Elementary Particles II   Problem Set #1   due 21/11/02

The Standard Model

1. Show explicitly that the transformation laws (1.6) and (1.9) guarantee local gauge invariance of a fermionic kinetic term, $i\overline{\Psi}\gamma^\mu D_\mu \Psi$.

2. Find the value of $\rho \equiv m_W^2/(m_Z^2 \cos^2\theta_W)$ for $SU(2)_{\mathrm{L}} \times U(1)_{\mathrm{Y}} \to U(1)_{\mathrm{EM}}$ breaking through the vacuum expectation value of a single scalar multiplet with quantum numbers (T, Y). (Here T denotes an $SU(2)$ representation of dimension $2T+1$, *e.g.* $T = 1/2$ for an SU(2) doublet.)