Magnetic Field and Order Parameter Profiles in Type-I and Type-II Superconductors

Type-I

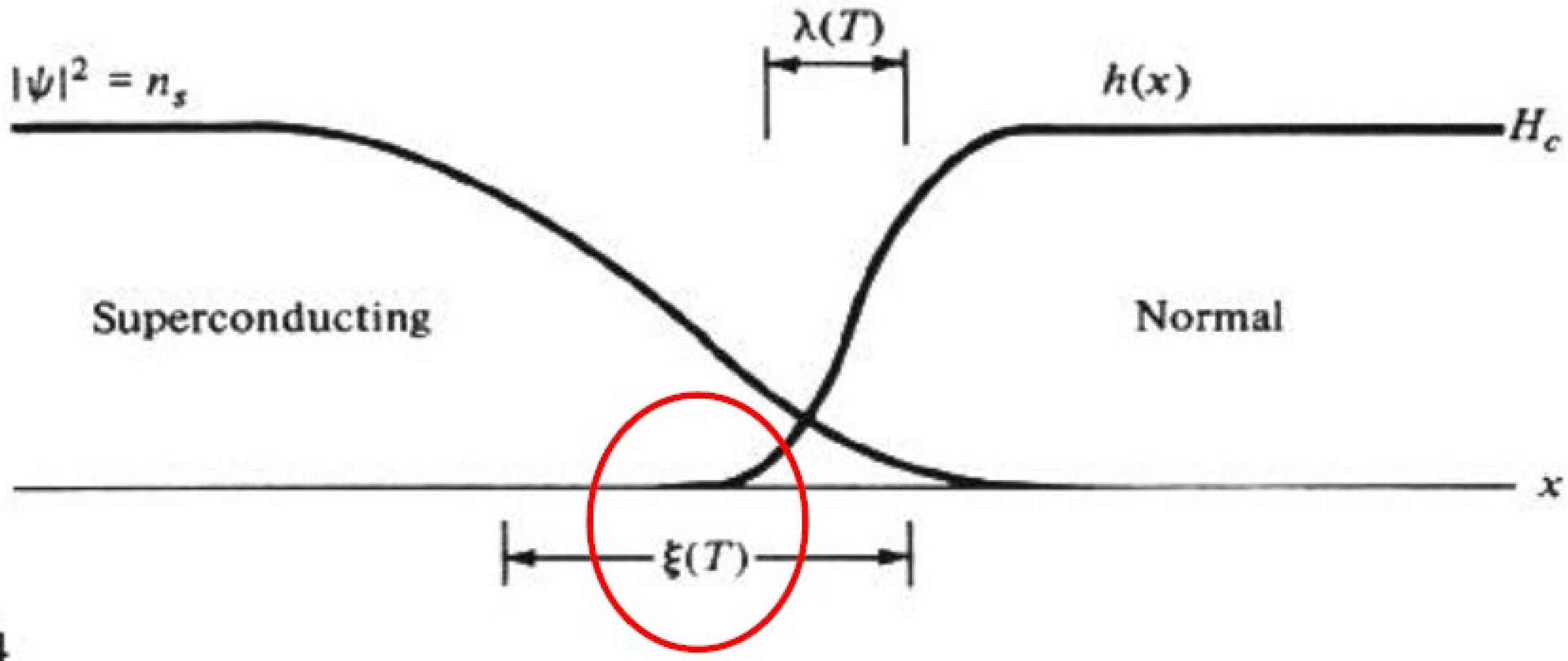


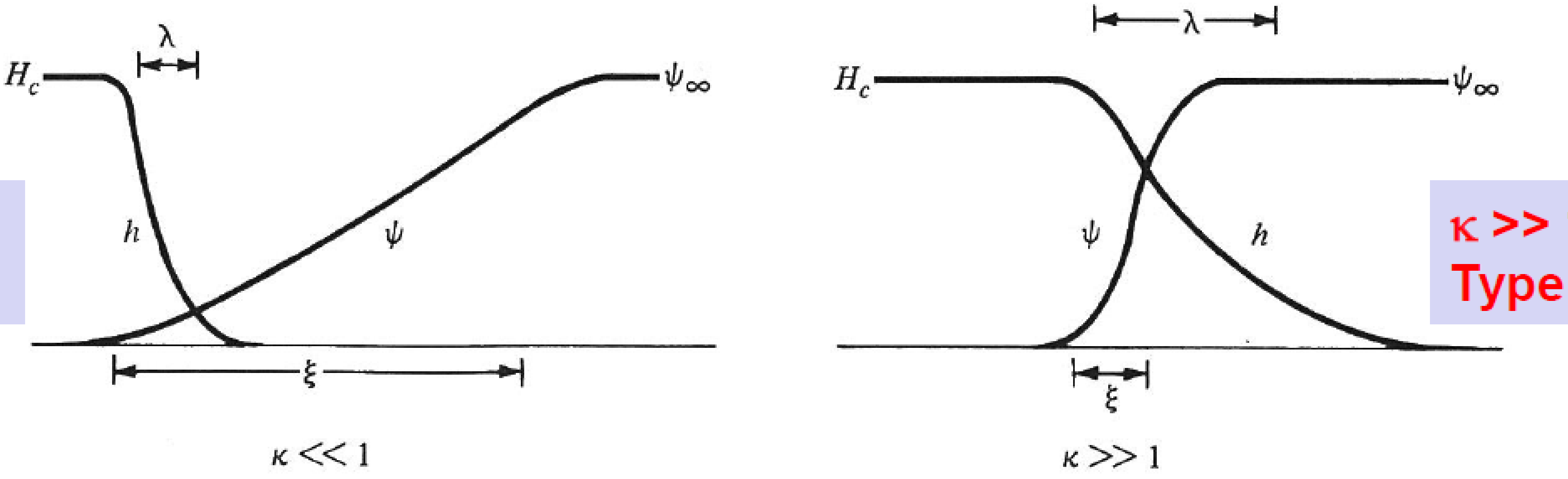
FIGURE 1-4
Interface between superconducting and normal domains in the intermediate state.

From: http://www.phys.nthu.edu.tw/~spin/course/104S/Ch12-2-revised-2.pdf

Ginsburg Landau Parameter
Tinkham, eq. (4-27)

$$\kappa = \frac{\lambda_{eff}(T)}{\xi(T)} = \frac{2\sqrt{2}\,\pi H_c(T)\lambda_{eff}^2(T)}{\Phi_0}$$

κ << 1
Type I



κ >> 1
Type II

FIGURE 4-2
Schematic diagram of variation of h and ψ in a domain wall. The case $\kappa \ll 1$ refers to a type I superconductor (positive wall energy); the case $\kappa \gg 1$ refers to a type II superconductor (negative wall energy).

