In [1]:
```
#%display latex
load("three_flavor.sage")
```

In [2]:
```
v = v_mu
n = 2
S, Sd, dS, dSd = get_S(n, l2, indx="mu")
```

In [3]:
```
indxs = ["mu", "nu", "rho"]

v = []
COM = []
COMd = []
for i in indxs:
    d = var("d"+i, latex_name="\\delta_\\"+i, domain="real")
    v = d*mu
    COM.append(-(v*S - S*v))      # [v_mu, Sigma]
    COMd.append(v*Sd - Sd*v) # [v_nu, Sigma^\dagger]
```

In [4]:
```
dS = []
dSd=[]
for i in indxs:
    _, _, dSi, dSdi = get_S(n, l2, indx=i)
    dS.append(dSi)
    dSd.append(dSdi)
```

In [5]:
```
kin = []
for i, ind in enumerate(indxs):
    term1 = mat_prep(dS[i]*(dSd[i]), n=n)
    term2 = -I*mat_prep(dS[i]*COMd[i] - COM[i]*dS[i], n=n)
    term3 = mat_prep(COM[i]*COMd[i], n=n)
    kin.append(term1 + term2 + term3)
```

In [6]:
```
L1 = (kin[0].trace()**2).series(e, n+1).truncate().trig_reduce().full_simplify()
print_coeff2(L1)
```

1 :

$$4\,{\delta_\mu}^4{\mu_I}^4\sin\left(\alpha\right)^4$$

e :

$$16\,{\delta_\mu}^4{\mu_I}^4\varphi_2\cos\left(\alpha\right)\sin\left(\alpha\right)^3$$

e^2 :

$$-8\,{\delta_\mu}^4{\mu_I}^4{\varphi_1}^2\sin\left(\alpha\right)^4-32\,{\delta_\mu}^4{\mu_I}^4{\varphi_2}^2\sin\left(\alpha\right)^4-8\,{\delta_\mu}^4{\mu_I}^4{\varphi_3}^2\sin\left(\alpha\right)^4-4\,{\delta_\mu}^4{\mu_I}^4{\varphi_4}^2\sin\left(\alpha\right)^4-4\,{\delta_\mu}^4{\mu_I}^4{\varphi_5}^2\sin\left(\alpha\right)^4-4\,{\delta_\mu}^4{\mu_I}^4{\varphi_6}^2\sin\left(\alpha\right)^4-4\,{\delta_\mu}^4{\mu_I}^4{\varphi_7}^2\sin\left(\alpha\right)^4+8\,{\delta_\mu}^4{\mu_I}^3\mu_S{\varphi_4}^2\cos\left(\alpha\right)\sin\left(\alpha\right)^2+8\,{\delta_\mu}^4{\mu_I}^3\mu_S{\varphi_5}^2\cos\left(\alpha\right)\sin\left(\alpha\right)^2-8\,{\delta_\mu}^4{\mu_I}^3\mu_S{\varphi_6}^2\cos\left(\alpha\right)\sin\left(\alpha\right)^2-8\,{\delta_\mu}^4{\mu_I}^3\mu_S{\varphi_7}^2\cos\left(\alpha\right)\sin\left(\alpha\right)^2+8\,{\delta_\mu}^4{\mu_I}^4{\varphi_1}^2\sin\left(\alpha\right)^2+24\,{\delta_\mu}^4{\mu_I}^4{\varphi_2}^2\sin\left(\alpha\right)^2+2\,{\delta_\mu}^4{\mu_I}^4{\varphi_4}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^4{\mu_I}^2{\mu_S}^2{\varphi_4}^2\sin\left(\alpha\right)^2+2\,{\delta_\mu}^4{\mu_I}^4{\varphi_5}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^4{\mu_I}^2{\mu_S}^2{\varphi_5}^2\sin\left(\alpha\right)^2+2\,{\delta_\mu}^4{\mu_I}^4{\varphi_6}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^4{\mu_I}^2{\mu_S}^2{\varphi_6}^2\sin\left(\alpha\right)^2+2\,{\delta_\mu}^4{\mu_I}^4{\varphi_7}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^4{\mu_I}^2{\mu_S}^2{\varphi_7}^2\sin\left(\alpha\right)^2+\frac{16}{3}i\,\sqrt{3}{\delta_\mu}^3\partial_\mu\varphi_1{\mu_I}^3\varphi_8\sin\left(\alpha\right)^3+4\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^3\varphi_4\cos\left(\alpha\right)\sin\left(\alpha\right)^2-8\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_4\cos\left(\alpha\right)\sin\left(\alpha\right)^2-4\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^3\varphi_5\cos\left(\alpha\right)\sin\left(\alpha\right)^2+8\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_5\cos\left(\alpha\right)\sin\left(\alpha\right)^2-4\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^3\varphi_6\cos\left(\alpha\right)\sin\left(\alpha\right)^2-8\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_6\cos\left(\alpha\right)\sin\left(\alpha\right)^2+4\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^3\varphi_7\cos\left(\alpha\right)\sin\left(\alpha\right)^2+8\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_7\cos\left(\alpha\right)\sin\left(\alpha\right)^2+4i\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^3\varphi_4\sin\left(\alpha\right)^3-8i\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_4\sin\left(\alpha\right)^3+4i\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^3\varphi_5\sin\left(\alpha\right)^3-8i\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_5\sin\left(\alpha\right)^3+4i\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^3\varphi_6\sin\left(\alpha\right)^3+8i\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_6\sin\left(\alpha\right)^3+4i\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^3\varphi_7\sin\left(\alpha\right)^3+8i\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_7\sin\left(\alpha\right)^3-4\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^3\varphi_4\sin\left(\alpha\right)^2+8\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_4\sin\left(\alpha\right)^2+4\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^3\varphi_5\sin\left(\alpha\right)^2-8\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_5\sin\left(\alpha\right)^2+4\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^3\varphi_6\sin\left(\alpha\right)^2+8\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_6\sin\left(\alpha\right)^2-4\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^3\varphi_7\sin\left(\alpha\right)^2-8\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_7\sin\left(\alpha\right)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_1}^2{\mu_I}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_2}^2{\mu_I}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_3}^2{\mu_I}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_4}^2{\mu_I}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_5}^2{\mu_I}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_6}^2{\mu_I}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_7}^2{\mu_I}^2\sin\left(\alpha\right)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_8}^2{\mu_I}^2\sin\left(\alpha\right)^2$$

