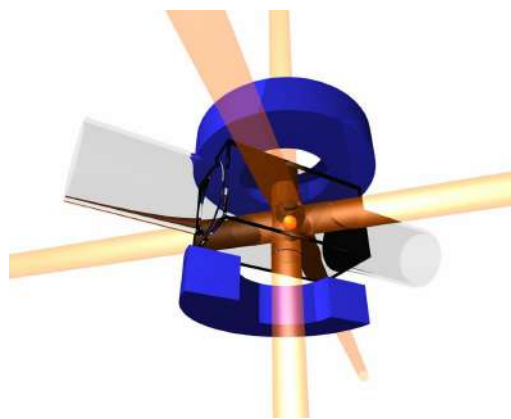
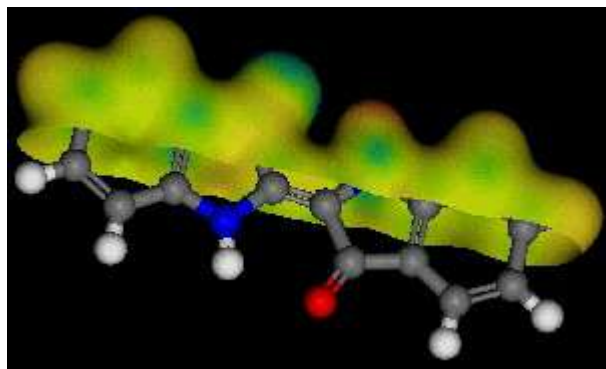
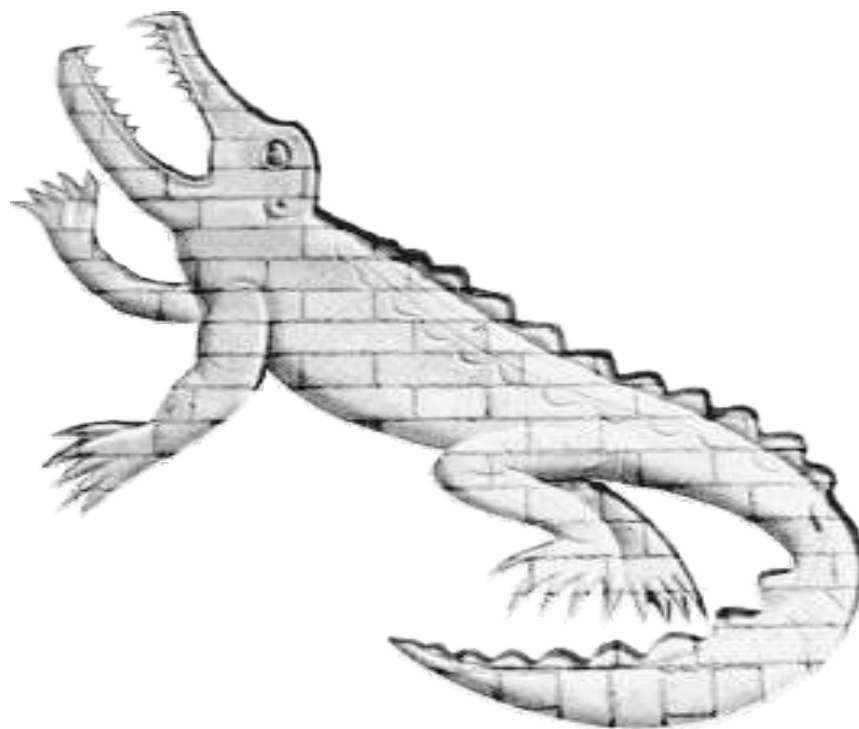


