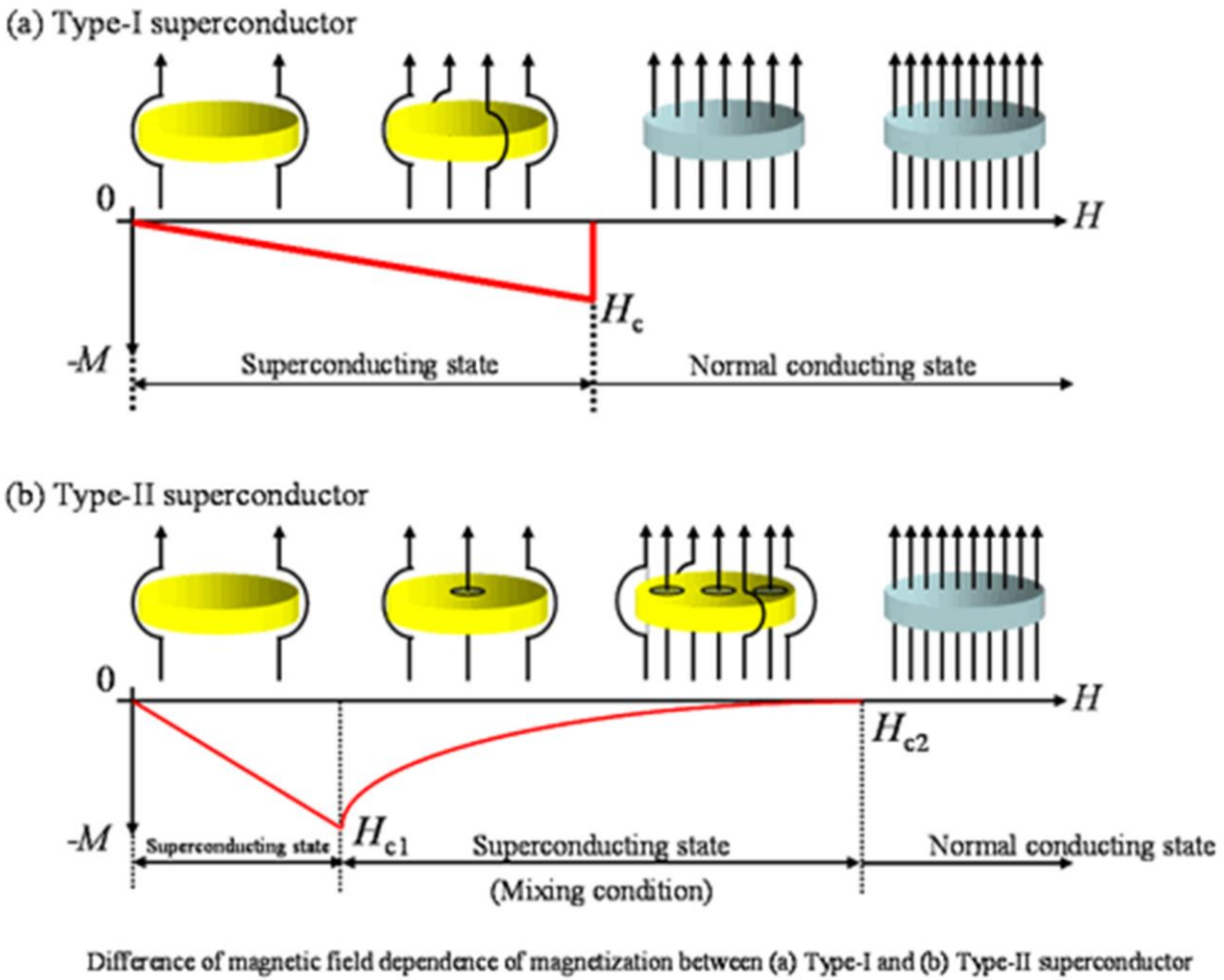
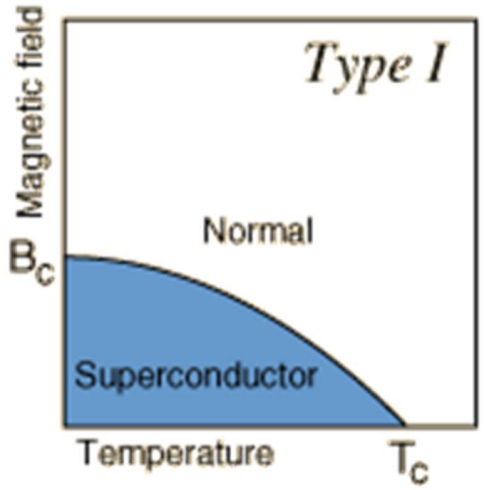
TYPE I AND TYPE II SUPERCONDUCTORS

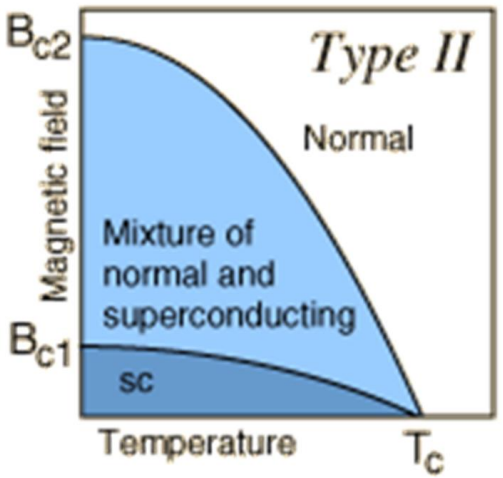
- Type I
  - Surface energy is positive
  - Perfect Diamagnetism
  - Superconductivity is lost above a Critical Field Hc
- Type II
  - Surface energy is negative
  - Magnetic fields can penetrate
  - Two critical fields (H_{c1} and H_{c2})
  - Below Hc1, behaves as Type I superconductor
  - Heigher critical magnetic field (H_{c2})
  - Superconductivity is lost above H_{c2}.