In [7]:

```
L2 = kin[0].trace()*kin[1].trace()
L2 = L2.series(e, n+1).truncate().trig_reduce().full_simplify()
print_coeff2(L2)
```

1 :

$$4\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4\sin(\alpha)^4$$

e :

$$16\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4\varphi_2\cos(\alpha)\sin(\alpha)^3$$

e^2 :

$$-8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_1}^2\sin(\alpha)^4-32\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_2}^2\sin(\alpha)^4-8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_3}^2\sin(\alpha)^4-4\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_4}^2\sin(\alpha)^4-4\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_5}^2\sin(\alpha)^4-4\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_6}^2\sin(\alpha)^4-4\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_7}^2\sin(\alpha)^4+8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^3\mu_S{\varphi_4}^2\cos(\alpha)\sin(\alpha)^2+8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^3\mu_S{\varphi_5}^2\cos(\alpha)\sin(\alpha)^2-8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^3\mu_S{\varphi_6}^2\cos(\alpha)\sin(\alpha)^2-8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^3\mu_S{\varphi_7}^2\cos(\alpha)\sin(\alpha)^2+8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_1}^2\sin(\alpha)^2+24\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_2}^2\sin(\alpha)^2+2\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_4}^2\sin(\alpha)^2+8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^2{\mu_S}^2{\varphi_4}^2\sin(\alpha)^2+2\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_5}^2\sin(\alpha)^2+8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^2{\mu_S}^2{\varphi_5}^2\sin(\alpha)^2+2\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_6}^2\sin(\alpha)^2+8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^2{\mu_S}^2{\varphi_6}^2\sin(\alpha)^2+2\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^4{\varphi_7}^2\sin(\alpha)^2+8\,{\delta_\mu}^2{\delta_\nu}^2{\mu_I}^2{\mu_S}^2{\varphi_7}^2\sin(\alpha)^2+\frac{8}{3}i\sqrt{3}\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_1{\mu_I}^3\varphi_8\sin(\alpha)^3+\frac{8}{3}i\sqrt{3}{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_1{\mu_I}^3\varphi_8\sin(\alpha)^3+2\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_5{\mu_I}^3\varphi_4\cos(\alpha)\sin(\alpha)^2+2\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_5{\mu_I}^3\varphi_4\cos(\alpha)\sin(\alpha)^2-4\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_4\cos(\alpha)\sin(\alpha)^2-4\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_5{\mu_I}^2\mu_S\varphi_4\cos(\alpha)\sin(\alpha)^2-2\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_4{\mu_I}^3\varphi_5\cos(\alpha)\sin(\alpha)^2-2\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_4{\mu_I}^3\varphi_5\cos(\alpha)\sin(\alpha)^2+4\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_5\cos(\alpha)\sin(\alpha)^2+4\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_4{\mu_I}^2\mu_S\varphi_5\cos(\alpha)\sin(\alpha)^2-2\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_7{\mu_I}^3\varphi_6\cos(\alpha)\sin(\alpha)^2-2\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_7{\mu_I}^3\varphi_6\cos(\alpha)\sin(\alpha)^2-4\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_6\cos(\alpha)\sin(\alpha)^2-4\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_7{\mu_I}^2\mu_S\varphi_6\cos(\alpha)\sin(\alpha)^2+2\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_6{\mu_I}^3\varphi_7\cos(\alpha)\sin(\alpha)^2+2\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_6{\mu_I}^3\varphi_7\cos(\alpha)\sin(\alpha)^2+4\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_7\cos(\alpha)\sin(\alpha)^2+4\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_6{\mu_I}^2\mu_S\varphi_7\cos(\alpha)\sin(\alpha)^2+2i\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_6{\mu_I}^3\varphi_4\sin(\alpha)^3+2i\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_6{\mu_I}^3\varphi_4\sin(\alpha)^3-4i\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_4\sin(\alpha)^3-4i\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_6{\mu_I}^2\mu_S\varphi_4\sin(\alpha)^3+2i\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_7{\mu_I}^3\varphi_5\sin(\alpha)^3+2i\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_7{\mu_I}^3\varphi_5\sin(\alpha)^3-4i\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_5\sin(\alpha)^3-4i\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_7{\mu_I}^2\mu_S\varphi_5\sin(\alpha)^3+2i\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_4{\mu_I}^3\varphi_6\sin(\alpha)^3+2i\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_4{\mu_I}^3\varphi_6\sin(\alpha)^3+4i\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_6\sin(\alpha)^3+4i\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_4{\mu_I}^2\mu_S\varphi_6\sin(\alpha)^3+2i\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_5{\mu_I}^3\varphi_7\sin(\alpha)^3+2i\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_5{\mu_I}^3\varphi_7\sin(\alpha)^3+4i\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_7\sin(\alpha)^3+4i\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_5{\mu_I}^2\mu_S\varphi_7\sin(\alpha)^3-2\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_5{\mu_I}^3\varphi_4\sin(\alpha)^2-2\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_5{\mu_I}^3\varphi_4\sin(\alpha)^2+4\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_4\sin(\alpha)^2+4\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_5{\mu_I}^2\mu_S\varphi_4\sin(\alpha)^2+2\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_4{\mu_I}^3\varphi_5\sin(\alpha)^2+2\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_4{\mu_I}^3\varphi_5\sin(\alpha)^2-4\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_5\sin(\alpha)^2-4\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_4{\mu_I}^2\mu_S\varphi_5\sin(\alpha)^2+2\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_7{\mu_I}^3\varphi_6\sin(\alpha)^2+2\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_7{\mu_I}^3\varphi_6\sin(\alpha)^2+4\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_6\sin(\alpha)^2+4\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_7{\mu_I}^2\mu_S\varphi_6\sin(\alpha)^2-2\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_6{\mu_I}^3\varphi_7\sin(\alpha)^2-2\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_6{\mu_I}^3\varphi_7\sin(\alpha)^2-4\,\delta_\mu{\delta_\nu}^2\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_7\sin(\alpha)^2-4\,{\delta_\mu}^2\delta_\nu\partial_\nu\varphi_6{\mu_I}^2\mu_S\varphi_7\sin(\alpha)^2+4\,{\delta_\nu}^2\partial_\mu{\varphi_1}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\mu}^2\partial_\nu{\varphi_1}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\nu}^2\partial_\mu{\varphi_2}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\mu}^2\partial_\nu{\varphi_2}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\nu}^2\partial_\mu{\varphi_3}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\mu}^2\partial_\nu{\varphi_3}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\nu}^2\partial_\mu{\varphi_4}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\mu}^2\partial_\nu{\varphi_4}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\nu}^2\partial_\mu{\varphi_5}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\mu}^2\partial_\nu{\varphi_5}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\nu}^2\partial_\mu{\varphi_6}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\mu}^2\partial_\nu{\varphi_6}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\nu}^2\partial_\mu{\varphi_7}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\mu}^2\partial_\nu{\varphi_7}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\nu}^2\partial_\mu{\varphi_8}^2{\mu_I}^2\sin(\alpha)^2+4\,{\delta_\mu}^2\partial_\nu{\varphi_8}^2{\mu_I}^2\sin(\alpha)^2$$