The life of a condensed matter theorist

Gareth Conduit



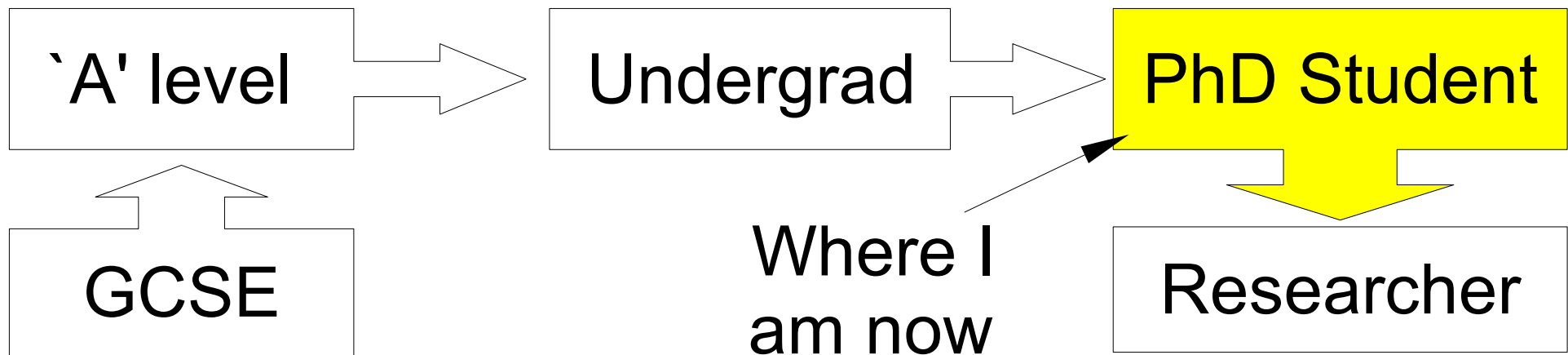
Talk outline:

What is condensed matter physics?

Research in Theory of Condensed Matter



Career progression of a physicist:



What is condensed matter physics?

Gareth Conduit

- We study the objects that surround us in our every day lives



Sand is used to
make computers!



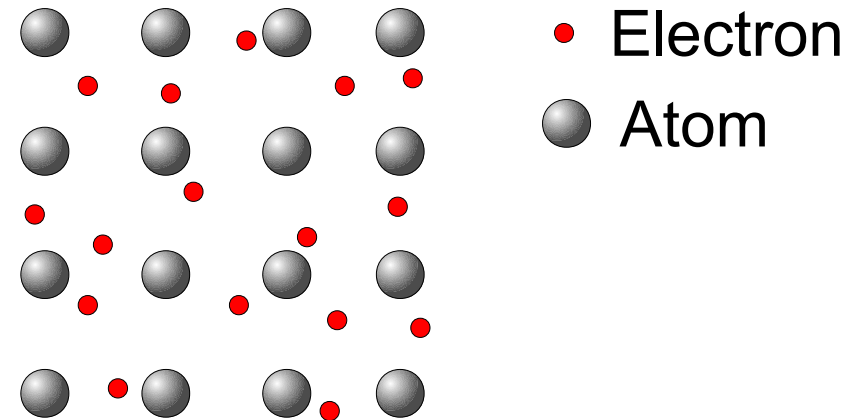
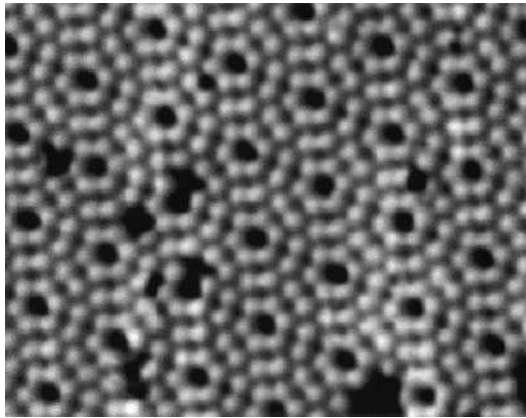
Steel is used to
make bridges



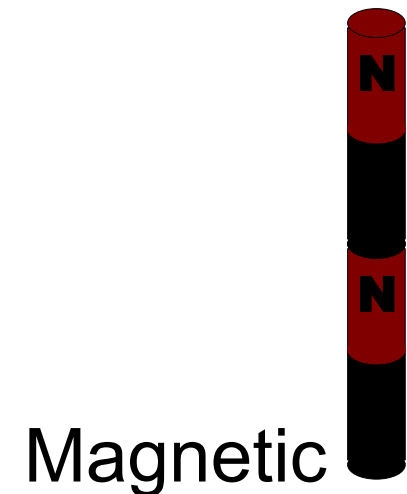
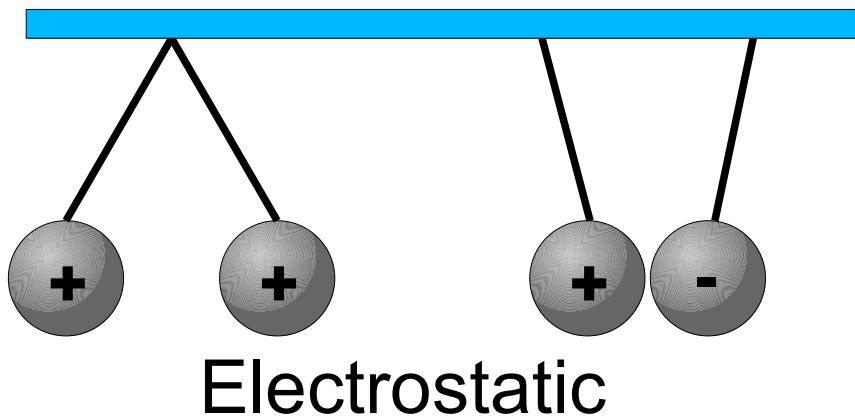
Constituent particles

