

NOTES

- [a] Theoretical value. A mass as large as a few MeV may not be precluded.
- [b] ℓ indicates each type of lepton (e , μ , and τ), not sum over them.
- [c] This represents the width for the decay of the W boson into a charged particle with momentum below detectability, $p < 200$ MeV.
- [d] The Z -boson mass listed here corresponds to a Breit-Wigner resonance parameter. It lies approximately 34 MeV above the real part of the position of the pole (in the energy-squared plane) in the Z -boson propagator.
- [e] This partial width takes into account Z decays into $\nu\bar{\nu}$ and any other possible undetected modes.
- [f] This ratio has not been corrected for the τ mass.
- [g] Here $A \equiv 2g_V g_A / (g_V^2 + g_A^2)$.
- [h] Here ℓ indicates e or μ .
- [i] The value is for the sum of the charge states or particle/antiparticle states indicated.
- [j] This value is updated using the product of (i) the $Z \rightarrow b\bar{b}$ fraction from this listing and (ii) the b -hadron fraction in an unbiased sample of weakly decaying b -hadrons produced in Z -decays provided by the Heavy Flavor Averaging Group (HFAG, <http://www.slac.stanford.edu/xorg/hfag/osc/PDG.2009/#FRACZ>).
- [k] See the Z Particle Listings for the γ energy range used in this measurement.
- [l] For $m_{\gamma\gamma} = (60 \pm 5)$ GeV.
- [n] The limits assume no invisible decays.