In [8]:

```
L3 = (kin[0]**2).trace()
L3 = L3.series(e, n+1).truncate().trig_reduce().full_simplify()
print_coeff2(L3)
```

1 :

$$2\,{\delta_\mu}^4{\mu_I}^4\sin(\alpha)^4$$

e :

$$8\,{\delta_\mu}^4{\mu_I}^4\varphi_2\cos(\alpha)\sin(\alpha)^3$$

e^2 :

$$-4\,{\delta_\mu}^4{\mu_I}^4{\varphi_1}^2\sin(\alpha)^4-16\,{\delta_\mu}^4{\mu_I}^4{\varphi_2}^2\sin(\alpha)^4-4\,{\delta_\mu}^4{\mu_I}^4{\varphi_3}^2\sin(\alpha)^4-2\,{\delta_\mu}^4{\mu_I}^4{\varphi_4}^2\sin(\alpha)^4-2\,{\delta_\mu}^4{\mu_I}^4{\varphi_5}^2\sin(\alpha)^4-2\,{\delta_\mu}^4{\mu_I}^4{\varphi_6}^2\sin(\alpha)^4-2\,{\delta_\mu}^4{\mu_I}^4{\varphi_7}^2\sin(\alpha)^4+4\,{\delta_\mu}^4{\mu_I}^3\mu_S{\varphi_4}^2\cos(\alpha)\sin(\alpha)^2+4\,{\delta_\mu}^4{\mu_I}^3\mu_S{\varphi_5}^2\cos(\alpha)\sin(\alpha)^2-4\,{\delta_\mu}^4{\mu_I}^3\mu_S{\varphi_6}^2\cos(\alpha)\sin(\alpha)^2-4\,{\delta_\mu}^4{\mu_I}^3\mu_S{\varphi_7}^2\cos(\alpha)\sin(\alpha)^2+4\,{\delta_\mu}^4{\mu_I}^4{\varphi_1}^2\sin(\alpha)^2+12\,{\delta_\mu}^4{\mu_I}^4{\varphi_2}^2\sin(\alpha)^2+{\delta_\mu}^4{\mu_I}^4{\varphi_4}^2\sin(\alpha)^2+4\,{\delta_\mu}^4{\mu_I}^2{\mu_S}^2{\varphi_4}^2\sin(\alpha)^2+{\delta_\mu}^4{\mu_I}^4{\varphi_5}^2\sin(\alpha)^2+4\,{\delta_\mu}^4{\mu_I}^2{\mu_S}^2{\varphi_5}^2\sin(\alpha)^2+{\delta_\mu}^4{\mu_I}^4{\varphi_6}^2\sin(\alpha)^2+4\,{\delta_\mu}^4{\mu_I}^2{\mu_S}^2{\varphi_6}^2\sin(\alpha)^2+{\delta_\mu}^4{\mu_I}^4{\varphi_7}^2\sin(\alpha)^2+4\,{\delta_\mu}^4{\mu_I}^2{\mu_S}^2{\varphi_7}^2\sin(\alpha)^2+\frac{8}{3}i\sqrt{3}{\delta_\mu}^3\partial_\mu\varphi_1{\mu_I}^3\varphi_8\sin(\alpha)^3+2\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^3\varphi_4\cos(\alpha)\sin(\alpha)^2-4\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_4\cos(\alpha)\sin(\alpha)^2-2\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^3\varphi_5\cos(\alpha)\sin(\alpha)^2+4\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_5\cos(\alpha)\sin(\alpha)^2-2\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^3\varphi_6\cos(\alpha)\sin(\alpha)^2-4\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_6\cos(\alpha)\sin(\alpha)^2+2\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^3\varphi_7\cos(\alpha)\sin(\alpha)^2+4\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_7\cos(\alpha)\sin(\alpha)^2+2i\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^3\varphi_4\sin(\alpha)^3-4i\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_4\sin(\alpha)^3+2i\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^3\varphi_5\sin(\alpha)^3-4i\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_5\sin(\alpha)^3+2i\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^3\varphi_6\sin(\alpha)^3+4i\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_6\sin(\alpha)^3+2i\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^3\varphi_7\sin(\alpha)^3+4i\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_7\sin(\alpha)^3-\frac{16}{3}i\sqrt{3}{\delta_\mu}^2\partial_\mu\varphi_2\partial_\mu\varphi_8{\mu_I}^2\cos(\alpha)\sin(\alpha)^3-2\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^3\varphi_4\sin(\alpha)^2+4\,{\delta_\mu}^3\partial_\mu\varphi_5{\mu_I}^2\mu_S\varphi_4\sin(\alpha)^2+2\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^3\varphi_5\sin(\alpha)^2-4\,{\delta_\mu}^3\partial_\mu\varphi_4{\mu_I}^2\mu_S\varphi_5\sin(\alpha)^2+2\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^3\varphi_6\sin(\alpha)^2+4\,{\delta_\mu}^3\partial_\mu\varphi_7{\mu_I}^2\mu_S\varphi_6\sin(\alpha)^2-2\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^3\varphi_7\sin(\alpha)^2-4\,{\delta_\mu}^3\partial_\mu\varphi_6{\mu_I}^2\mu_S\varphi_7\sin(\alpha)^2+8\,{\delta_\mu}^2\partial_\mu{\varphi_2}^2{\mu_I}^2\sin(\alpha)^4+\frac{8}{3}\,{\delta_\mu}^2\partial_\mu{\varphi_8}^2{\mu_I}^2\sin(\alpha)^4-2\,{\delta_\mu}^2\partial_\mu{\varphi_4}^2{\mu_I}^2\cos(\alpha)\sin(\alpha)^2-2\,{\delta_\mu}^2\partial_\mu{\varphi_5}^2{\mu_I}^2\cos(\alpha)\sin(\alpha)^2-2\,{\delta_\mu}^2\partial_\mu{\varphi_6}^2{\mu_I}^2\cos(\alpha)\sin(\alpha)^2-2\,{\delta_\mu}^2\partial_\mu{\varphi_7}^2{\mu_I}^2\cos(\alpha)\sin(\alpha)^2-4i\,{\delta_\mu}^2\partial_\mu\varphi_5\partial_\mu\varphi_6{\mu_I}^2\sin(\alpha)^3+4i\,{\delta_\mu}^2\partial_\mu\varphi_4\partial_\mu\varphi_7{\mu_I}^2\sin(\alpha)^3+4\,{\delta_\mu}^2\partial_\mu{\varphi_1}^2{\mu_I}^2\sin(\alpha)^2-4\,{\delta_\mu}^2\partial_\mu{\varphi_2}^2{\mu_I}^2\sin(\alpha)^2-4\,{\delta_\mu}^2\partial_\mu{\varphi_3}^2{\mu_I}^2\sin(\alpha)^2+2\,{\delta_\mu}^2\partial_\mu{\varphi_4}^2{\mu_I}^2\sin(\alpha)^2+2\,{\delta_\mu}^2\partial_\mu{\varphi_5}^2{\mu_I}^2\sin(\alpha)^2+2\,{\delta_\mu}^2\partial_\mu{\varphi_6}^2{\mu_I}^2\sin(\alpha)^2+2\,{\delta_\mu}^2\partial_\mu{\varphi_7}^2{\mu_I}^2\sin(\alpha)^2+\frac{4}{3}\,{\delta_\mu}^2\partial_\mu{\varphi_8}^2{\mu_I}^2\sin(\alpha)^2$$

In [17]:

```
chiS = chi*Sd + S*chi.T
L6 = (chiS.trace())^2
L6 = L6.series(e, n+1).truncate().trig_reduce().full_simplify()
print_coeff2(L6)
```

