

# Rescaling LO SM

$$\sigma(gg \rightarrow h) = c^2 \sigma(gg \rightarrow h)_{SM}$$

$$\sigma(qq \rightarrow qqh) = a^2 \sigma(qq \rightarrow qqh)_{SM}$$

$$\sigma(qq\bar{q} \rightarrow Vh) = a^2 \sigma(qq\bar{q} \rightarrow Vh)_{SM}$$

$$\sigma(gg, qq\bar{q} \rightarrow t\bar{t}h) = c^2 \sigma(gg, qq\bar{q} \rightarrow t\bar{t}h)_{SM}$$

$$\Gamma(h \rightarrow VV) = a^2 \Gamma(h \rightarrow VV)_{SM}$$

$$\Gamma(h \rightarrow f\bar{f}) = c^2 \Gamma(h \rightarrow f\bar{f})_{SM}$$

$$\Gamma(h \rightarrow gg) = c^2 \Gamma(h \rightarrow gg)_{SM}$$

$$\Gamma(h \rightarrow \gamma\gamma) = \frac{|c A_f(m_h) + a A_W(m_h)|^2}{|A_f(m_h) + A_W(m_h)|^2} \Gamma(h \rightarrow \gamma\gamma)_{SM}$$

$$\Gamma(h \rightarrow Z\gamma) = \frac{|c B_f(m_h) - a B_W(m_h)|^2}{|B_f(m_h) + B_W(m_h)|^2} \Gamma(h \rightarrow Z\gamma)_{SM}$$

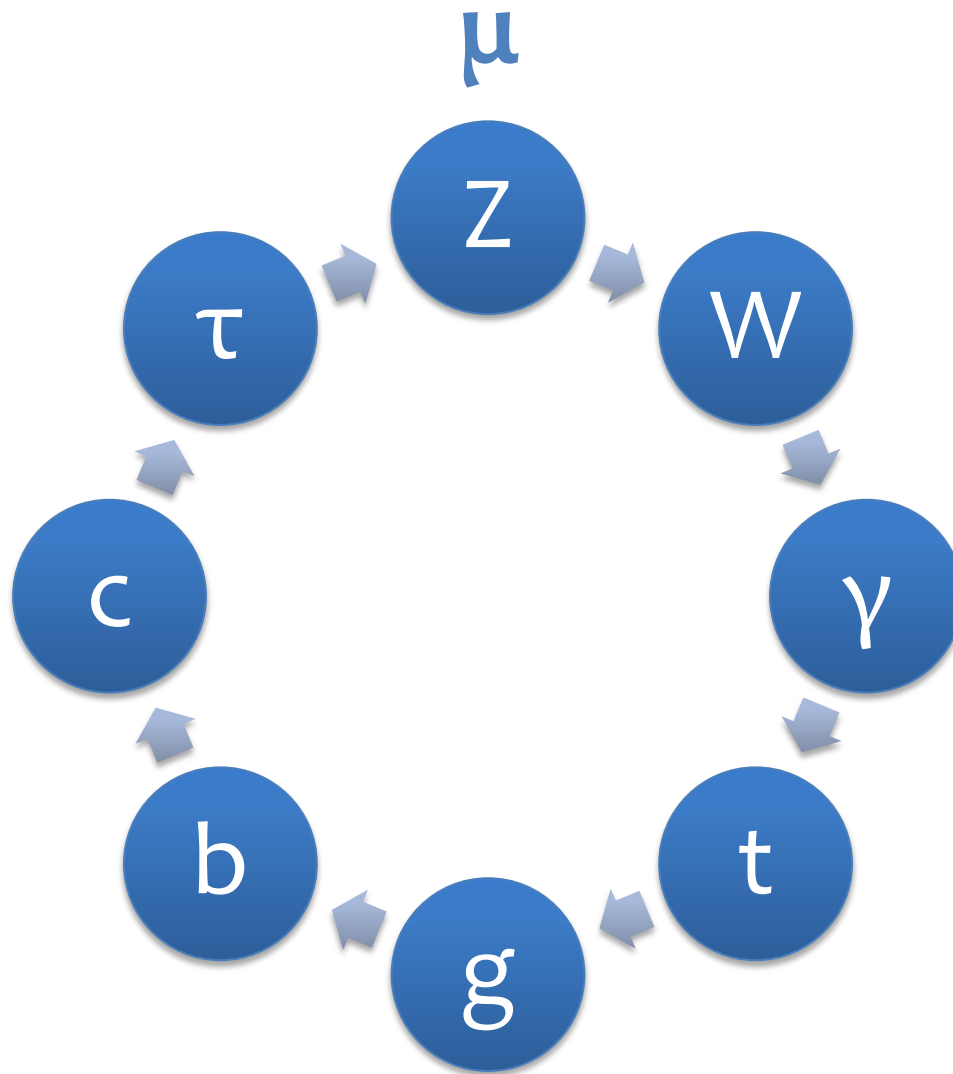
$m_h$ (GeV)	$A_f$	$A_W$	$B_f$	$B_W$
100	-1.81	7.72	0.635	-10.8
110	-1.82	7.93	0.638	-11.2
120	-1.83	8.19	0.641	-11.7
130	-1.84	8.53	0.644	-12.3
140	-1.85	9.01	0.648	-13.2
150	-1.86	9.76	0.652	-14.7
160	-1.87	12.40	0.657	-20.0

