- $$M_V = \frac{M_V^{OS}}{\sqrt{1+\left(\frac{\Gamma_V^{OS}}{M_V^{OS}}\right)^2}} \qquad \Gamma_f = \frac{\Gamma_f^{OS}}{\sqrt{1+\left(\frac{\Gamma_f^{OS}}{M_V^{OS}}\right)^2}}$$
- $$\Gamma_f = \frac{N_c^f M_Z}{12\pi}\left[R_V^f F_V^f + R_A^f F_A^f\right]_{s=M_Z^2}$$
- R_V^f and R_A^f contain QCD and QED corrections:
  - QCD up to $\mathcal{O}(\alpha_s^4)$ and QED up to $\mathcal{O}(\alpha^2)$ for massless fermions
  - mass corrections up to $\mathcal{O}(\alpha_s^3)$
- F_V^f and F_A^f contain EW and mixed EW-QCD and EW-QED corrections
  - QCD up to $\mathcal{O}(\alpha_s^4)$ and QED up to $\mathcal{O}(\alpha^2)$ for massless fermions
  - mass corrections up to $\mathcal{O}(\alpha_s^3)$

- numerical impacts of higher order contributions

Γ_i [MeV]	Γ_e	Γ_ν	Γ_d	Γ_u	Γ_b	$\Gamma_{\rm Z}$
Born	81.142	160.096	371.141	292.445	369.562	2420.19
$\mathcal{O}(\alpha)$	2.273	6.174	9.717	5.799	3.857	60.22
$\mathcal{O}(\alpha\alpha_{\rm s})$	0.288	0.458	1.276	1.156	2.006	9.11
$\mathcal{O}(\alpha_{\rm t}\alpha_{\rm s}^2,\ \alpha_{\rm t}\alpha_{\rm s}^3,\ \alpha_{\rm t}^2\alpha_{\rm s},\ \alpha_{\rm t}^3)$	0.038	0.059	0.191	0.170	0.190	1.20
$\mathcal{O}(N_f^2\alpha^2)$	0.244	0.416	0.698	0.528	0.694	5.13
$\mathcal{O}(N_f\alpha^2)$	0.120	0.185	0.493	0.494	0.144	3.04
$\mathcal{O}(\alpha_{\rm bos}^2)$	0.017	0.019	0.059	0.058	0.167	0.51

Table 2: *Contributions of different orders in perturbation theory to the partial and total Z widths. A fixed value of $M_{\rm W}$ has been used as input, instead of G_μ. N_f and N_f^2 refer to corrections with one and two closed fermion loops, respectively, whereas $\alpha_{\rm bos}^2$ denotes contributions without closed fermion loops. Furthermore, $\alpha_{\rm t} = y_{\rm t}^2/(4\pi)$. In all rows the radiator functions $\mathcal{R}_{\rm V,A}$ with known contributions through $\mathcal{O}(\alpha_{\rm s}^4)$, $\mathcal{O}(\alpha^2)$ and $\mathcal{O}(\alpha\alpha_{\rm s})$ are included.*

- estimated theoretical uncertainties

$\Gamma_{e,\mu\,\tau}$	0.018 MeV	$\Gamma_{u,c}$	0.11 MeV	R_ℓ	$6 \cdot 10^{-3}$
Γ_ν	0.016 MeV	Γ_b	0.18 MeV	R_c	$5 \cdot 10^{-5}$
$\Gamma_{d,s}$	0.08 MeV	$\Gamma_{\rm Z}$	0.4 MeV	R_b	$1 \cdot 10^{-4}$

Table 6: *Theory uncertainty estimates for the partial and total Z widths and branching ratios from missing 3-loop and higher orders. See text for details.*