1 :

$$16\,\bar{m}^4\cos(\alpha)^2+16\,{m_S}^2\bar{m}^2\cos(\alpha)+4\,{m_S}^4$$

e :

$$-32\,\bar{m}^4\varphi_2\cos(\alpha)\sin(\alpha)-16\,{m_S}^2\bar{m}^2\varphi_2\sin(\alpha)$$

e^2 :

$$-16\,\bar{m}^4{\varphi_1}^2\cos(\alpha)^2-32\,\bar{m}^4{\varphi_2}^2\cos(\alpha)^2-16\,\bar{m}^4{\varphi_3}^2\cos(\alpha)^2-8\,\bar{m}^4{\varphi_4}^2\cos(\alpha)^2-8\,\bar{m}^4{\varphi_5}^2\cos(\alpha)^2-8\,\bar{m}^4{\varphi_6}^2\cos(\alpha)^2-8\,\bar{m}^4{\varphi_7}^2\cos(\alpha)^2-\frac{16}{3}\,\bar{m}^4{\varphi_8}^2\cos(\alpha)^2+\frac{32}{3}\sqrt{3}\Delta m^2\bar{m}^2\varphi_3\varphi_8\cos(\alpha)-8\,{m_S}^2\bar{m}^2{\varphi_1}^2\cos(\alpha)-8\,{m_S}^2\bar{m}^2{\varphi_2}^2\cos(\alpha)-8\,{m_S}^2\bar{m}^2{\varphi_3}^2\cos(\alpha)+8\,\Delta m^2\bar{m}^2{\varphi_4}^2\cos(\alpha)-12\,{m_S}^2\bar{m}^2{\varphi_4}^2\cos(\alpha)+8\,\Delta m^2\bar{m}^2{\varphi_5}^2\cos(\alpha)-12\,{m_S}^2\bar{m}^2{\varphi_5}^2\cos(\alpha)-8\,\Delta m^2\bar{m}^2{\varphi_6}^2\cos(\alpha)-12\,{m_S}^2\bar{m}^2{\varphi_6}^2\cos(\alpha)-8\,\Delta m^2\bar{m}^2{\varphi_7}^2\cos(\alpha)-12\,{m_S}^2\bar{m}^2{\varphi_7}^2\cos(\alpha)-\frac{40}{3}\,{m_S}^2\bar{m}^2{\varphi_8}^2\cos(\alpha)+\frac{16}{3}\sqrt{3}\Delta m^2{m_S}^2\varphi_3\varphi_8+16\,\bar{m}^4{\varphi_2}^2+4\,\Delta m^2{m_S}^2{\varphi_4}^2-4\,{m_S}^4{\varphi_4}^2+4\,\Delta m^2{m_S}^2{\varphi_5}^2-4\,{m_S}^4{\varphi_5}^2-4\,\Delta m^2{m_S}^2{\varphi_6}^2-4\,{m_S}^4{\varphi_6}^2-4\,\Delta m^2{m_S}^2{\varphi_7}^2-4\,{m_S}^4{\varphi_7}^2-\frac{16}{3}\,{m_S}^4{\varphi_8}^2$$

In [10]:

```
L7 = mat_prep(chi*Sd - S*chi.T, n=n)
L7 = (L7.trace())^2
L7 = L7.series(e, n+1).truncate().trig_reduce().full_simplify()
print_coeff(L7)
```

e^2 :

$$-16\,\Delta m^4{\varphi_3}^2+\frac{32}{3}\left(\sqrt{3}\Delta m^2\bar{m}^2\cos(\alpha)-\sqrt{3}\Delta m^2{m_S}^2\right)\varphi_3\varphi_8-\frac{16}{3}\left(\bar{m}^4\cos(\alpha)^2-2\,{m_S}^2\bar{m}^2\cos(\alpha)+{m_S}^4\right){\varphi_8}^2$$

In [11]:

```
L8 = mat_prep((chi*Sd)^2 + (S*chi.T)^2, n=n)
L8 = L8.trace().series(e, n+1).truncate().trig_reduce()
print_coeff2(L8)
```

1 :

$$4\left(2\cos(\alpha)^2-1\right)\bar{m}^4+4\,\Delta m^4+2\,{m_S}^4$$

e :

$$-16\,\bar{m}^4\varphi_2\cos(\alpha)\sin(\alpha)$$

e^2 :