- $\Gamma_{tot} = \sum \Gamma_i(\text{rescaled})$  and  $BR_i = \Gamma_i / \Gamma_{tot}$ .

- Two ways forward:

1. Float couplings to W/Z ( $\mathbf{c} = \mathbf{C}_V$ ) and fermions ( $\mathbf{a} = \mathbf{C}_F$ ), **fix gluon and photon couplings from LO SM loops.**
2. Float couplings to W/Z ( $\mathbf{C}_V$ ), b,  $\tau$  ( $\mathbf{C}_b, \mathbf{C}_\tau$ ) as well as **(effective) couplings to gluons and photons ( $\mathbf{C}_\gamma, \mathbf{C}_g$ ).**

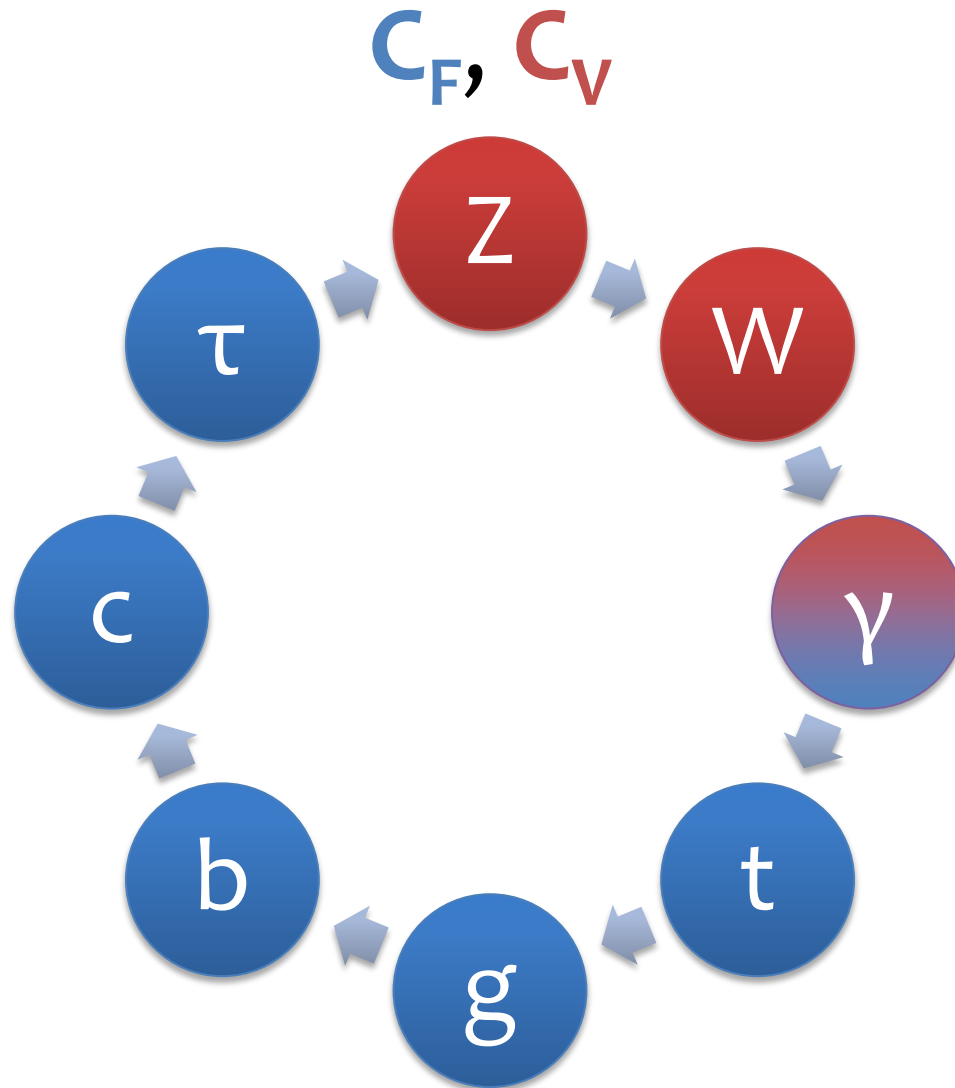
# One global scale (2011)