Gareth Conduit

- A condensed matter physicist assumes everything is made up of electrons and atoms



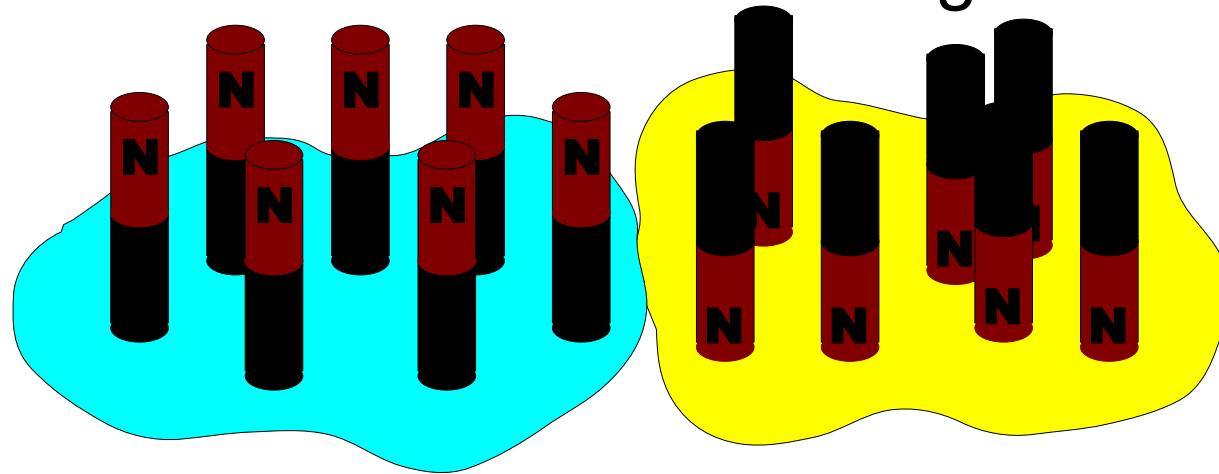
- and takes for granted that they interact according to the well-established laws of electromagnetism



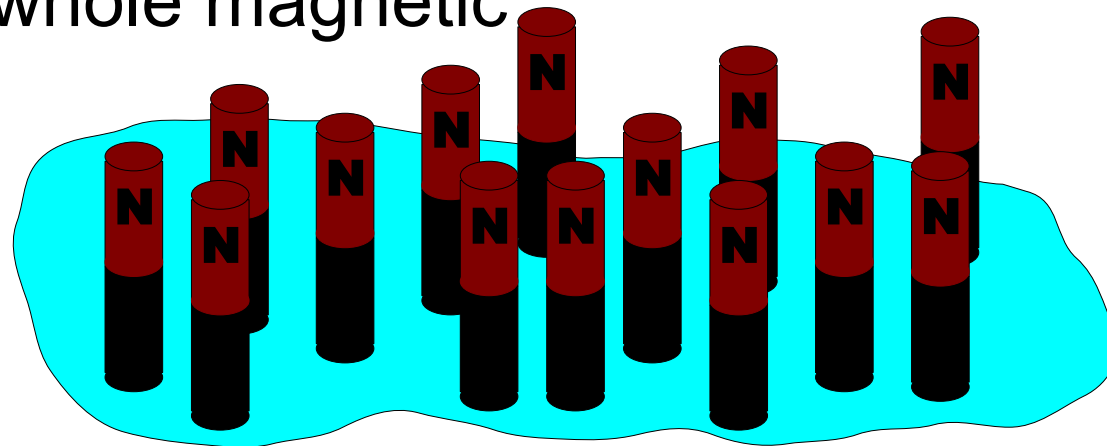
Particle interactions

Gareth Conduit

- The effects of simple interactions can be seen in a magnet
- A magnet can be thought of as many small magnetic domains – each one is like a small bar magnet