$$\frac{2}{9}\sqrt{3}\Big(12\left(\sqrt{3}\sin(\alpha)^2-\sqrt{3}\right)\bar{m}^4{\varphi_1}^2+12\left(2\sqrt{3}\sin(\alpha)^2-\sqrt{3}\right)\bar{m}^4{\varphi_2}^2+48\,\Delta m^2\bar{m}^2\varphi_3\varphi_8\cos(\alpha)+12$$
$$\left(\left(\sqrt{3}\sin(\alpha)^2-\sqrt{3}\right)\bar{m}^4-\sqrt{3}\Delta m^4\right){\varphi_3}^2+3$$
$$\left(\left(2\sqrt{3}\sin(\alpha)^2-\sqrt{3}\right)\bar{m}^4-\sqrt{3}\Delta m^4+2\sqrt{3}\Delta m^2{m_S}^2-\sqrt{3}{m_S}^4+2\left(\sqrt{3}\Delta m^2\cos(\alpha)-\sqrt{3}{m_S}^2\cos(\alpha)\right)\bar{m}^2\right){\varphi_4}^2+3$$
$$\left(\left(2\sqrt{3}\sin(\alpha)^2-\sqrt{3}\right)\bar{m}^4-\sqrt{3}\Delta m^4+2\sqrt{3}\Delta m^2{m_S}^2-\sqrt{3}{m_S}^4+2\left(\sqrt{3}\Delta m^2\cos(\alpha)-\sqrt{3}{m_S}^2\cos(\alpha)\right)\bar{m}^2\right){\varphi_5}^2+3$$
$$\left(\left(2\sqrt{3}\sin(\alpha)^2-\sqrt{3}\right)\bar{m}^4-\sqrt{3}\Delta m^4-2\sqrt{3}\Delta m^2{m_S}^2-\sqrt{3}{m_S}^4-2\left(\sqrt{3}\Delta m^2\cos(\alpha)+\sqrt{3}{m_S}^2\cos(\alpha)\right)\bar{m}^2\right){\varphi_6}^2+3$$
$$\left(\left(2\sqrt{3}\sin(\alpha)^2-\sqrt{3}\right)\bar{m}^4-\sqrt{3}\Delta m^4-2\sqrt{3}\Delta m^2{m_S}^2-\sqrt{3}{m_S}^4-2\left(\sqrt{3}\Delta m^2\cos(\alpha)+\sqrt{3}{m_S}^2\cos(\alpha)\right)\bar{m}^2\right){\varphi_7}^2+4$$
$$\left(\left(2\sqrt{3}\sin(\alpha)^2-\sqrt{3}\right)\bar{m}^4-\sqrt{3}\Delta m^4-2\sqrt{3}{m_S}^4\right){\varphi_8}^2\Big)$$

In [16]:
```
L4 = kin[0].trace()*chiS.trace()
L4 = L4.series(e, n+1).truncate().trig_reduce().full_simplify()
print_coeff2(L4)
```

1 :

$$-8\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2\cos(\alpha)^3-4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2\cos(\alpha)^2+8\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2\cos(\alpha)+4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2$$

e :

$$24\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2\varphi_2\cos(\alpha)^2\sin(\alpha)+8\,{\delta_\mu}^2{m_S}^2{\mu_I}^2\varphi_2\cos(\alpha)\sin(\alpha)-8\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2\varphi_2\sin(\alpha)$$

e^2 :