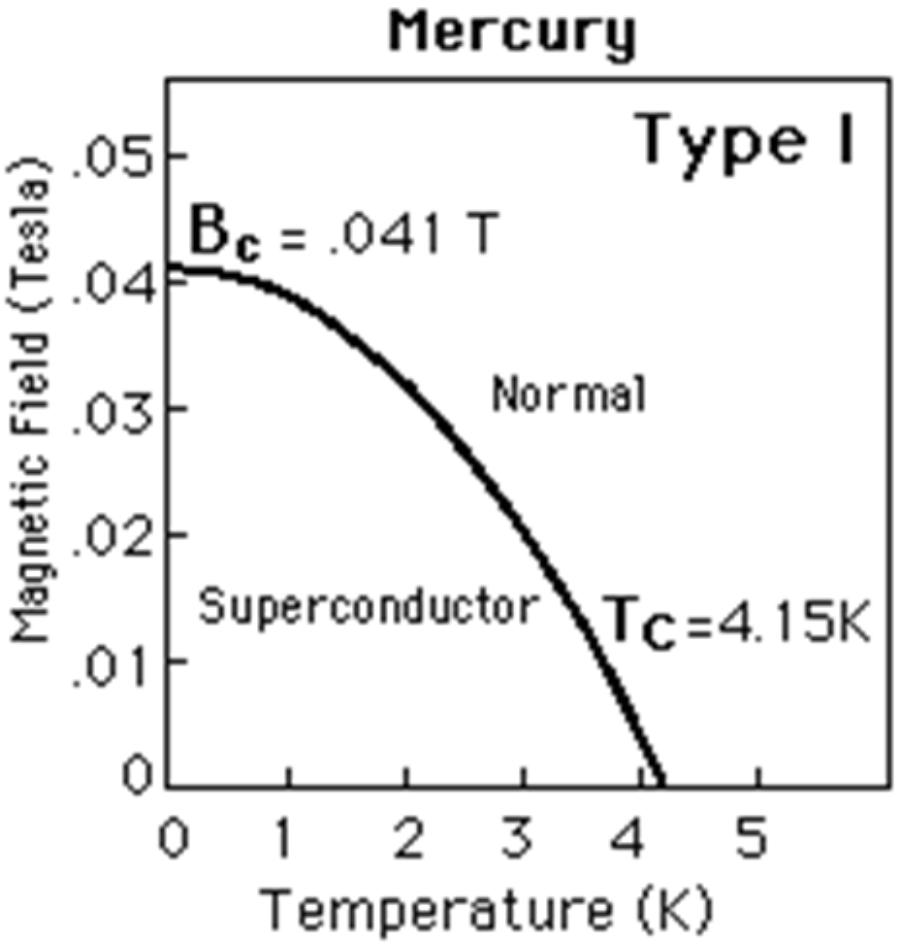


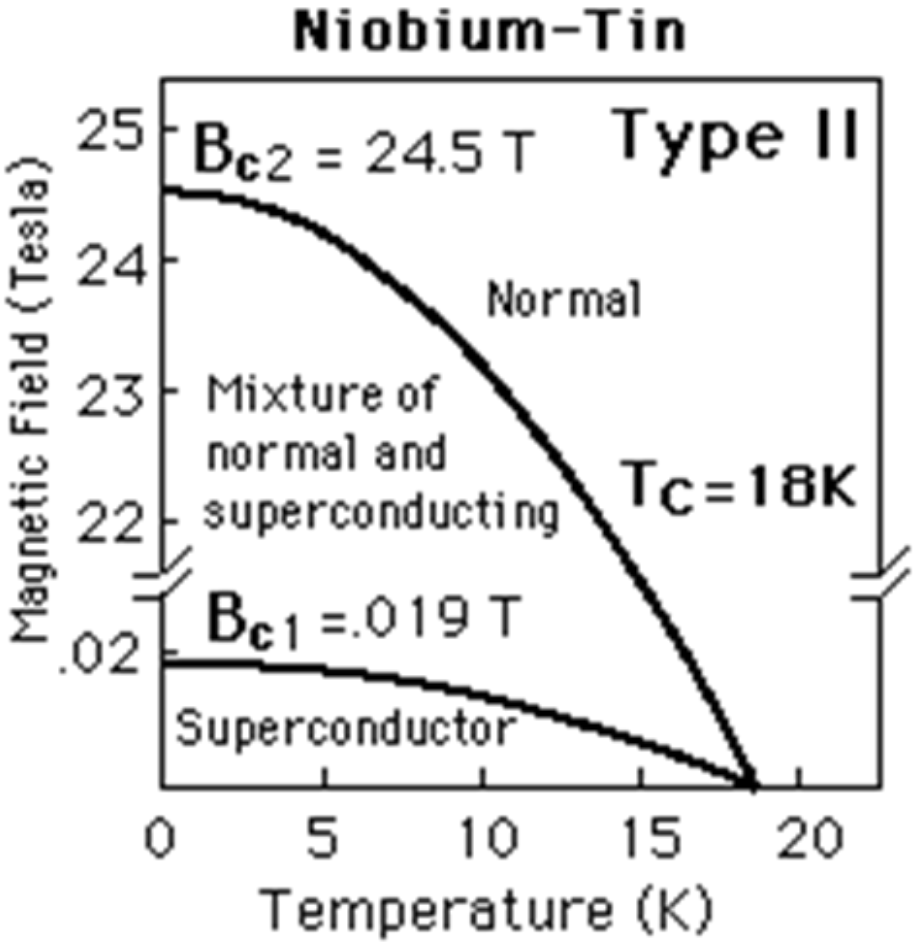
Difference of magnetic field dependence of magnetization between (a) Type-I and (b) Type-II superconductor

