13.3 Quantum corrections to $\langle\phi\rangle$.

Consider the propagator at coincident points,

$$\langle\phi(0)^2\rangle = \lim_{x\to 0}\int \frac{d^d}{(2\pi)^d}\frac{\mathrm{e}^{-\mathrm{i}kx}}{k^2}\,. \tag{260}$$

Additionally to the usual UV divergence (which we may cure introducing a simple cutoff), the propagator of a massless field may have an IR divergence: The integral diverges for $k\to 0$, if $d\leq 2$. But $\langle\phi(0)^2\rangle\to\infty$ means that our classical field is not trapped in a minima. Thus SSB is only possible for $d>2$, a result called Coleman–Mermin-Wagner theorem.