# **SM DECONSTRUCTION SCENARIOS**

# SM deconstruction 2



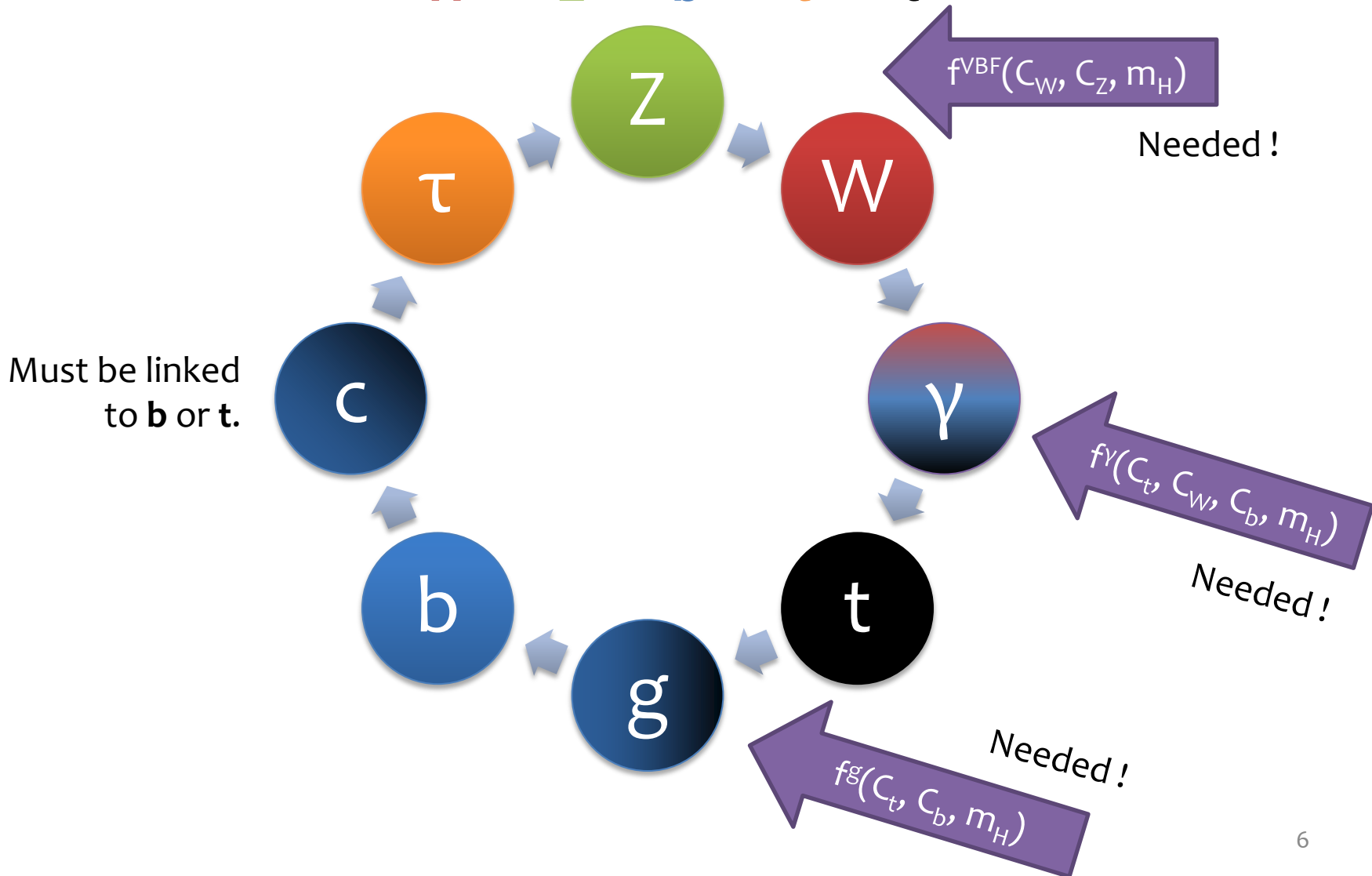
✓ Well-known!