EXAMPLE OF 'TYPE I' AND 'TYPE II' SUPERCONDUCTORS



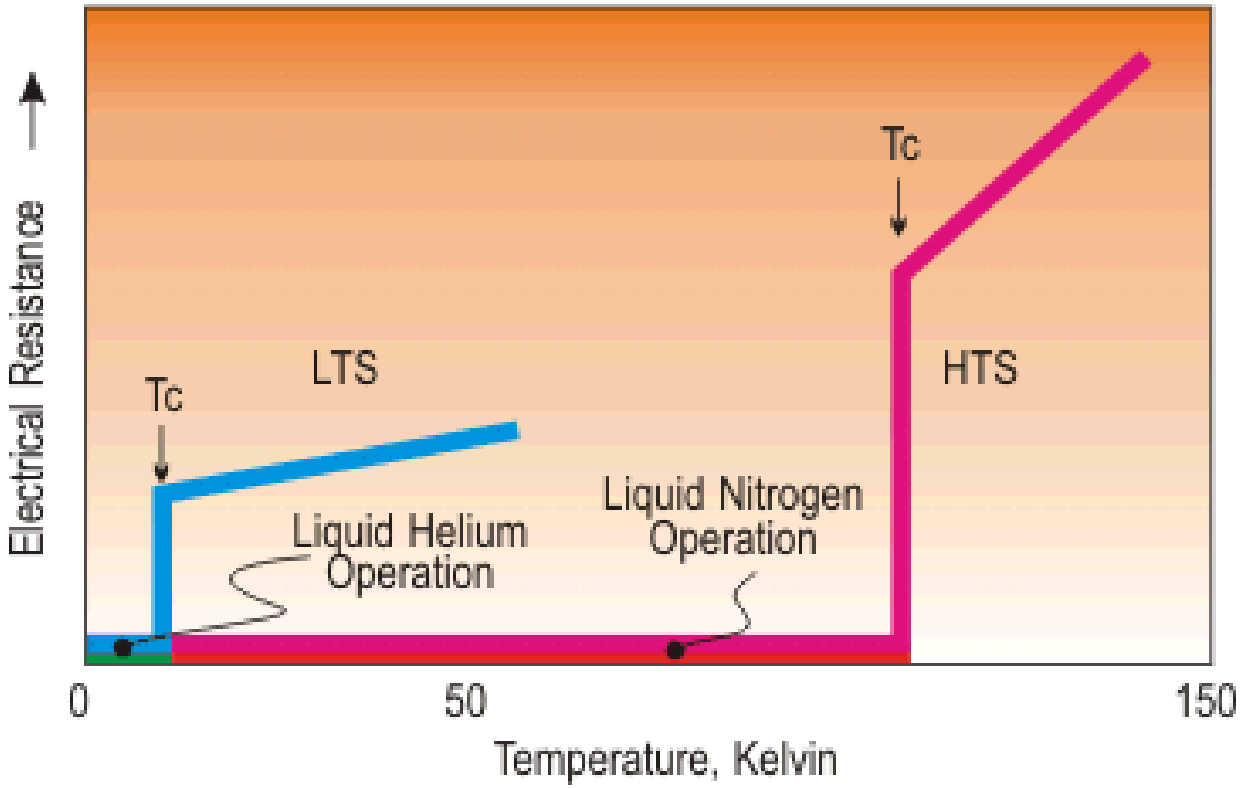




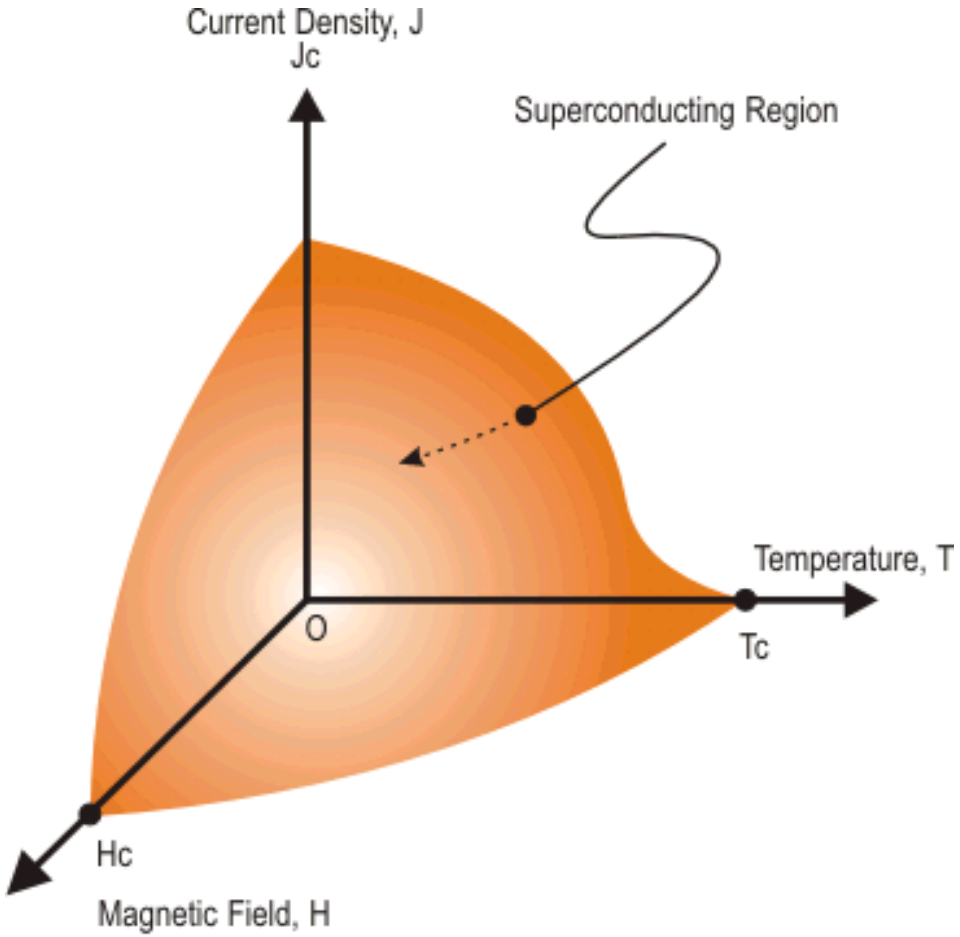


HIGH TEMPERATURE AND LOW TEMPERATURE SUPERCONDUCTORS

- LTS material (niobium-titanium alloy)
  - Liquid helium at 4.2 K
- HTS material (bismuth-based, copper oxide ceramic)
  - Liquid nitrogen at 77 K



