Problem Set 4

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PHYS2470

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Goldenfeld 7-1

Consider the Landau free energy

$$L = \int \mathrm{d}^d x \left\{ \frac{1}{2}(\nabla \phi)^2 + \frac{1}{2} r_0 \phi^2 + \frac{u_n}{n!} \phi^n \right\}$$

a) Use the Ginzburg criterion or dimensional analysis to find the upper critical dimension.

b) Comment on the accuracy of the tricritical exponents which were calculated in exercise 5-2, as a function of dimension.

c) Show that higher powers of $\nabla \phi$ and higher derivatives of ϕ are negligible as $T \to T_c$.

Solution

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$$(i\not{\partial} - m)\underbrace{\psi(x)}_{=1} = 0 \tag{1}$$

See equation (1).