$$\frac{|c A_f(m_h) + a A_W(m_h)|^2}{|A_f(m_h) + A_W(m_h)|^2}$$

$m_h$ (GeV)	$A_f$	$A_W$
100	-1.81	7.72
110	-1.82	7.93
120	-1.83	8.19
130	-1.84	8.53

# SM deconstruction 5

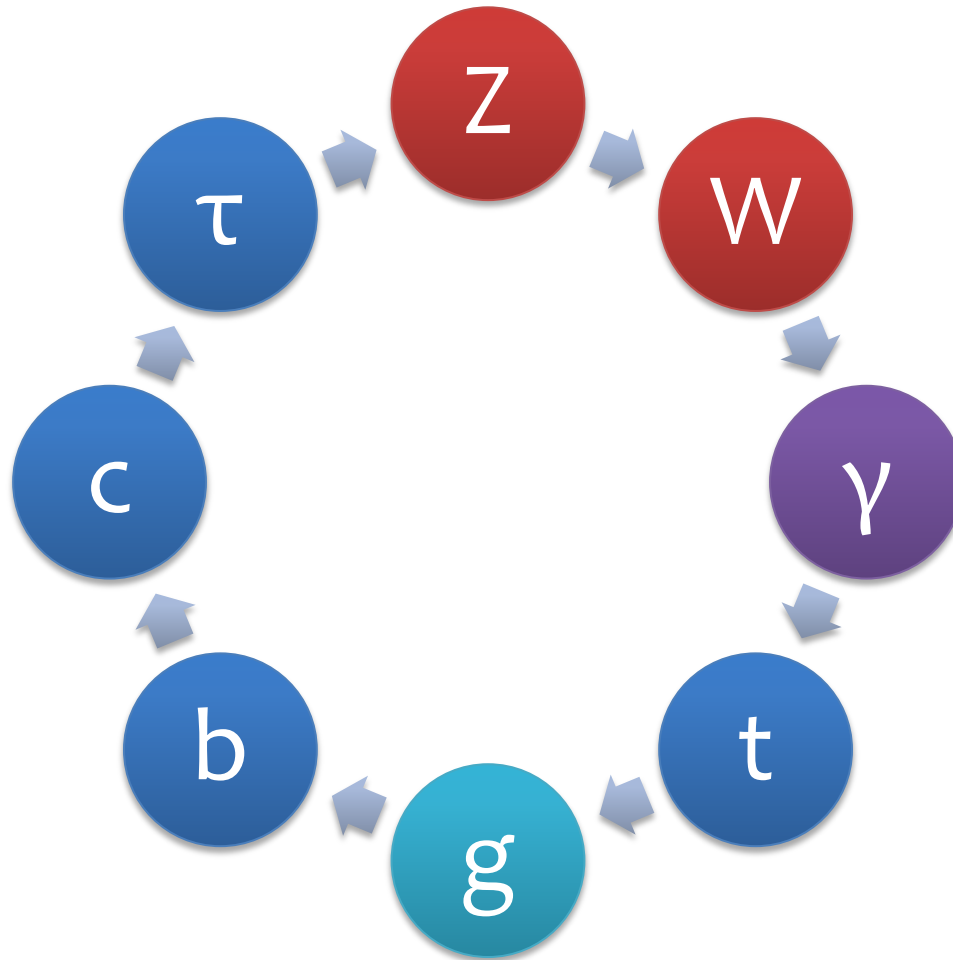
$C_W, C_Z, C_b, C_\tau, C_t$