$$12\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_1}^2\cos(\alpha)^3+36\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_2}^2\cos(\alpha)^3+12\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_3}^2\cos(\alpha)^3+6\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_4}^2\cos(\alpha)^3+6\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_5}^2\cos(\alpha)^3$$
$$+6\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_6}^2\cos(\alpha)^3+6\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_7}^2\cos(\alpha)^3+\frac{4}{3}\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_8}^2\cos(\alpha)^3-\frac{8}{3}\,\sqrt{3}\Delta m^2{\delta_\mu}^2{\mu_I}^2\varphi_3\varphi_8\cos(\alpha)^2+4$$
$$\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_1}^2\cos(\alpha)^2+8\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_2}^2\cos(\alpha)^2+4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_3}^2\cos(\alpha)^2-2\,\Delta m^2{\delta_\mu}^2{\mu_I}^2{\varphi_4}^2\cos(\alpha)^2+4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_4}^2\cos(\alpha)^2$$
$$+8\,{\delta_\mu}^2\bar{m}^2{\mu_I}\mu_S{\varphi_4}^2\cos(\alpha)^2-2\,\Delta m^2{\delta_\mu}^2{\mu_I}^2{\varphi_5}^2\cos(\alpha)^2+4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_5}^2\cos(\alpha)^2+8\,{\delta_\mu}^2\bar{m}^2{\mu_I}\mu_S{\varphi_5}^2\cos(\alpha)^2+2$$
$$\Delta m^2{\delta_\mu}^2{\mu_I}^2{\varphi_6}^2\cos(\alpha)^2+4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_6}^2\cos(\alpha)^2-8\,{\delta_\mu}^2\bar{m}^2{\mu_I}\mu_S{\varphi_6}^2\cos(\alpha)^2+2\,\Delta m^2{\delta_\mu}^2{\mu_I}^2{\varphi_7}^2\cos(\alpha)^2+4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_7}^2\cos$$
$$(\alpha)^2-8\,{\delta_\mu}^2\bar{m}^2{\mu_I}\mu_S{\varphi_7}^2\cos(\alpha)^2+\frac{8}{3}\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_8}^2\cos(\alpha)^2-4\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_1}^2\cos(\alpha)-28\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_2}^2\cos(\alpha)-12$$
$$\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_3}^2\cos(\alpha)-4\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_4}^2\cos(\alpha)+4\,{\delta_\mu}^2{m_S}^2{\mu_I}\mu_S{\varphi_4}^2\cos(\alpha)+8\,{\delta_\mu}^2\bar{m}^2{\mu_S}^2{\varphi_4}^2\cos(\alpha)-4\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_5}^2\cos(\alpha)+4$$
$$\,{\delta_\mu}^2{m_S}^2{\mu_I}\mu_S{\varphi_5}^2\cos(\alpha)+8\,{\delta_\mu}^2\bar{m}^2{\mu_S}^2{\varphi_5}^2\cos(\alpha)-4\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_6}^2\cos(\alpha)-4\,{\delta_\mu}^2{m_S}^2{\mu_I}\mu_S{\varphi_6}^2\cos(\alpha)+8\,{\delta_\mu}^2\bar{m}^2{\mu_S}^2{\varphi_6}^2\cos(\alpha)-4$$
$$\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_7}^2\cos(\alpha)-4\,{\delta_\mu}^2{m_S}^2{\mu_I}\mu_S{\varphi_7}^2\cos(\alpha)+8\,{\delta_\mu}^2\bar{m}^2{\mu_S}^2{\varphi_7}^2\cos(\alpha)-\frac{4}{3}\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2{\varphi_8}^2\cos(\alpha)+\frac{8}{3}\,\sqrt{3}\Delta m^2{\delta_\mu}^2{\mu_I}^2\varphi_3\varphi_8+\frac{16}{3}i$$
