Spontaneous Symmetry Breaking

Part 2

- Ginzburg - Landau theory
- Correlation functions
- Higgs and Goldstone modes
- The Anderson - Higgs mechanism.

Ginzburg - Landau theory

The idea of the Landau theory was to describe a phase transition by means of a free energy $f(m)$ which depends on the magnetization m and is such that its minima correspond to the equilibrium configurations.

Ginzburg - Landau is the extension of this theory to include also the possibility that m depends on the position $\vec{r}$:

$$m \longrightarrow m(\vec{r}) \qquad (1)$$

The idea is to keep this at a phenomenological level. We want to have an approximate expression for the Landau free energy which, in addition to the effects of the FM-PM transition, also contemplates the effects of inhomogeneities in $m(\vec{r})$.

We can make some progress by imposing some symmetries (and by being reasonable!). Intuitively, we want a term which increases the energy when the magnetization is inhomogeneous. This means this term must depend on derivatives of $m(\vec{r})$.