interview and I think that the gender diversity issue definitely had an impact on most of my career. I slowly began to have a better understanding on this matter. But I think that maybe it would be worthwhile encouraging everyone, including men, to think about these issues.

»»» **Yiwen Chu** is a leader of QuantERA MQSens Project and a tenure-track assistant professor who leads the Hybrid Quantum Systems Group at ETH Zürich.

»»» **Lydia González Orta** is the gender equality practitioner from Spanish Foundation for Science and Technology (FECYT) who provides support to the QuantERA consortium towards a more gender-balanced quantum field.