CRITICAL SURFACE OF HTS AND LTS SUPERCONDUCTORS



LTS

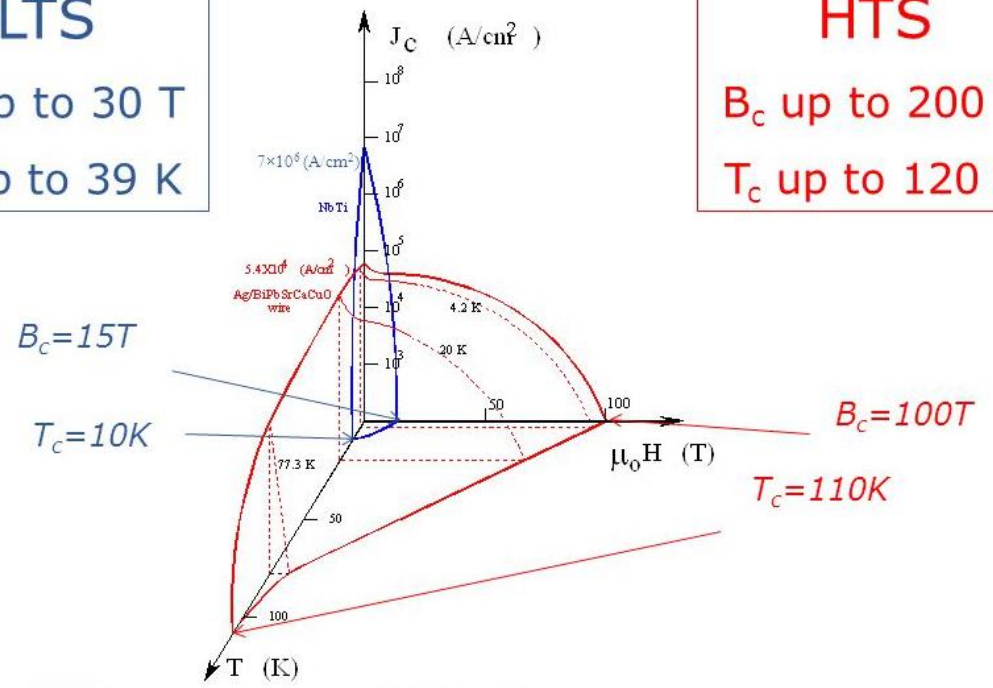
B_c up to 30 T

T_c up to 39 K

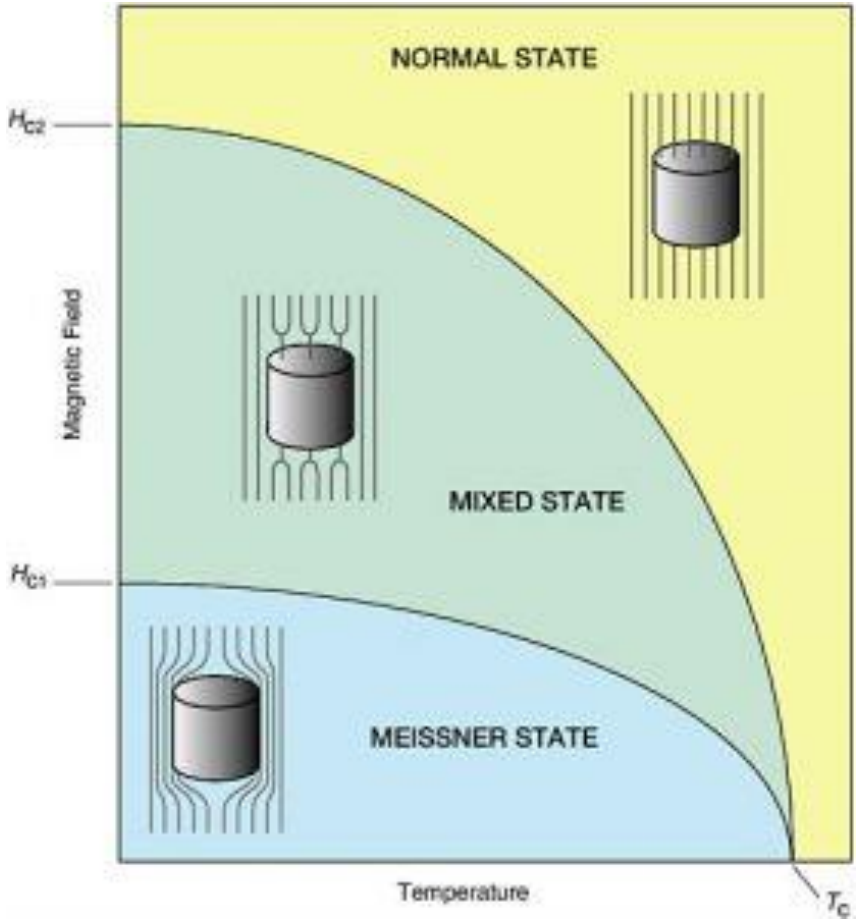
HTS

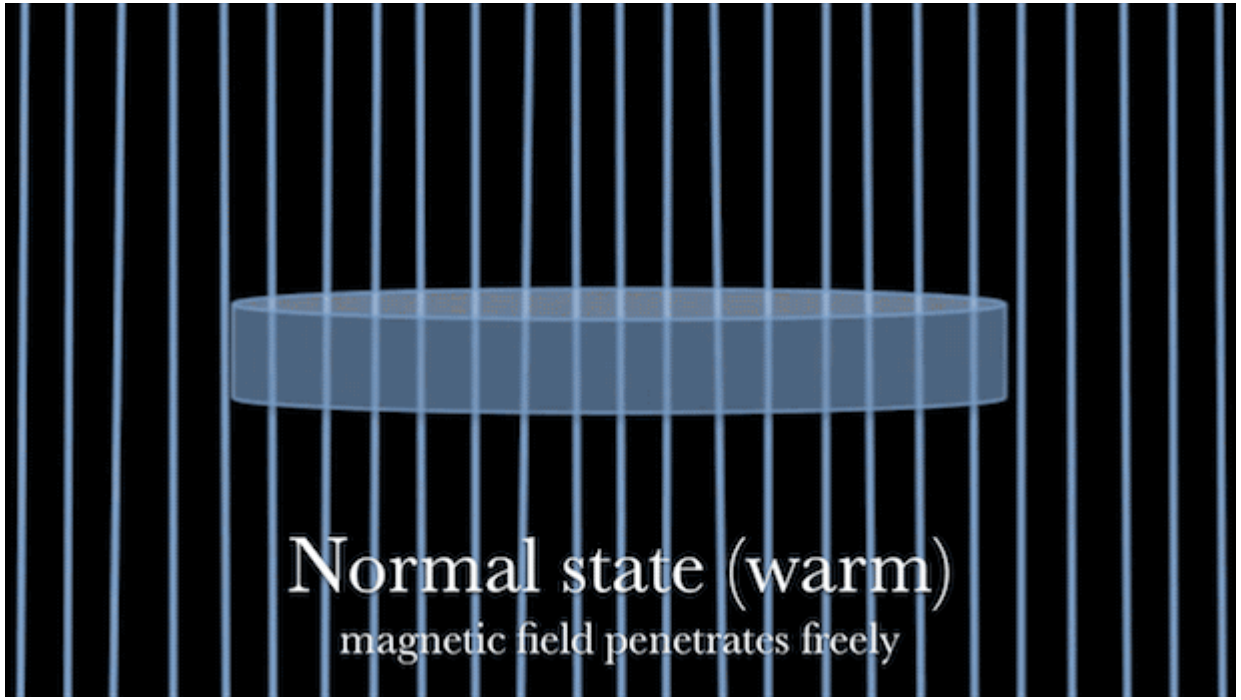
B_c up to 200 T