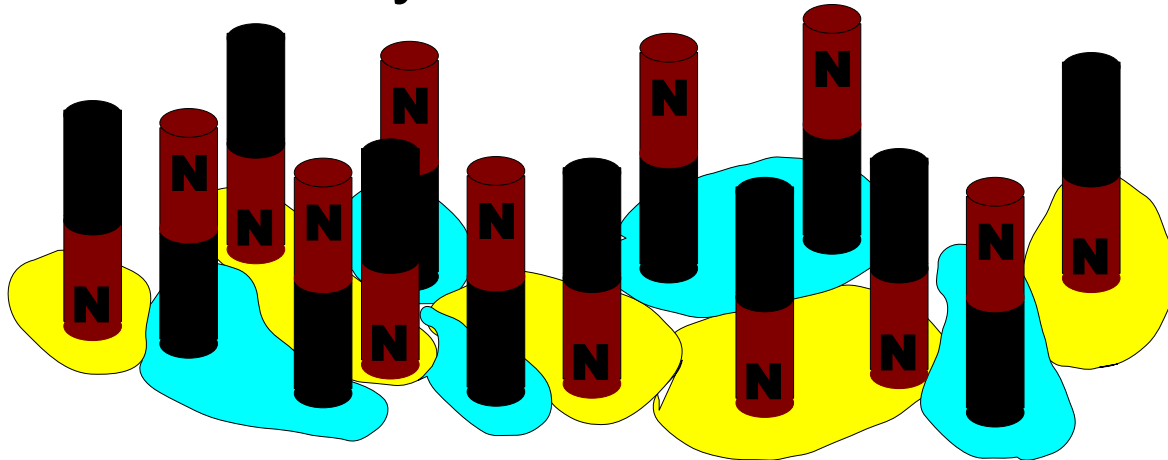
- An external magnetic field makes the domains align and the material as a whole magnetic



Thermal fluctuations

Gareth Conduit

- If the magnet is hot the thermal energy allows some of the domains to flip, so a very hot magnet would prefer the domains to be randomly N or S

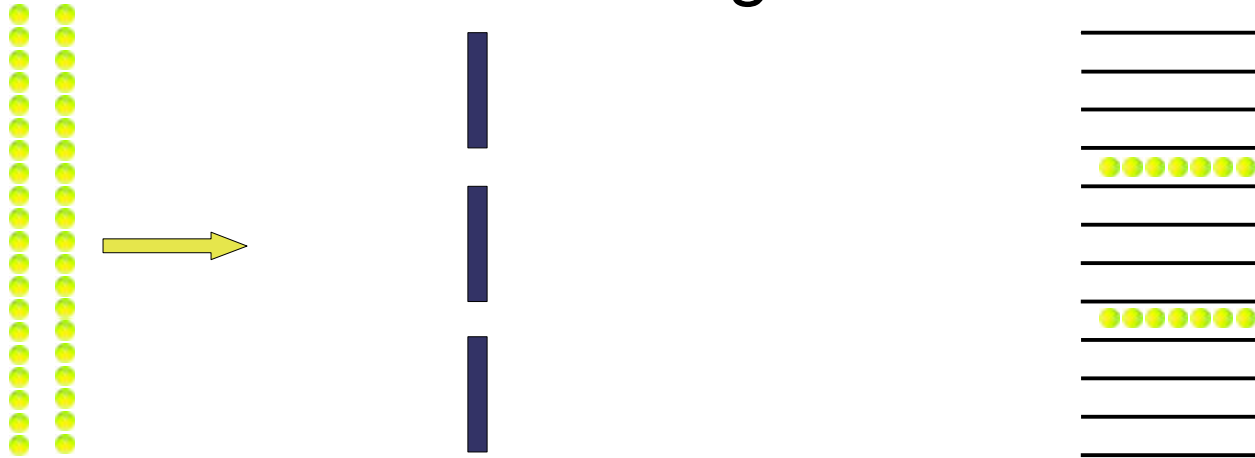


- At an intermediate temperature there is a transition from aligned to randomly distributed domains, as the computer simulation shows

