$\sigma$ and $R$ in $e^+e^-$ Collisions

![Graph showing $\sigma$ and $R$ vs. $\sqrt{s}$](image)

**Figure 49.5:** World data on the total cross section of $e^+e^-\rightarrow$ hadrons and the ratio $R(s) = \sigma(e^+e^-\rightarrow$ hadrons, $s)/\sigma(e^+e^-\rightarrow\mu^+\mu^-$, $s)$. $\sigma(e^+e^-\rightarrow$ hadrons, $s$) is the experimental cross section corrected for initial state radiation and electron-positron vertex loops, $\sigma(e^+e^-\rightarrow\mu^+\mu^-$, $s) = 4\pi\alpha^2(s)/3s$. Data errors are total below 2 GeV and statistical above 2 GeV. The curves are an educative guide: the broken one (green) is a naive quark-parton model prediction, and the solid one (red) is 3-loop pQCD prediction (see “Quantum Chromodynamics” section of this Review, Eq. (9.7) or, for more details, K. G. Chetyrkin et al., Nucl. Phys. B586, 56 (2000) (Erratum ibid. B634, 413 (2002)). Breit-Wigner parameterizations of $J/\psi$, $\psi(2S)$, and $\Upsilon(nS)$, $n = 1, 2, 3, 4$ are also shown. The full list of references to the original data and the details of the $R$ ratio extraction from them can be found in [arXiv:hep-ph/0312114]. Corresponding computer-readable data files are available at http://pdg.lbl.gov/current/xsect/. (Courtesy of the COMPAS (Protvino) and HEPDATA (Durham) Groups, May 2010.)