

Quantum Materials Seminar

8th July 2020 - Dr Alexy Karenowksa: "*Making Waves in Magnetism: exploring a fantastical face of an everyday phenomenon*"

Q&A - written answers

Q: *How common is a spin wave and what is the frequency?*

A: Good question! They exist up into the terahertz but in the laboratory we generally work with microwave frequency spin waves. These are very interesting because they can interface with other bits of microwave-frequency electronics.

Q: *Do spin waves also display non-linearity like the water waves?*

A: Yes! This is one of the most interesting things about them.

Q: *Do these magnetic waves also produce electric waves?*

A: That's a good question! They can do. The oscillating magnetic field associated with them can excite EM waves.

Q: *Are permanent magnets really permanent?*

A: In theory, yes. In reality, they are if you store them carefully but over time the magnetic field they produce will reduce, especially if you expose them to high temperatures.

Q: *How is a spin wave produced in the lab?*

A: Good question! We can produce them using small antennae (essentially bits of wire) that we excite with microwave-frequency signals.

Q: *How do magnets and superconductors link together, e.g. in hyperloops?*

A: Magnetism and superconductivity are linked in several very interesting ways. Superconductors can be used to produce very large magnetic fields: essentially by passing very large currents through them. Such systems are used in transportation concepts like hyperloops and also in hospital scanners — MRI systems use superconducting magnets.