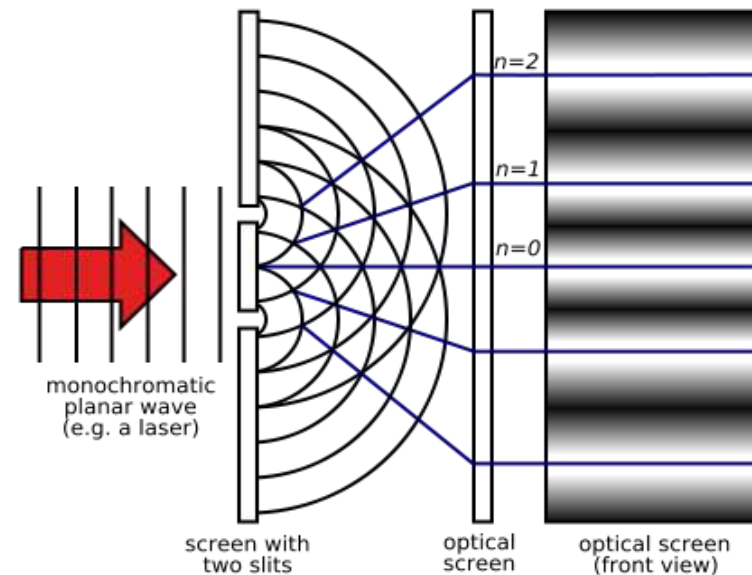
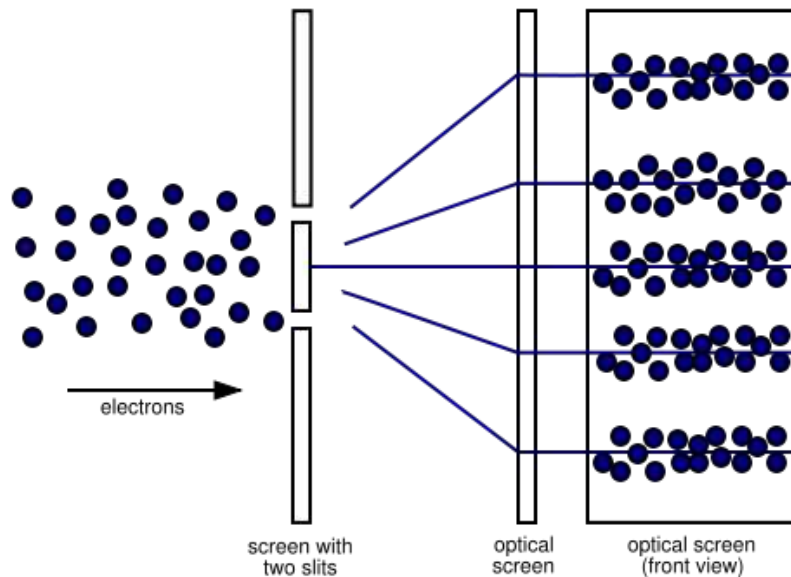
Quantum mechanics

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- Tennis balls fired through slits travel in straight lines



- However, quantum mechanics tells us that electrons behave like waves and interfere



What is condensed matter?

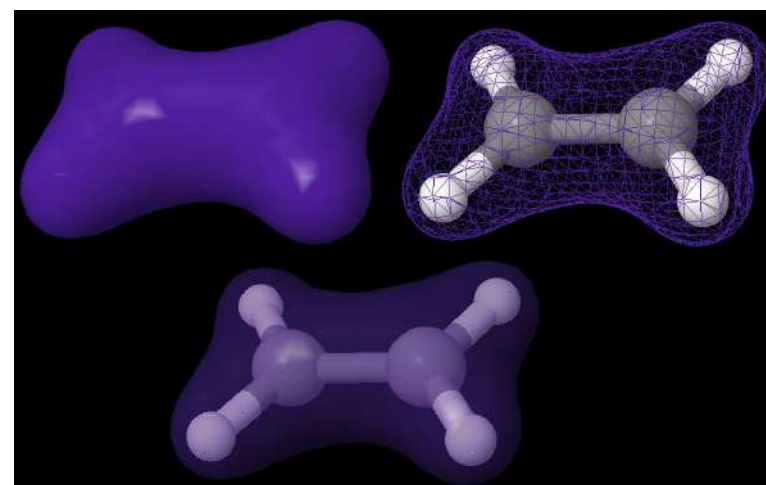
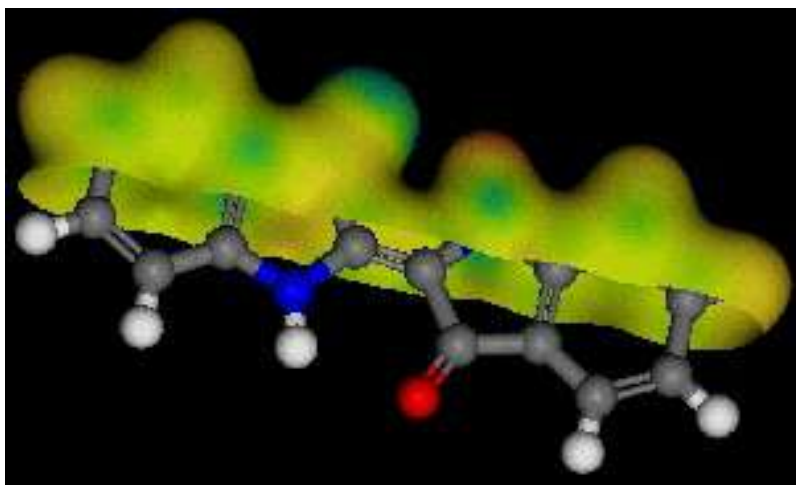
Gareth Conduit

