

1 Model description

This file contains the Feynman rules for the model `ALP_leptophilic`. The Feynman rules have been generated automatically by FeynRules2.3.49.

1.1 Model information

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1.2 Index description

Index	Index range	Symbol
Gluon	1 ... 8	a
SU2W	1 ... 3	j
Generation	1 ... 3	f
Colour	1 ... 3	m
SU2D	1 , 2	k

1.3 Particle content of the model

1. Class: $V(1) = A$, Fieldtype: Real Vectorfield.
Indices: Lorentz.
2. Class: $V(2) = Z$, Fieldtype: Real Vectorfield.
Indices: Lorentz.
3. Class: $V(3) = W$, Fieldtype: Complex Vectorfield.
Indices: Lorentz.
4. Class: $V(4) = G$, Fieldtype: Real Vectorfield.
Indices: Lorentz, Gluon.
5. Class: $U(1) = ghA$, Fieldtype: Ghost Field.
Indices: N/A.
6. Class: $U(2) = ghZ$, Fieldtype: Ghost Field.
Indices: N/A.
7. Class: $U(31) = ghWp$, Fieldtype: Ghost Field.
Indices: N/A.

8. Class: $U(32) = ghWm$, Fieldtype: Ghost Field.
Indices: N/A.
9. Class: $U(4) = ghG$, Fieldtype: Ghost Field.
Indices: Gluon.
10. Class: $V(11) = B$, Fieldtype: Real Vectorfield (Unphysical).
Indices: Lorentz.
11. Class: $V(12) = Wi$, Fieldtype: Real Vectorfield (Unphysical).
Indices: Lorentz, SU2W.
12. Class: $U(11) = ghB$, Fieldtype: Ghost Field (Unphysical).
Indices: N/A.
13. Class: $U(12) = ghWi$, Fieldtype: Ghost Field (Unphysical).
Indices: SU2W.
14. Class: $F(1) = vl$, Fieldtype: Dirac Field.
Indices: Spin, Generation.
Class Members: ve, vm, vt.
15. Class: $F(2) = l$, Fieldtype: Dirac Field.
Indices: Spin, Generation.
Class Members: e, mu, ta.
16. Class: $F(3) = uq$, Fieldtype: Dirac Field.
Indices: Spin, Generation, Colour.
Class Members: u, c, t.
17. Class: $F(4) = dq$, Fieldtype: Dirac Field.
Indices: Spin, Generation, Colour.
Class Members: d, s, b.
18. Class: $F(11) = LL$, Fieldtype: Dirac Field (Unphysical).
Indices: Spin, SU2D, Generation.
19. Class: $F(12) = lR$, Fieldtype: Dirac Field (Unphysical).
Indices: Spin, Generation.
20. Class: $F(13) = QL$, Fieldtype: Dirac Field (Unphysical).
Indices: Spin, SU2D, Generation, Colour.
21. Class: $F(14) = uR$, Fieldtype: Dirac Field (Unphysical).
Indices: Spin, Generation, Colour.
22. Class: $F(15) = dR$, Fieldtype: Dirac Field (Unphysical).
Indices: Spin, Generation, Colour.

23. Class: $S(1) = H$, Fieldtype: Real Scalar Field.
Indices: N/A.
24. Class: $S(2) = G_0$, Fieldtype: Real Scalar Field.
Indices: N/A.
25. Class: $S(3) = GP$, Fieldtype: Complex Scalar Field.
Indices: N/A.
26. Class: $S(11) = Phi$, Fieldtype: Complex Scalar Field (Unphysical).
Indices: SU2D.
27. Class: $S(105) = ALP$, Fieldtype: Real Scalar Field.
Indices: N/A.
28. Class: $W(PRIVATE'x1000) = theta$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
29. Class: $W(PRIVATE'x1001) = eps0$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
30. Class: $W(PRIVATE'x1002) = eps1$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
31. Class: $W(PRIVATE'x1003) = eps2$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
32. Class: $W(PRIVATE'x1004) = eps3$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
33. Class: $W(PRIVATE'x1005) = eps4$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
34. Class: $W(PRIVATE'x1006) = eps5$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
35. Class: $W(PRIVATE'x1007) = eps6$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
36. Class: $W(PRIVATE'x1008) = eps7$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
37. Class: $W(PRIVATE'x1009) = eps8$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.
38. Class: $W(PRIVATE'x1010) = eps9$, Fieldtype: Weyl Field (Unphysical).
Indices: Spin1.

2 Vertices

2.1 3-point vertices

- Vertex $\{ALP, 1\}, \{W+, 2\}, \{W-, 3\}$

$$2ic_{WW}\epsilon_{\mu_2,\mu_3,\alpha,\beta}p_2^\alpha p_3^\beta$$

- Vertex $\{a, 1\}, \{a, 2\}, \{ALP, 3\}$

$$-2ic_{FF}\epsilon_{\mu_1,\mu_2,\alpha,\beta}p_1^\beta p_2^\alpha + 2ic_{FF}\epsilon_{\mu_1,\mu_2,\alpha,\beta}p_1^\alpha p_2^\beta$$

- Vertex $\{ALP, 1\}, \{Z, 2\}, \{Z, 3\}$

$$-2ic_{ZZ}\epsilon_{\mu_2,\mu_3,\alpha,\beta}p_2^\beta p_3^\alpha + 2ic_{ZZ}\epsilon_{\mu_2,\mu_3,\alpha,\beta}p_2^\alpha p_3^\beta$$

- Vertex $\{a, 1\}, \{ALP, 2\}, \{Z, 3\}$

$$2ic_{FZ}\epsilon_{\mu_1,\mu_3,\alpha,\beta}p_1^\beta p_3^\alpha$$

- Vertex $\{e+, 1\}, \{e-, 2\}, \{ALP, 3\}$

$$-ic_L\gamma_{s_1,s_2}{}^5\delta_{f_1,f_2}$$

2.2 4-point vertices

- Vertex $\{e+, 1\}, \{ve, 2\}, \{ALP, 3\}, \{W-, 4\}$

$$ic_{EWV}\delta_{f_1,f_2}\gamma^{\mu_4}.P_{-s_1,s_2}$$

- Vertex $\{ve, 1\}, \{e-, 2\}, \{ALP, 3\}, \{W+, 4\}$

$$ic_{EWV}\delta_{f_1,f_2}\gamma^{\mu_4}.P_{+s_1,s_2}$$