# **FLOATING LOOPS SCENARIOS**

# Floating loops 2+2

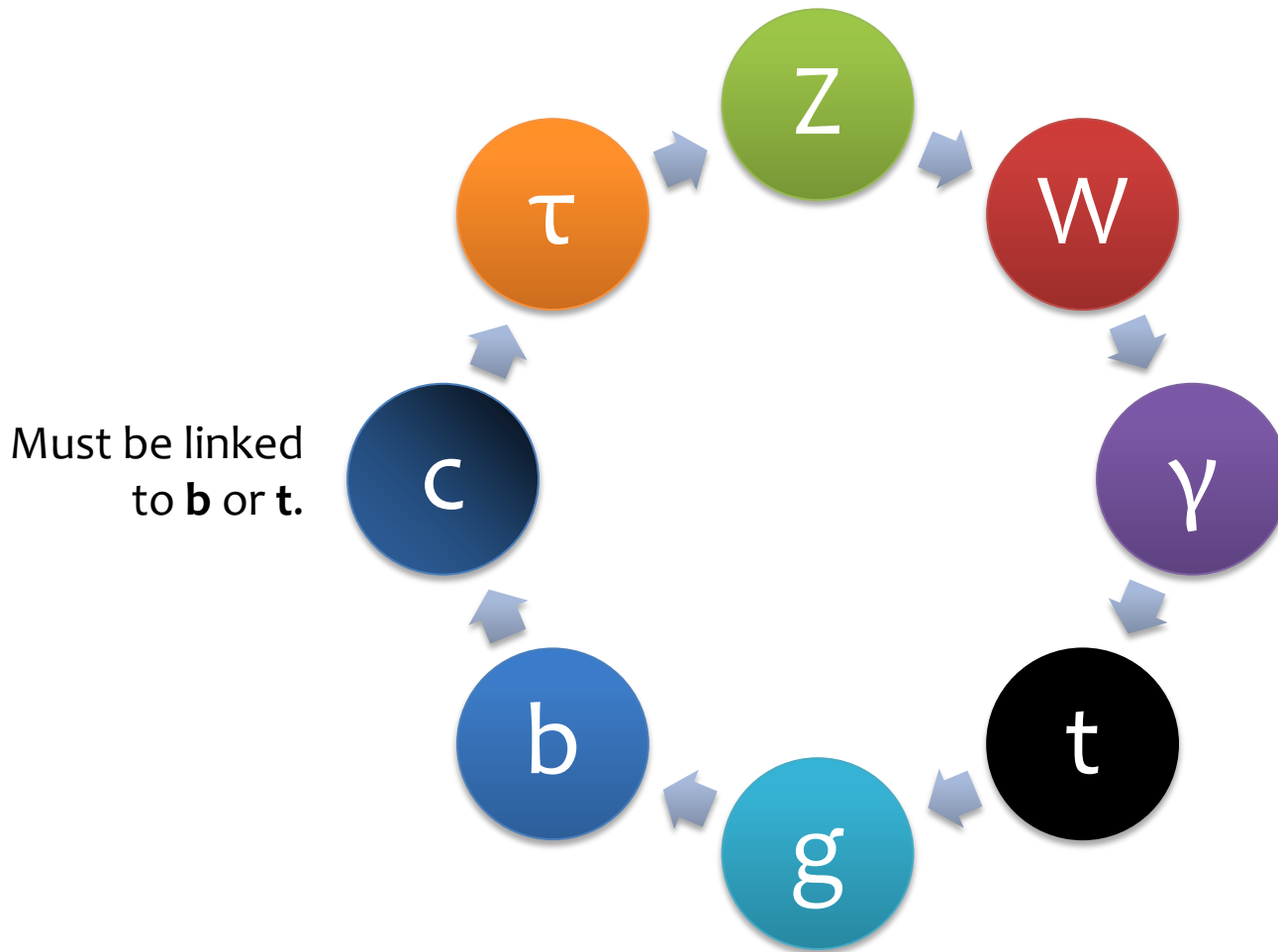
$$C_V, C_F + C_\gamma, C_g$$





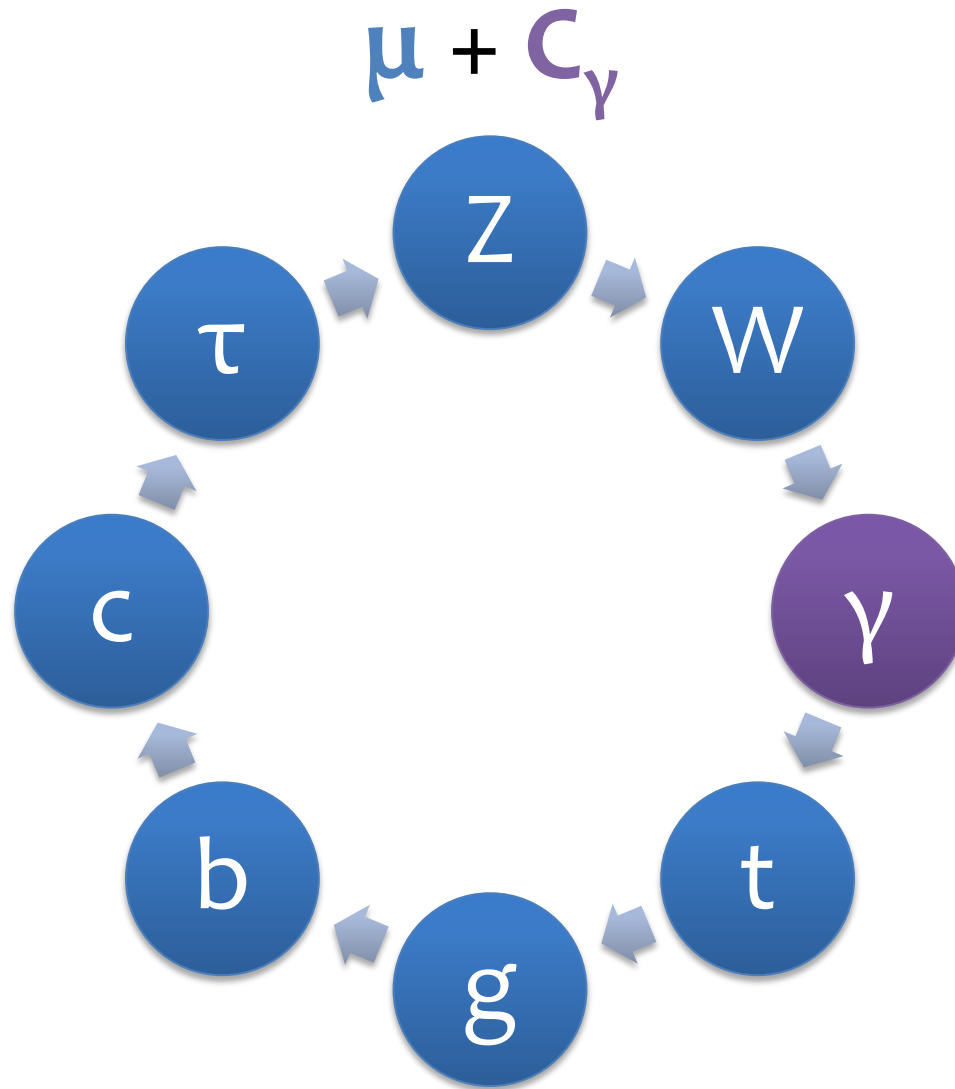
# Floating loops 5+2

$C_W, C_Z, C_b, C_\tau, C_t + C_\gamma, C_g$

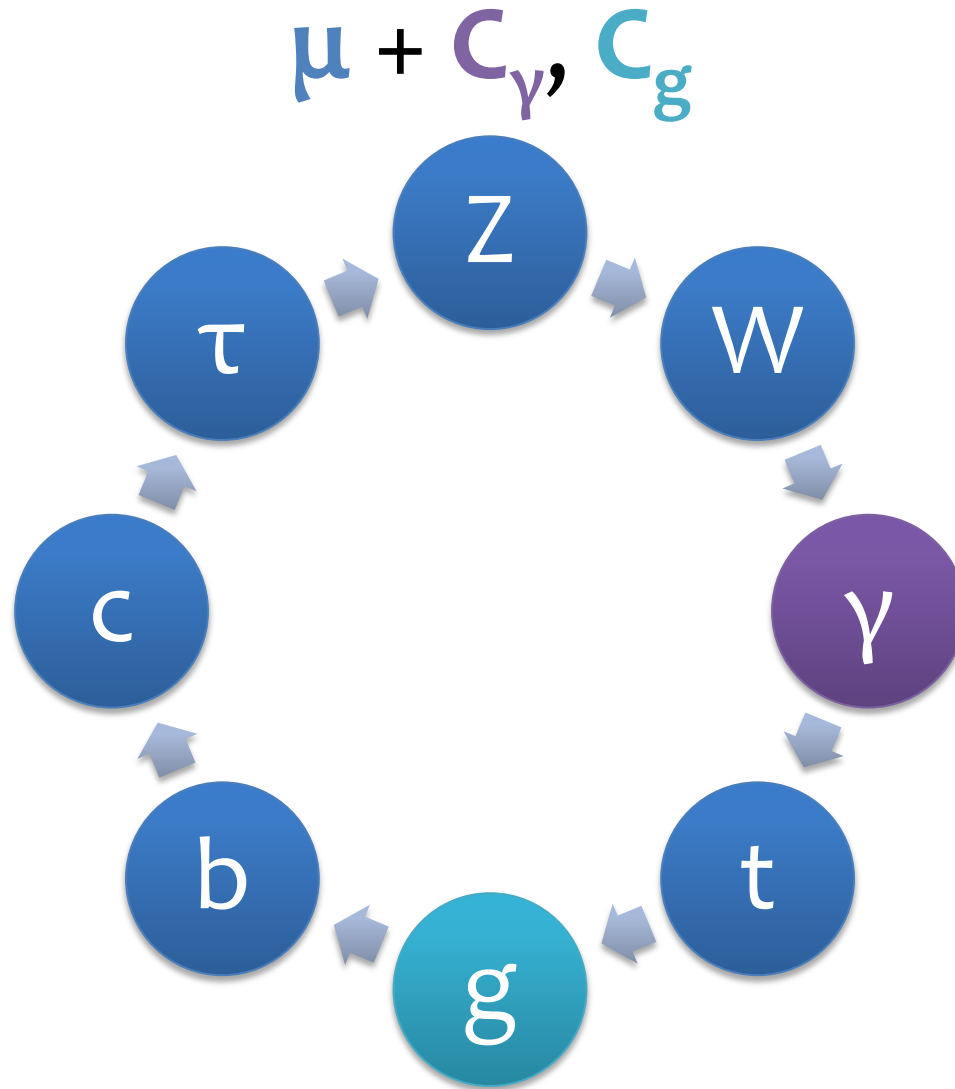


