

Description for RenConstSQCD.m

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The renormalization constants up to three-loop order for the wave functions of quarks, squarks, gluons, ϵ -scalars, gluinos, ghosts, and for the masses of quarks and gluinos, as well as for all cubic vertices evaluated in softly broken SUSY-QCD are listed in the Mathematica file `RenConstSQCD.m`, available from

<http://www-ttp.particle.uni-karlsruhe.de/Progdata>

or from any of the authors upon request. If you use any of the contents of this file, please refer to Ref. [1] in the corresponding publication.

The renormalization constants for the fields, masses and vertices are defined as

$$\Phi^B = \sqrt{Z_\Phi} \Phi, \quad m^B = m Z_m, \quad \Gamma_X^B = Z_X \Gamma_X,$$

where the bare quantities are marked by the superscript “B”, and Φ , m , Γ_X denotes a generic field, mass and vertex function, respectively. Our notation for the renormalization constants is given by

Wave function ren. const.		Vertex ren. const.		ϵ -scalar-Vertex ren. const.		Mass ren. const.	
Z3es	Z_ϵ	Zggg	Z_{ggg}	Zgep	$Z_{g\epsilon\epsilon}$	Zmq	Z_m^q
Z2q	Z_q	Zgqq	$Z_{gq\bar{q}}$	Zepqq	$Z_{\epsilon q\bar{q}}$	Zmgl	$Z_m^{\tilde{g}}$
Z2gl	$Z_{\tilde{g}}$	Zgglgl	$Z_{g\tilde{g}\tilde{g}}$	Zepglgl	$Z_{\epsilon\tilde{g}\tilde{g}}$		
Z2sq	$Z_{\tilde{q}}$	Zgsqsq	$Z_{g\tilde{q}\tilde{q}}$				
Z3g	Z_g	Zgcc	$Z_{gc\bar{c}}$				
Z3c	Z_c	Zglssq	$Z_{\tilde{g}q\bar{q}}$				

The following notation has been used ($\epsilon = (4 - d)/2$):

q	quark	as	$\frac{\alpha_s}{\pi}$
\tilde{q}	squark	ep	ϵ
g	gluon	z3	$\zeta(3)$
\tilde{g}	gluino	xi	ξ
c	ghost	CF	C_F
ϵ	ϵ -scalar	CA	C_A
		Tf	T_f

where the gauge parameter ξ is defined through the gluon propagator

$$D_g^{\mu\nu}(q) = -i \frac{g^{\mu\nu} - \xi \frac{q^\mu q^\nu}{q^2}}{q^2 + i\varepsilon}.$$

(See Ref. [1] for more details concerning the notation.) The renormalization constants for the SUSY–Yang–Mills theory can be obtained by setting $T_f = 0$.

References

- [1] R.V. Harlander, L. Mihaila, M. Steinhauser, *The SUSY-QCD β function to three loops*, SFB/PPP-09-36, TTP09-13, WUB/09-02