T_c up to 120 K



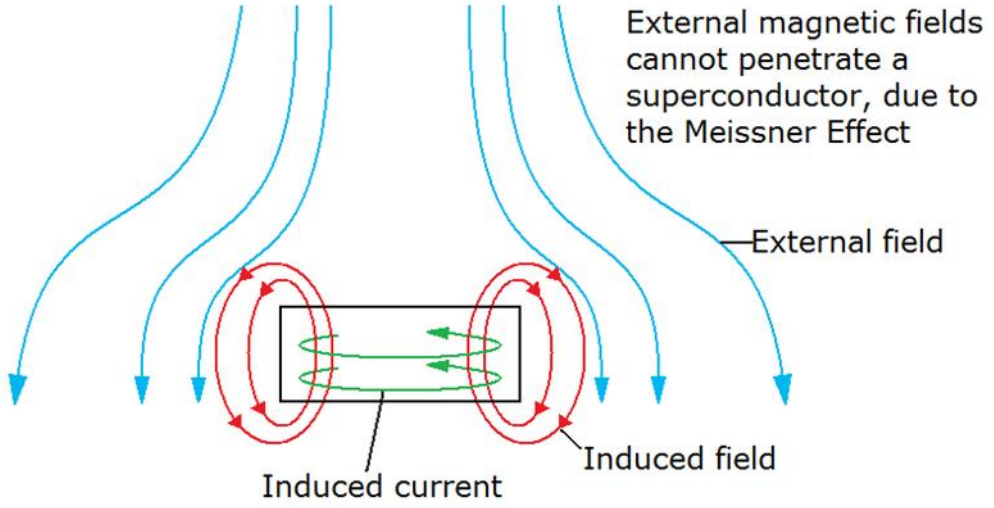
USE OF TYPE II SUPERCONDUCTOR FOR PRACTICAL WORK





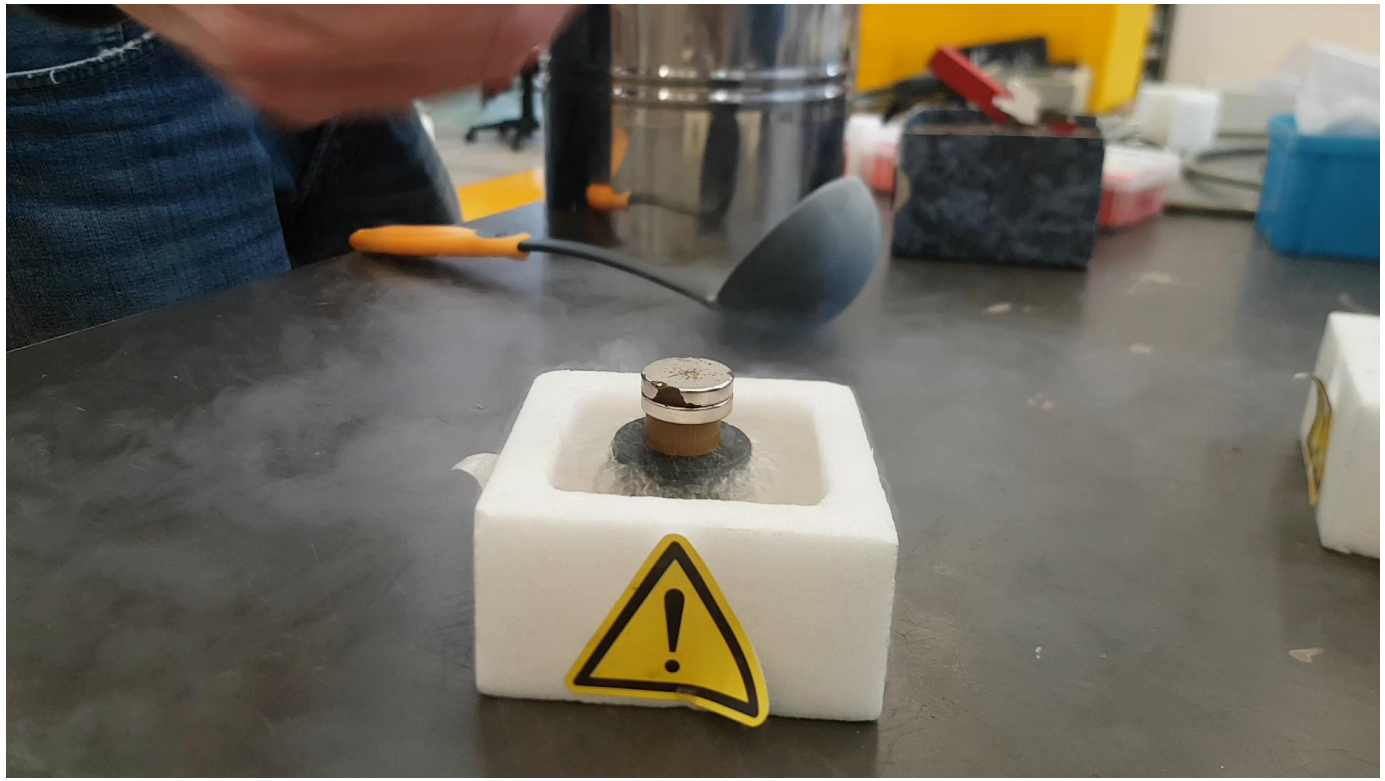
ACTIVITY 1: LEVITATION WITH ZERO FIELD COOLING

- Levitation with Zero Field Cooling