# **MISCELLANEOUS SCENARIOS**

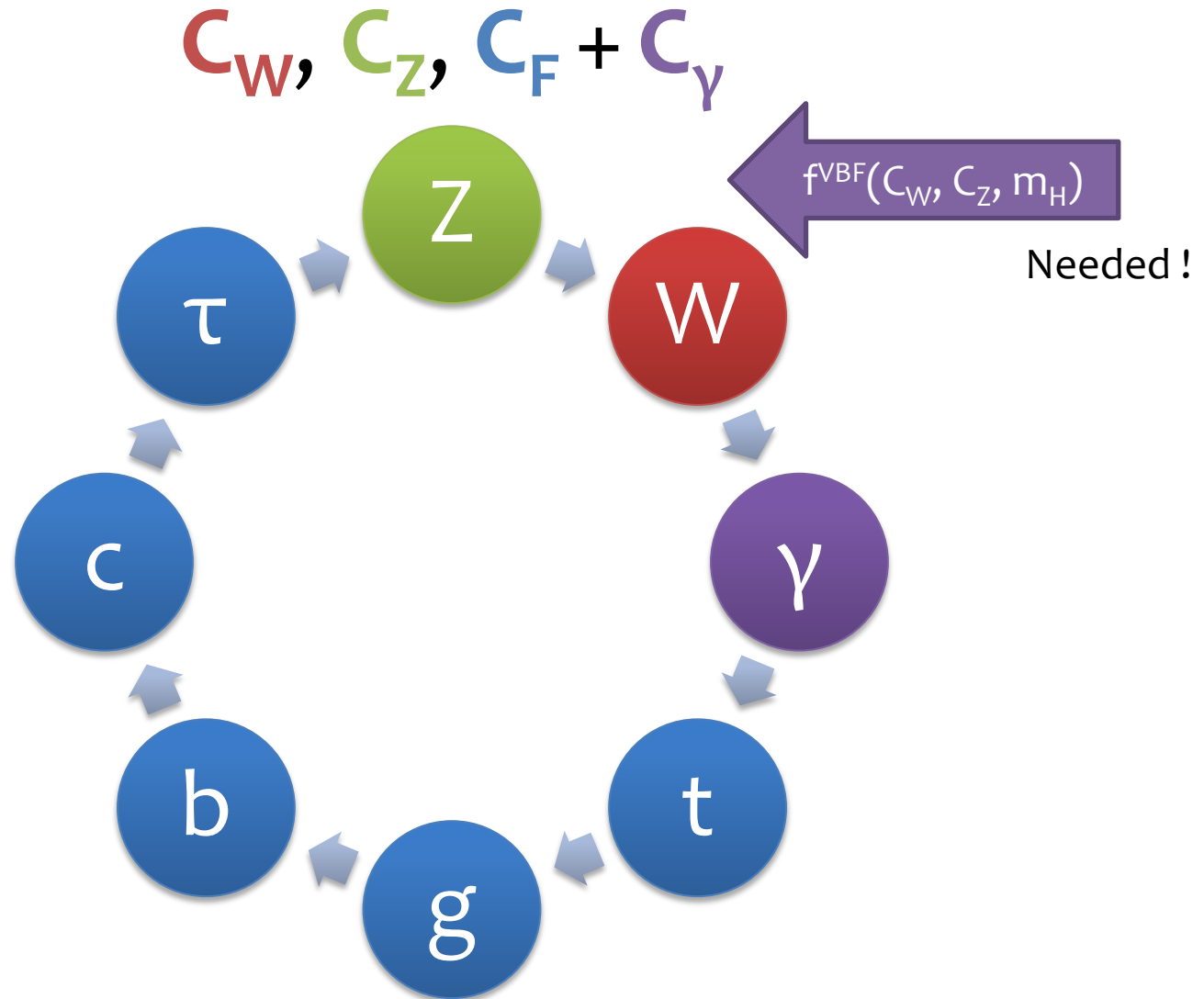
# A simple 2012 scenario 1+1



# A next-to-simple 1+2 scenario



# A likely to be used 3+1 scenario



# Two ways forward at the LHC

- They will likely be mixed
  - Gluon loop pinned to SM, photon loop free.
- **First step uncontroversial:  $C_V, C_F$ .**
- There are many possible intermediate steps.
  - As long as EXP have a common framework, comparison is possible.
- **Some scaling factors need to be pinned down:**
  - **VBF production** scaling beyond  $C_V$ :  $f^{\text{VBF}}(C_W, C_Z, m_H)$ .
  - **Gluon loop** scaling beyond  $C_F$ :  $f^g(C_t, C_b, m_H)$ .
  - **Photon loop** scaling beyond  $C_V, C_F$ :  $f^\gamma(C_t, C_W, C_b, m_H)$ .
  - $Z\gamma$  ignored in this discussion because it is almost completely W-dominated so  $C_V$  or  $C_W$  should be enough.