- Condensed matter physics is when interactions are strong and quantum mechanics is important
- Leads to new interesting many-body effects that have practical applications in modern day life e.g.
- Elastic bands used in hospitals and the same technology is relevant to making quieter car tyres
- Hi-tech magnets used in computer hard drives
- Superconductors used in MRI scanners in hospitals

Research in condensed matter

Gareth Conduit

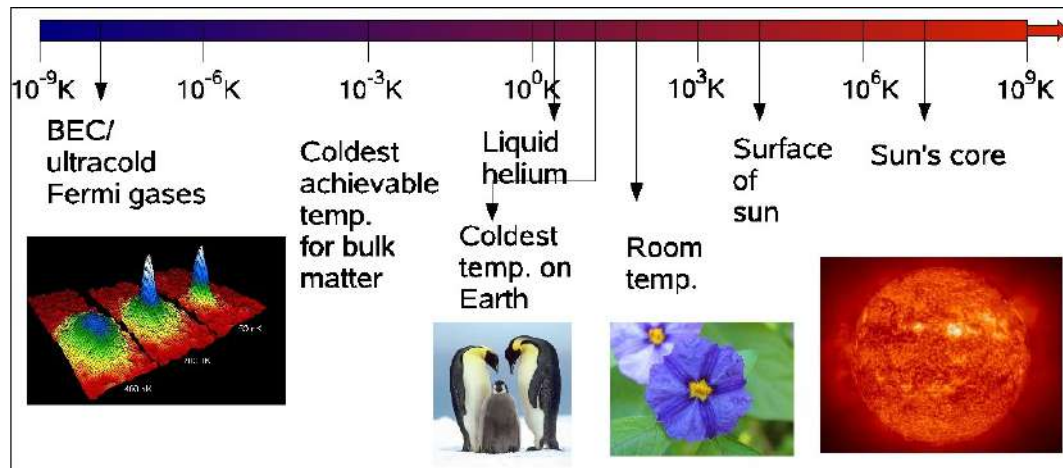
- TCM is also involved with computational research:
- CASTEP models electrons in solid and molecules
- Used by drug and chemical companies, and researchers



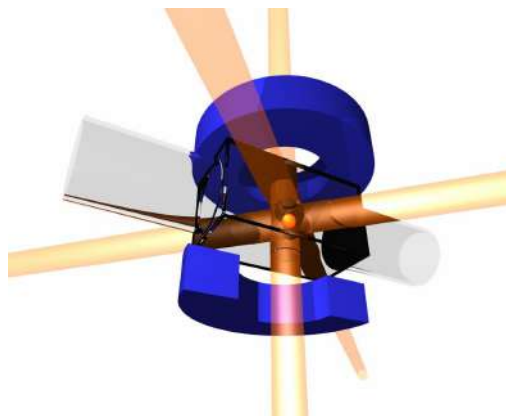
Cold atom gases

Gareth Conduit

- In my PhD I study atoms that have been cooled to 10^{-9} K



- Experimentalists have an unprecedented degree of control over cold atomic gases, making them ideal to study many-body systems



What does a theorist do?

Gareth Conduit

