τ-DECAY PARAMETERS

Neglecting radiative corrections and terms proportional to m_ℓ^2/m_τ^2, the energy spectrum of the charged decay lepton ℓ in the τ rest frame is given by

$$\frac{d^2\Gamma_{\tau\to\ell\nu\overline{\nu}}}{d\Omega\,dx} \propto x^2$$
$$\times\left\{12(1-x) + \rho_\tau\left(\frac{32}{3}x-8\right) + 24\eta_\tau\,\frac{m_\ell}{m_\tau}\,\frac{(1-x)}{x}\right.$$
$$\left. -P_\tau\,\xi_\tau\cos\theta\left[4(1-x)+\delta_\tau\left(\frac{32}{3}x-8\right)\right]\right\}\ . \qquad (1)$$

Here $x = 2E_\ell/m_\tau$ is the scaled lepton energy, P_τ is the τ polarization, and θ is the angle between the τ spin and the lepton momentum. With unpolarized τ's or integrating over the full θ range, the spectrum depends only on ρ_τ and η_τ. Measurements of the other two Michel parameters, ξ_τ and δ_τ, require polarized τ's. The Standard Model predicitions for ρ_τ, η_τ, ξ_τ and δ_τ are $\frac{3}{4}$, 0, 1 and $\frac{3}{4}$. Where possible, we give separately the parameters for $\tau^-\to e^-\nu_\tau\overline{\nu}_e$ and $\tau^-\to\mu^-\nu_\tau\overline{\nu}_\mu$, to avoid assumptions about universality. Listings labelled "(e or μ)" contain either the results assuming lepton universality if quoted by the experiments or repeat the results from the "e" or "μ" section.

Hadronic two-body decays $\tau\to\nu_\tau h$, $h=\pi$, ρ, a_1, …, can under minimal assumptions be written

$$\frac{1}{\Gamma}\,\frac{d\Gamma}{dz} = f_h(z) + P_\tau\,\xi_h\,g_h(z)\ , \qquad (2)$$

where the kinematic functions f_h, g_h and the definition of the variable z depend on the spin of the hadron h. For the simple case $h=\pi$, one has $z = E_\pi/E_\tau$, $f(z)=1$, and $g(z)=2z-1$. The parameter ξ_h is predicted to be unity and can be identified with twice the negative ν_τ helicity. Again ξ_h is listed, when available, separately for each hadron and averaged over all hadronic decays modes.