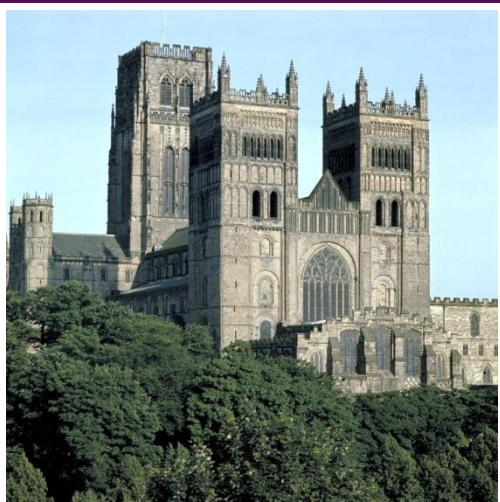


# Superconductors for fusion magnets



Centre for Materials Physics

Superconductivity Group

[www.durham.ac.uk/cmp](http://www.durham.ac.uk/cmp)



Durham  
University

Presentation by

Prof. Damian Hampshire and Dr. Mark Raine

# Structure of the talk

1. Applications that use superconducting materials.
2. The Icy Durham Practical Course.
3. Soldering the high temperature superconductor (HTS)  $\text{GdBa}_2\text{Cu}_3\text{O}_7$  for critical current ( $I_c$ ) measurements.
4. The critical current ( $I_c$ ) of superconducting materials.
5. Basic superconductivity.
6. The flux-line lattice, fluxons and supercurrents.
7. Reference Laboratory measurements.
8. The 3 Industrial Superconducting Materials.
9. Advanced measurements on superconductors.
10. The Icy Durham practical course lectures.
11. Post lecture discussion

# Questions to discuss after the end of the 'Superconductors for Fusion Magnets' Lecture

- i) What are the materials components of HTS ReBCO tapes and Nb<sub>3</sub>Sn superconducting wires?
- ii) What is the highest magnetic field inside the ITER, STEP, SPARC and ARC tokamaks?
- iii) What is the approximate energy stored in the magnets in the ITER fusion tokamak ?
- iv) Name the superconductors that are used to build (any) commercial magnets – state their critical temperature and upper critical field (at zero temperature).
- v) Name the superconductors (to be) used in ITER, STEP, SPARC and ARC.
- vi) What is the typical current density in a magnet? How can we make it larger? What impact would it have if we increased current density in superconductors by a factor 5.
- vii) Either : If a room temperature superconductor was discovered would it affect your thesis research/ the magnetic confinement system for STEP and SPARC/ARC ?  
or: List the important properties of the current superconductors used to build fusion magnets.  
Rank a five-fold improvement in the important state-of-the-art properties of a superconductor for fusion applications.