  - Repulsive force while bring magnet near (Meissner Effect)
  - Push the magnet hard, and the magnet is pinned to the SC surface



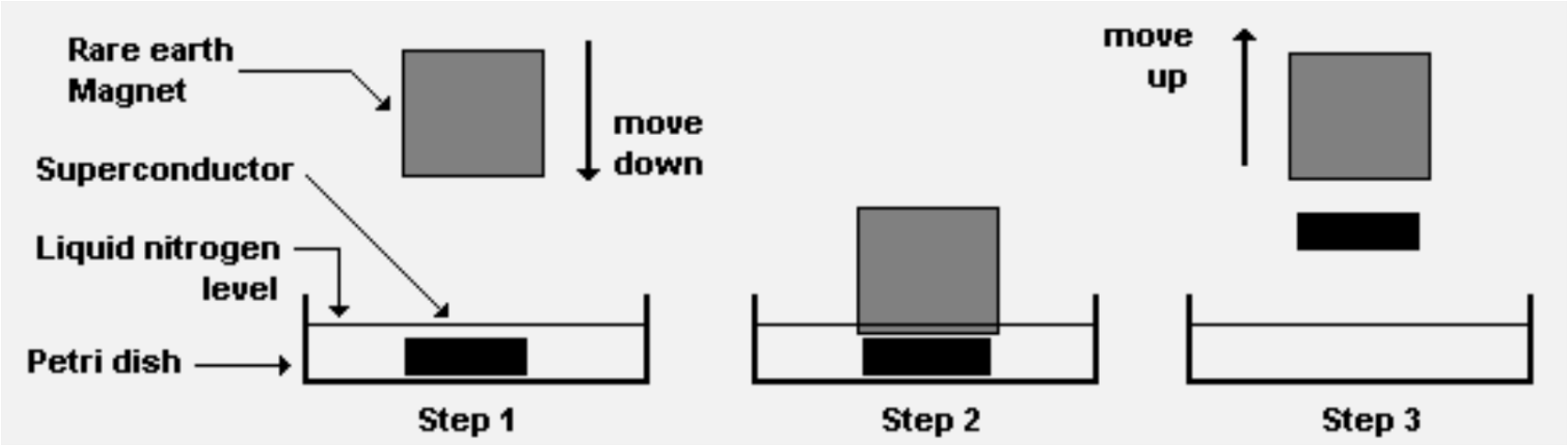
ACTIVITY 1: LEVITATION WITH FIELD COOLING