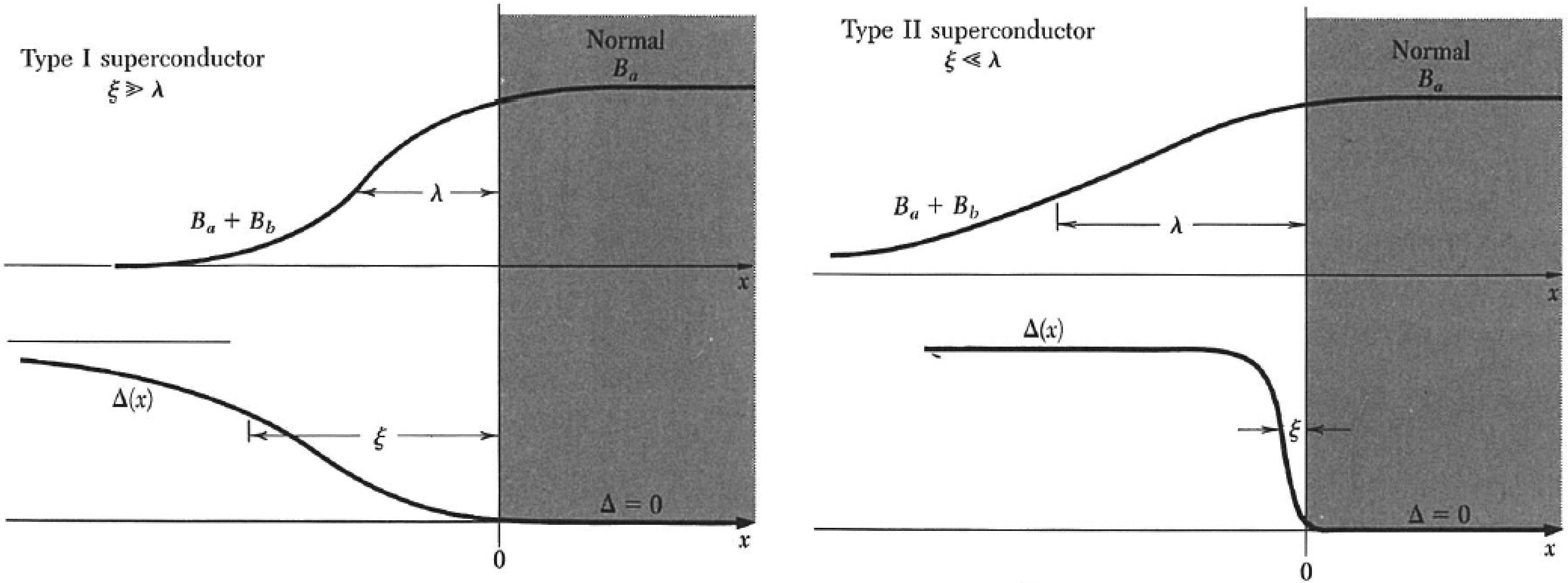


Figure 18 Variation of the magnetic field and energy gap parameter $\Delta(x)$ at the interface of superconducting and normal regions, for type I and type II superconductors. The energy gap parameter is a measure of the stabilization energy density of the superconducting state.