$$\sqrt{3}\delta_\mu\partial_\mu\varphi_1\bar{m}^2{\mu_I}\varphi_8\cos(\alpha)\sin(\alpha)-4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_2}^2-4\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_3}^2+2\,\Delta m^2{\delta_\mu}^2{\mu_I}^2{\varphi_4}^2-3\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_4}^2+4\,{\delta_\mu}^2{m_S}^2{\mu_S}^2{\varphi_4}^2+2$$
$$\Delta m^2{\delta_\mu}^2{\mu_I}^2{\varphi_5}^2-3\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_5}^2+4\,{\delta_\mu}^2{m_S}^2{\mu_S}^2{\varphi_5}^2-2\,\Delta m^2{\delta_\mu}^2{\mu_I}^2{\varphi_6}^2-3\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_6}^2+4\,{\delta_\mu}^2{m_S}^2{\mu_S}^2{\varphi_6}^2-2\,\Delta m^2{\delta_\mu}^2{\mu_I}^2{\varphi_7}^2$$
$$-3\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_7}^2+4\,{\delta_\mu}^2{m_S}^2{\mu_S}^2{\varphi_7}^2-\frac{8}{3}\,{\delta_\mu}^2{m_S}^2{\mu_I}^2{\varphi_8}^2+4\,\delta_\mu\partial_\mu\varphi_5\bar{m}^2{\mu_I}\varphi_4\cos(\alpha)^2-8\,\delta_\mu\partial_\mu\varphi_5\bar{m}^2{\mu_S}\varphi_4\cos(\alpha)^2-4$$
$$\delta_\mu\partial_\mu\varphi_4\bar{m}^2{\mu_I}\varphi_5\cos(\alpha)^2+8\,\delta_\mu\partial_\mu\varphi_4\bar{m}^2{\mu_S}\varphi_5\cos(\alpha)^2-4\,\delta_\mu\partial_\mu\varphi_7\bar{m}^2{\mu_I}\varphi_6\cos(\alpha)^2-8\,\delta_\mu\partial_\mu\varphi_7\bar{m}^2{\mu_S}\varphi_6\cos(\alpha)^2-4\,\delta_\mu\partial_\mu\varphi_6\bar{m}^2{\mu_I}\varphi_7\cos$$
$$(\alpha)^2+8\,\delta_\mu\partial_\mu\varphi_6\bar{m}^2{\mu_S}\varphi_7\cos(\alpha)^2+4i\,\delta_\mu\partial_\mu\varphi_6\bar{m}^2{\mu_I}\varphi_4\cos(\alpha)\sin(\alpha)-8i\,\delta_\mu\partial_\mu\varphi_6\bar{m}^2{\mu_S}\varphi_4\cos(\alpha)\sin(\alpha)+4i\,\delta_\mu\partial_\mu\varphi_7\bar{m}^2{\mu_I}\varphi_5\cos$$
$$(\alpha)\sin(\alpha)-8i\,\delta_\mu\partial_\mu\varphi_7\bar{m}^2{\mu_S}\varphi_5\cos(\alpha)\sin(\alpha)+4i\,\delta_\mu\partial_\mu\varphi_4\bar{m}^2{\mu_I}\varphi_6\cos(\alpha)\sin(\alpha)+8i\,\delta_\mu\partial_\mu\varphi_4\bar{m}^2{\mu_S}\varphi_6\cos(\alpha)\sin(\alpha)+4i$$
$$\delta_\mu\partial_\mu\varphi_5\bar{m}^2{\mu_I}\varphi_7\cos(\alpha)\sin(\alpha)+8i\,\delta_\mu\partial_\mu\varphi_5\bar{m}^2{\mu_S}\varphi_7\cos(\alpha)\sin(\alpha)+\frac{8}{3}i\,\sqrt{3}\delta_\mu\partial_\mu\varphi_1{m_S}^2{\mu_I}\varphi_8\sin(\alpha)+2\,\delta_\mu\partial_\mu\varphi_5{m_S}^2{\mu_I}\varphi_4\cos(\alpha)-4$$
$$\delta_\mu\partial_\mu\varphi_5\bar{m}^2{\mu_I}\varphi_4\cos(\alpha)-4\,\delta_\mu\partial_\mu\varphi_5{m_S}^2{\mu_S}\varphi_4\cos(\alpha)+8\,\delta_\mu\partial_\mu\varphi_5\bar{m}^2{\mu_S}\varphi_4\cos(\alpha)-2\,\delta_\mu\partial_\mu\varphi_4{m_S}^2{\mu_I}\varphi_5\cos(\alpha)+4\,\delta_\mu\partial_\mu\varphi_4\bar{m}^2{\mu_I}\varphi_5\cos(\alpha)$$
