

Connecting Australia, using particles of light

Information can come from anywhere. It's contained in books, our phones, computers and even in our DNA. It can even be in tiny structures we can't see.

Can you tell us about what you do?

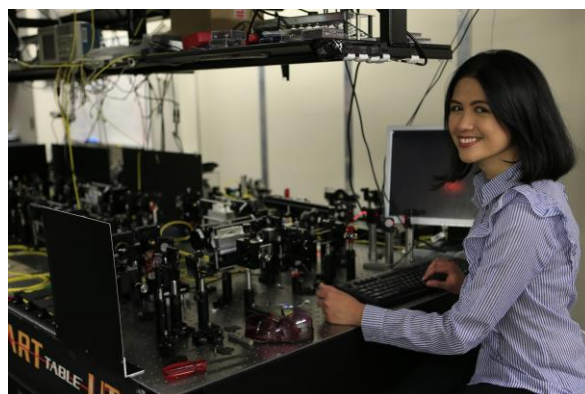
I am an experimental quantum physicist. I do experiments with particles of light called photons, and I use these photons to carry quantum information. It's very similar to the way that your internet arrives at your house, where information is carried through photons through optical fibre. I'm doing that, but instead of classical information, it's quantum information. Hopefully, in the future, with quantum information we will have more secure kinds of communication, and more powerful computation capabilities.

There are many properties of light that can carry information. There could be colour or frequency, but I am looking specifically at the shape of photons. We are at the point where we could make any shape we like, like donuts or even flower shapes. We can use those different shapes as something like an alphabet that you could use to carry information.

Other quantum technologies use matter to carry quantum information instead of light, like superconducting qubits, but that requires the superconducting qubit devices to be put in a very cold environment. What I like about photons is that you could do quantum information with them even at room temperature. One application of quantum is the quantum computer. If you think about your laptop at the moment it heats up because the electrons generate heat as they travel along the wires. A quantum computer based on photons won't have this problem. There has been a lot of investment in quantum technologies from governments all over the world, including here in Queensland. In the future, everyone could benefit from quantum information.

Can you tell something about your field that the public doesn't know?

When I tell students about quantum technologies, they expect you to be ultra smart. I get asked if I use a lot of maths. To their surprise the answer is 'not really'.



Associate Professor Jacqui Romero

Discipline: Physics

Organisation:

- The University of Queensland

Degrees:

- Bachelor of Science in Applied Physics
- Masters of Science in Physics
- PhD in Physics

Key words:

- Meaningful
- Excited
- Photons
- Communication
- Computation

Social Media:

- <https://www.quantum-atbp.org/>
- https://twitter.com/sinag_jacq
- <https://www.linkedin.com/in/jacquiline-romero-8967a1182/>

Prize: Queensland Young Tall Poppy Science Award winner 2018



**Queensland
Government**

I use maths, but it is not as much as you would imagine. Quantum doesn't have to be scary or intimidating. Just like anything else in life if you want to develop something or have a big project, you can divide it into small manageable parts; then you can work on each piece. If you want to get into quantum physics or quantum technologies, you just need to be curious and a problem solver. Quantum doesn't have to be intimidating, it's actually very fun!

“*The problems of the world are complex, it's not just science that's going to solve it...diversity is crucial.*”

What led you down this path?

I loved maths as child. My uncle gave me a book on algebra when I was young, around 8 years old. It was not like the algebra we were taught in school. It was basically a book of word problems. You could read the questions in English and then underneath there was the solution written as an equation. It was interesting to me because it was translating these English questions to equations. Back then I didn't know it was called an equation, but it was really empowering for me as an 8 year-old. I felt like I could translate any problem and then solve it with maths. It was like a recipe - you put something in, and you get something out. I am really fortunate that was my introduction to algebra.

Later on, I went to a science high school, and I found that I enjoyed physics the most. I was in my third year of high school when I heard one of my physics teachers complain about quantum physics, that it's the part of physics he hated most. I used Google to find out what quantum physics was, and I discovered many interesting things. So once again it wasn't a formal introduction. The search brought up weird things such as 'entanglement' and lots of misinformed articles too (though I wasn't wise enough to know it then). Those articles kept me curious. It helped that I am very curious and self-driven.

Is there a moment in your STEM career that is important to you?

Finishing my PhD was a pivotal moment in my career. I did my PhD in Glasgow, Scotland. Over there you have a PhD viva. A viva is basically an oral examination where you have to defend your PhD

thesis. My viva was a closed meeting with just myself and two examiners in a room. One of my examiners was a big name in the field, I idolised him. After almost three hours of talking about my thesis, he shook my hand and congratulated me. I didn't expect I will be in tears, but I cried! It was so emotional because coming from the Philippines, it was very hard to get a PhD scholarship, it looked uncertain.

What was one of the biggest challenges of your career?

The hardest part of my career was getting into the field. If you do not have the usual credentials or a privileged background, it can be really hard. The most difficult part for me was getting into a quantum physics PhD program because I did my undergraduate education in the Philippines. At the point when I was looking for a PhD, we did not have an experimental quantum physics program in the Philippines. That meant that I did not have a research background in quantum physics, so it was hard to find a scholarship.

I faced rejection often during my search for a PhD program, and it was a bit discouraging. I decided to get a masters degree to improve my chances. After my masters, I began emailing research groups to find a PhD program. I got lucky and identified a professor that aligned with my interests, and I was accepted into that group. We completed many interesting quantum projects together. Once I was in the field, I gave my very best shot and I am happy that my contributions are recognised.

What is your hope for the future and future generations?

In the future, I hope more people will get into STEM, especially younger people and underrepresented groups like women. The problems of the world are complex; it's not just science that's going to solve it. It's going to be a combination of everything we do, and we've got to have the best people working on it. Diversity is crucial to innovation and there is research to back that up.

You won a Queensland Young Tall Poppy Award. How did this benefit you?

The award ceremony in the Queensland Museum was very special. It put a spotlight on me and my work.

I have been invited to talk to groups of school students. It's great talking to younger students because they are still deciding what they want to do. I went to Mount Isa, and it was great speaking to communities that we don't usually reach.