- Levitation with Field Cooling
  - Magnet is on-top of YBCO without interaction
  - Pour Liquid Nitrogen
  - Magnet is levitated



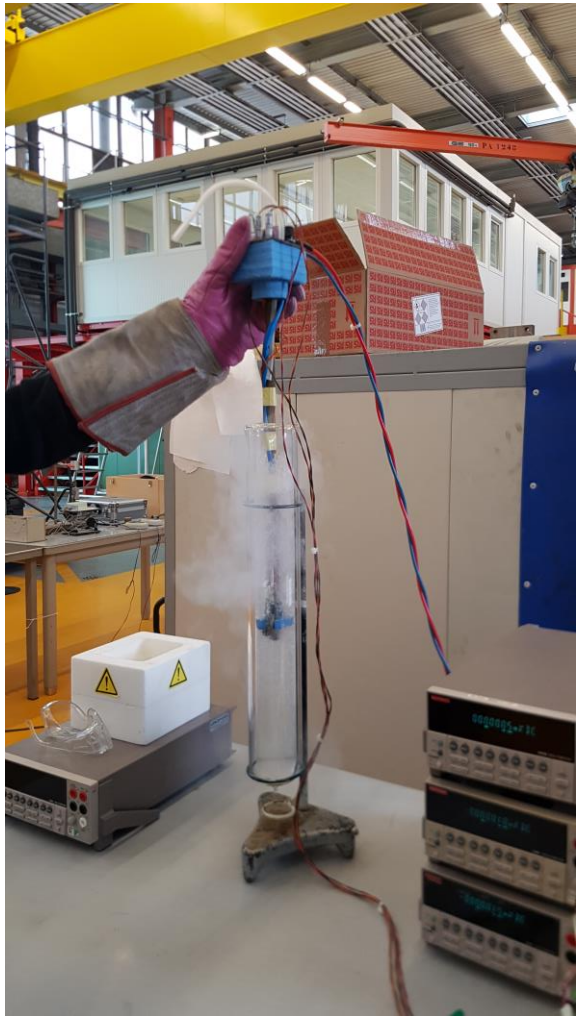
ACTIVITY 1: SUSPENSION

- Started with Field Cooling
- Slowly Magnet is lifted
- YBCO is suspended
- Suspension due to Flux pinning effect (Not Meissner Effect)



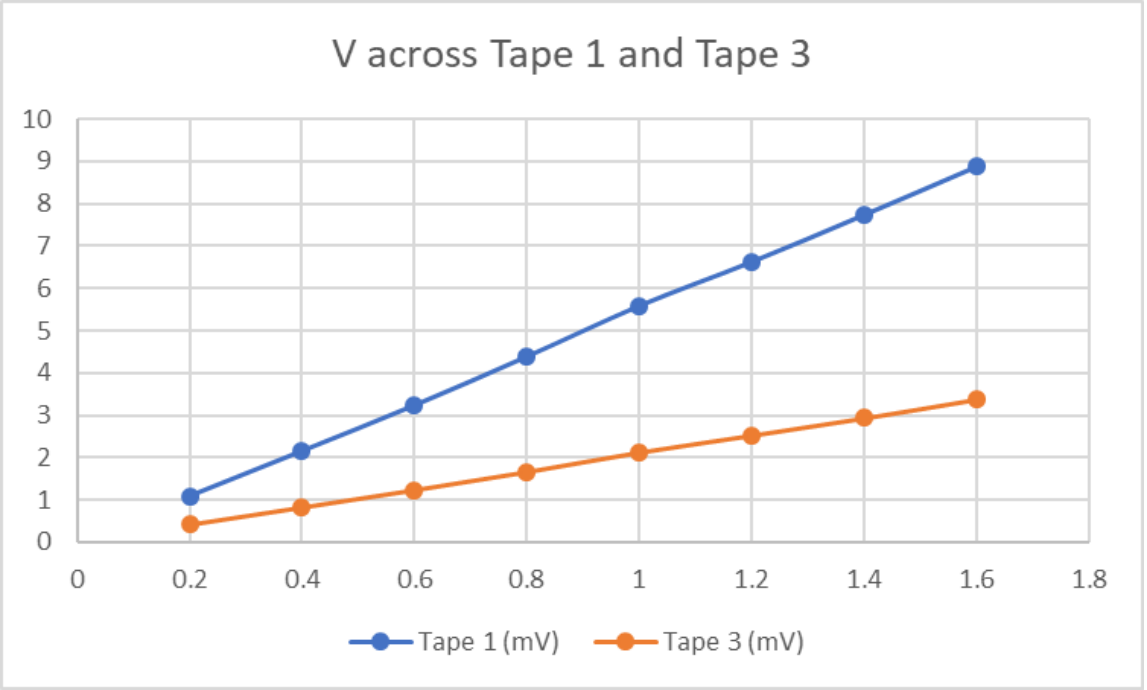
ACTIVITY 2: ELECTRICAL RESISTANCE OF A SUPERCONDUCTOR

- Tape 1, Tape 2, Tape 3
  - Copper tape
  - Stainless stell tape
  - BSCCO semiconductor tape



ACTIVITY 2: IDENTIFY WHICH IS THE SUPERCONDUCTING TAPE?

