

Superconductivity - M2 ICFP

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Bibliography assignment

Due October 13th

1 General Instructions

- You may work in groups of 1 to 3.
- Choose one of the articles listed below. You may choose another article that you find yourself, but send it to me beforehand for approval.
- Several groups may work on the same article.
- Your report on the article should be no more than 5 pages, excluding figures. It may be handwritten or electronic, at your convenience.
- **WARNING:** some articles may use CGS units rather than SI units.

2 Critical Current and Critical Field: article by J. Bardeen

- Briefly describe the context and the type of system being studied. What is the problem being addressed?
- Discuss Section 4 in detail.
- Discuss qualitatively the part dealing with the evolution of the superconducting gap in Section 5.
- Discuss Figure 5.

3 Vortex Core: article by J. Clem

- Briefly describe the context and the type of system being studied. What is the problem being addressed?
- Re-derive equations (1) to (16).
- Discuss the existence of two types of superconductors depending on whether $\frac{\lambda}{\xi} = \kappa < \frac{1}{\sqrt{2}}$ or $> \frac{1}{\sqrt{2}}$.
- Discuss Figure 1.
- Briefly discuss how neutron diffraction can be used to image vortices.

4 Little-Parks Oscillations: article by W.A. Little and R.D. Parks, 1962

- Briefly describe the context and the type of system being studied. What is the problem being addressed?
- Re-derive the quantization of magnetic flux using a Ginzburg-Landau-type approach.
- Deduce the equation describing the variation of T_c as a function of magnetic flux. You may also use the 1964 article by the same authors (available on eCampus).
- Discuss the comparison between theory and experiment based on the figures in the article.

5 Superconductivity: article by J. Simonin

- Briefly describe the context and the type of system being studied. What is the problem being addressed?
- Re-derive equations (1) to (9).
- You are not required to look at the part of the article dealing with the magnetic field (Eqs. (10) to (18)), but the discussion at the end of the article may help you with your understanding.
- Discuss the comparison between theory and experiment based on the figures in the article.