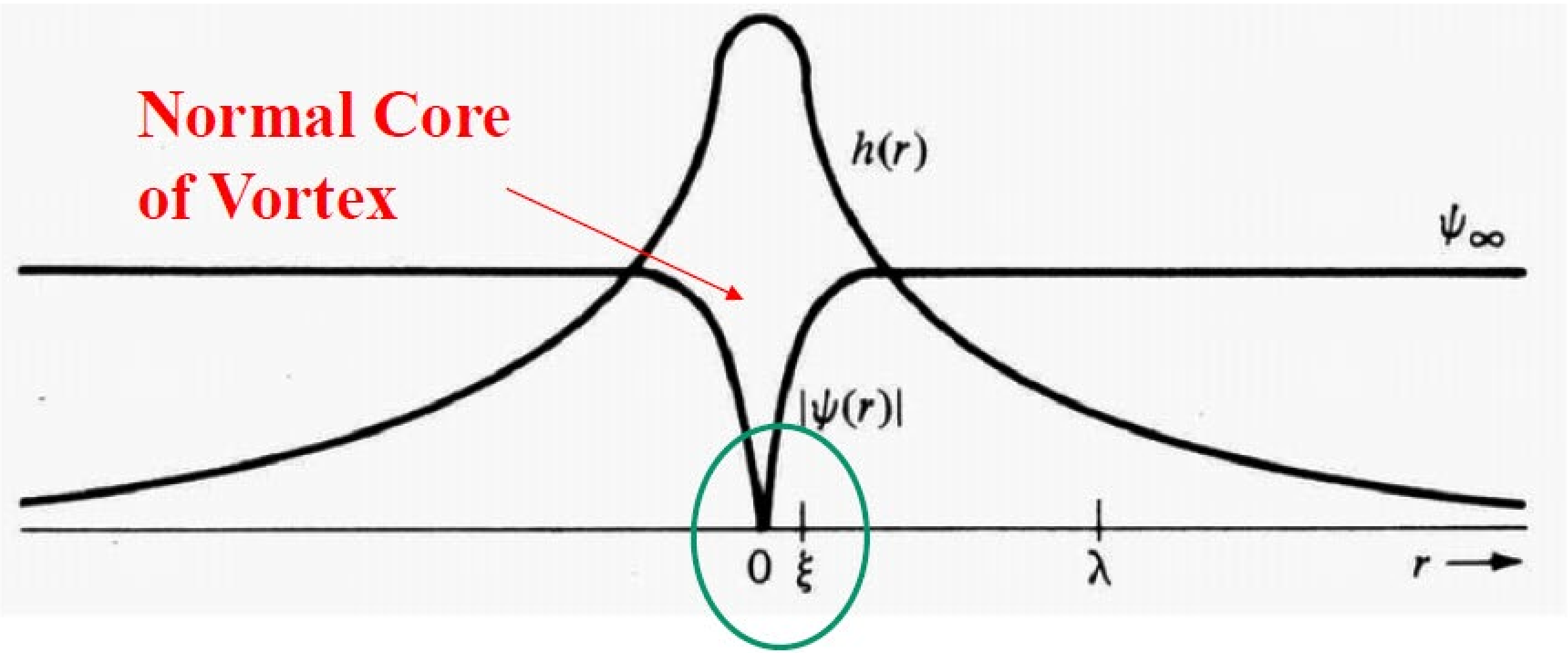
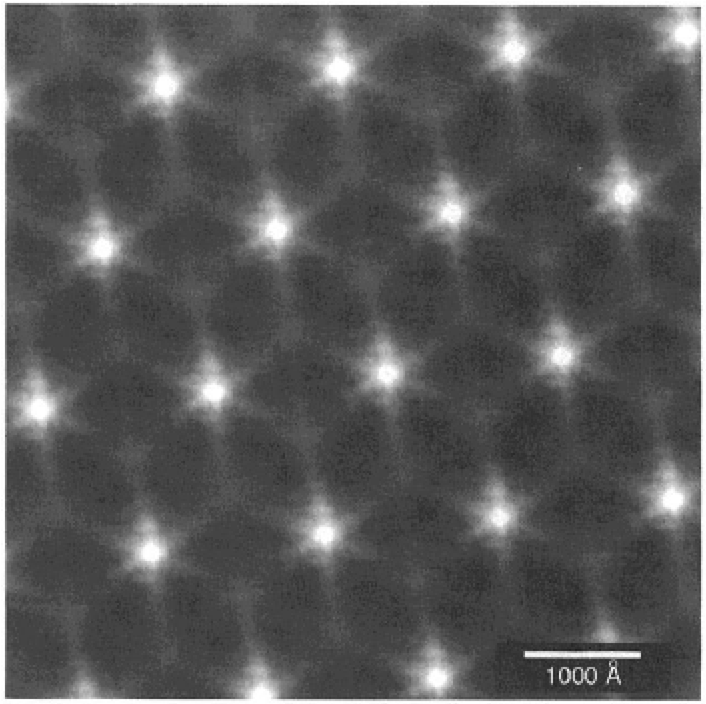


FIGURE 5-1
Structure of an isolated Abrikosov vortex in a material with $\kappa \approx 8$. The maximum value of $h(r)$ is approximately $2H_{c1}$.

Flux lattice
at 0.2K of $NbSe_2$



Abrikosov triangular
Lattice, as imaged by
LT-STM, H. Hess et al

Figure 19 Flux lattice in $NbSe_2$ at 1,000 gauss at 0.2K, as viewed with a scanning tunneling microscope. The photo shows the density of states at the Fermi level, as in Figure 23. The vortex cores have a high density of states and are shaded white; the superconducting regions are dark, with no states at the Fermi level. The amplitude and spatial extent of these states is determined by a potential well formed by $\Delta(x)$ as in Figure 18 for a Type II superconductor. The potential well confines the core state wavefunctions in the image here. The star shape is a finer feature, a result special to $NbSe_2$ of the sixfold disturbance of the charge density at the Fermi surface. Photo courtesy of H. F. Hess, AT&T Bell Laboratories.