Temperature at 300 K			
	Voltage (mV)		
Current (A)	Tape 1 (mV)	Tape 2 (mV)	Tape 3 (mV)
0.2	1.084	25.91	0.411
0.4	2.15	51.34	0.82
0.6	3.23	77.35	1.23
0.8	4.38	104.85	1.66
1	5.58	134	2.12
1.2	6.62	159	2.52
1.4	7.73	186.5	2.93
1.6	8.87	215	3.37



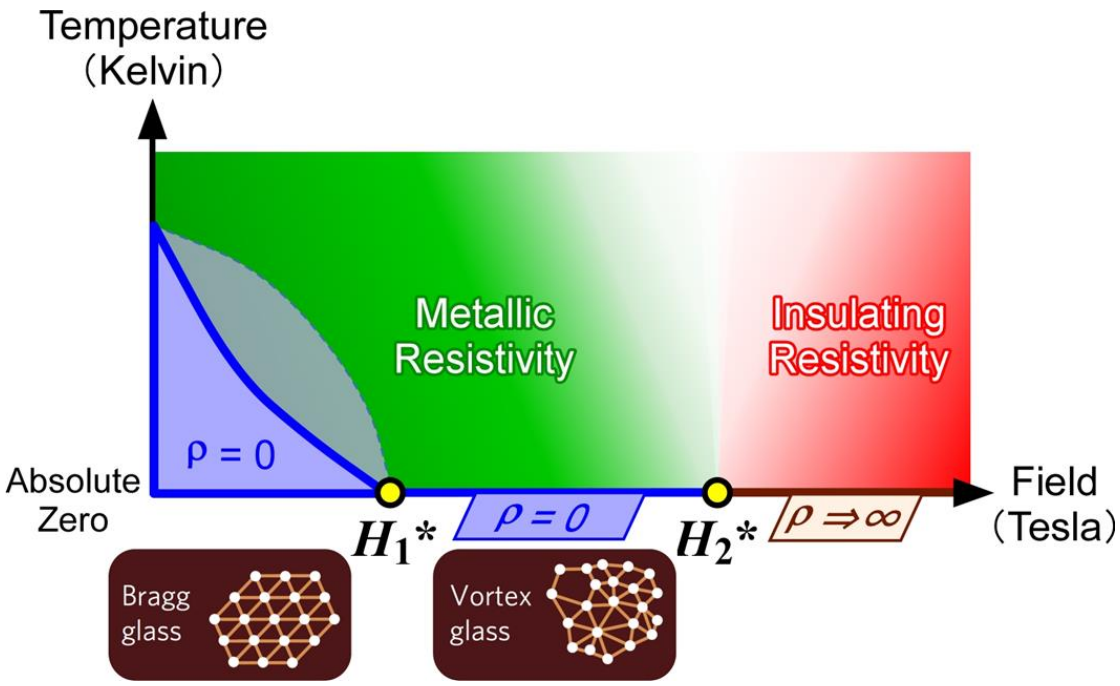
Stainless Steel S. C. Copper

First Assumption

ACTIVITY 2: 'TAPE 1' IS THE SUPERCONDUCTING TAPE

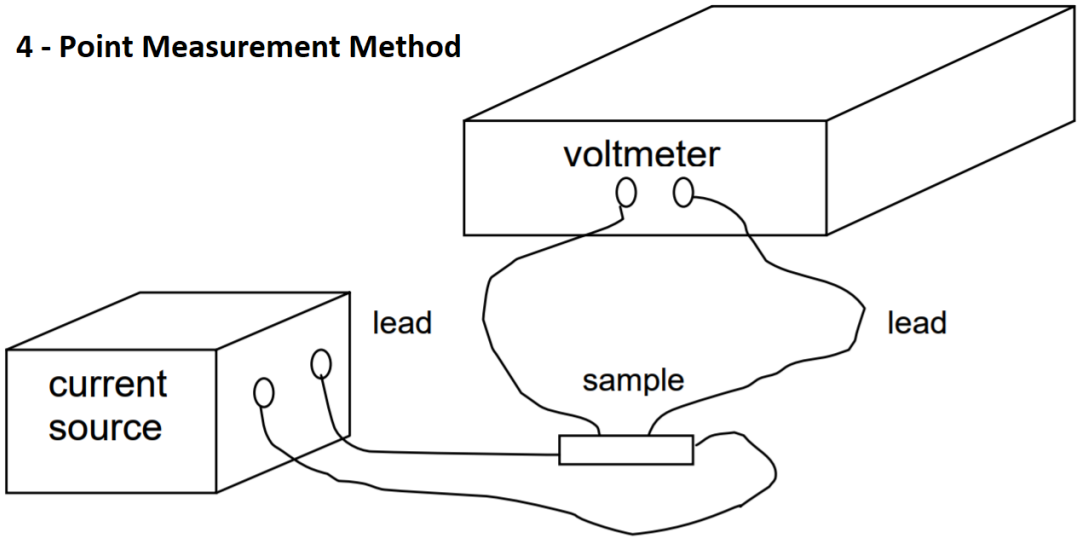
Temperature at 77 K			
	Voltage (mV)		
Current (A)	Tape 1 (mV)	Tape 2 (mV)	Tape 3 (mV)
0.2	0	97	0.266
0.4	0	198	0.534
0.6	0	300	0.812
0.8	0	398	1.07
1	0	496	1.33
1.2	0	596	1.6
1.4	0	696	1.87

Therefore, Tape 1 is the Superconducting Tape



Superconductor has metallic resistive above critical temperature

ACTIVITY 3: CRITICAL CURRENT MEASUREMENT



ACTIVITY 3: CRITICAL CURRENT MEASUREMENT