Quantum technologies

with Dr William Campbell and Emma Paterson

Talking *points*

Knowledge & Comprehension

1. What is MAGE, and how does the experiment work?
2. What is an axion?
3. What is the SQUID, and why is it necessary?
4. What is dark matter, and how much of the Universe does it make up?
5. What mass of particle (in eV) is currently measurable, and what mass can the new Anyon Cavity Resonator detect?
6. What technique was necessary to make the Anyon Cavity Resonator? Why?
7. What is piezoelectricity, and how does it help in the MAGE experiment?

Analysis

8. What are the similarities and differences in the formation of high-frequency and low-frequency gravitational waves?
9. Why do scientists think dark matter exists if they cannot detect it?

Application

10. How is Emma's research able to help in healthcare?

Evaluation

11. If you were a quantum physicist, how important would it be for you that your research had wider, real-life applications, and why?

More *resources*

- Watch this brilliant video of Emma talking on TV about her work around molecule separation: **www.innovationnation.tv/story.php?id=52**.
- Quartz plays an important role in Will's research. If you can get your hands on pieces of quartz, try hitting them together to see a quantum phenomenon called triboluminescence at work! Quartz is one of the few materials in the world that demonstrates both triboluminescence and piezoelectricity. Read here before you begin, and make sure to wear eye protection in case any pieces of quartz splinter off: **www.thoughtco.com/quartz-triboluminescence-607591**
- Emma recommends Quantum Girls (**www.quantumgirls.org**), a national project in Australia that introduces quantum physics to students in years 5-12. Even if you cannot join the project, have a look at the short videos on female role models working in quantum physics: **www.quantumgirls.org/role-models**
- Have a look at the Einstein-First Project (**www.einsteinianphysics.com**). "This teaches the fundamental concepts of modern physics to school students and works to improve STEM involvement in the classroom," says Emma.

Activities

Quantum physics is often seen as an extremely difficult and complicated area of science to understand. As scientists keen for others to understand their work, Will and Emma are both skilled in explaining complex ideas in accessible ways.

Will, for instance, compares the vibration of quartz to the plucking of a guitar string, and the movement of gravitational waves through space to ripples of water coming from a stone thrown into a pond.

Think about how you could compare difficult quantum concepts to things that are easier for others to understand.

- Create a poster, leaflet or presentation to explain Will and Emma's research to a friend who has not read their article or to younger students in your school.

To learn more about quantum technologies, Emma suggests listening to some of the podcast, 'Clear as Quantum' (**clearasquantum.transistor.fm**) where some of her colleagues and other Australian researchers explain quantum work in accessible and engaging ways.

- Create your own recording or write a script for your own podcast episode explaining Will and Emma's work on quantum technologies.