Figure 10.3: One-standard-deviation (39.35%) region in $M_W$ as a function of $m_t$ for the direct and indirect data, and the 90% CL region ($\Delta \chi^2 = 4.605$) allowed by all data. The SM prediction as a function of $M_H$ is also indicated. The widths of the $M_H$ bands reflect the theoretical uncertainty from $\alpha(M_Z)$.

they are equal to zero ($\rho_0 = 1$) exactly in the SM, and do not include any contributions from $m_t$ or $M_H$, which are treated separately. Our treatment differs from most of the original papers.

Many extensions of the SM are described by the $\rho_0$ parameter,

$$\rho_0 \equiv \frac{M_W^2}{(M_Z^2 \hat{c}_Z^2 \hat{s})},$$  

which describes new sources of SU(2) breaking that cannot be accounted for by the SM Higgs doublet or $m_t$ effects. In the presence of $\rho_0 \neq 1$, Eq. (10.52) generalizes Eq. (10.8b) while Eq. (10.8a) remains unchanged. Provided that the new physics which yields $\rho_0 \neq 1$ is a small perturbation which does not significantly affect the radiative corrections, $\rho_0$ can be regarded as a phenomenological parameter which multiplies $G_F$ in Eqs. (10.12)–(10.14), (10.29), and $\Gamma_Z$ in Eq. (10.44). There are enough data to determine $\rho_0$, $M_H$, $m_t$, and $\alpha_s$, simultaneously. From the global fit,