$$+4\,\delta_\mu\partial_\mu\varphi_4{m_S}^2{\mu_S}\varphi_5\cos(\alpha)-8\,\delta_\mu\partial_\mu\varphi_4\bar{m}^2{\mu_S}\varphi_5\cos(\alpha)-2\,\delta_\mu\partial_\mu\varphi_7{m_S}^2{\mu_I}\varphi_6\cos(\alpha)+4\,\delta_\mu\partial_\mu\varphi_7\bar{m}^2{\mu_I}\varphi_6\cos(\alpha)-4$$
$$\delta_\mu\partial_\mu\varphi_7{m_S}^2{\mu_S}\varphi_6\cos(\alpha)+8\,\delta_\mu\partial_\mu\varphi_7\bar{m}^2{\mu_S}\varphi_6\cos(\alpha)+2\,\delta_\mu\partial_\mu\varphi_6{m_S}^2{\mu_I}\varphi_7\cos(\alpha)-4\,\delta_\mu\partial_\mu\varphi_6\bar{m}^2{\mu_I}\varphi_7\cos(\alpha)+4\,\delta_\mu\partial_\mu\varphi_6{m_S}^2{\mu_S}\varphi_7\cos$$
$$(\alpha)-8\,\delta_\mu\partial_\mu\varphi_6\bar{m}^2{\mu_S}\varphi_7\cos(\alpha)+2i\,\delta_\mu\partial_\mu\varphi_6{m_S}^2{\mu_I}\varphi_4\sin(\alpha)-4i\,\delta_\mu\partial_\mu\varphi_6{m_S}^2{\mu_S}\varphi_4\sin(\alpha)+2i\,\delta_\mu\partial_\mu\varphi_7{m_S}^2{\mu_I}\varphi_5\sin(\alpha)-4i$$
$$\delta_\mu\partial_\mu\varphi_7{m_S}^2{\mu_S}\varphi_5\sin(\alpha)+2i\,\delta_\mu\partial_\mu\varphi_4{m_S}^2{\mu_I}\varphi_6\sin(\alpha)+4i\,\delta_\mu\partial_\mu\varphi_4{m_S}^2{\mu_S}\varphi_6\sin(\alpha)+2i\,\delta_\mu\partial_\mu\varphi_5{m_S}^2{\mu_I}\varphi_7\sin(\alpha)+4i$$
$$\delta_\mu\partial_\mu\varphi_5{m_S}^2{\mu_S}\varphi_7\sin(\alpha)-2\,\delta_\mu\partial_\mu\varphi_5{m_S}^2{\mu_I}\varphi_4+4\,\delta_\mu\partial_\mu\varphi_5{m_S}^2{\mu_S}\varphi_4+2\,\delta_\mu\partial_\mu\varphi_4{m_S}^2{\mu_I}\varphi_5-4\,\delta_\mu\partial_\mu\varphi_4{m_S}^2{\mu_S}\varphi_5+2\,\delta_\mu\partial_\mu\varphi_7{m_S}^2{\mu_I}\varphi_6+4$$
$$\delta_\mu\partial_\mu\varphi_7{m_S}^2{\mu_S}\varphi_6-2\,\delta_\mu\partial_\mu\varphi_6{m_S}^2{\mu_I}\varphi_7-4\,\delta_\mu\partial_\mu\varphi_6{m_S}^2{\mu_S}\varphi_7+8\,{\partial_\mu\varphi_1}^2\bar{m}^2\cos(\alpha)+8\,{\partial_\mu\varphi_2}^2\bar{m}^2\cos(\alpha)+8\,{\partial_\mu\varphi_3}^2\bar{m}^2\cos(\alpha)+8$$
$${\partial_\mu\varphi_4}^2\bar{m}^2\cos(\alpha)+8\,{\partial_\mu\varphi_5}^2\bar{m}^2\cos(\alpha)+8\,{\partial_\mu\varphi_6}^2\bar{m}^2\cos(\alpha)+8\,{\partial_\mu\varphi_7}^2\bar{m}^2\cos(\alpha)+8\,{\partial_\mu\varphi_8}^2\bar{m}^2\cos(\alpha)+4\,{\partial_\mu\varphi_1}^2{m_S}^2+4\,{\partial_\mu\varphi_2}^2{m_S}^2+4$$
$${\partial_\mu\varphi_3}^2{m_S}^2+4\,{\partial_\mu\varphi_4}^2{m_S}^2+4\,{\partial_\mu\varphi_5}^2{m_S}^2+4\,{\partial_\mu\varphi_6}^2{m_S}^2+4\,{\partial_\mu\varphi_7}^2{m_S}^2+4\,{\partial_\mu\varphi_8}^2{m_S}^2$$

In [13]:

```
L5 = (kin[0]*chiS).trace()
L5 = L5.series(e, n+1).truncate().trig_reduce().full_simplify()
print_coeff2(L5)
```

1 :

$$-4\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2\cos(\alpha)^3+4\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2\cos(\alpha)$$

e :

$$12\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2\varphi_2\cos(\alpha)^2\sin(\alpha)-\frac{8}{3}\sqrt{3}\Delta m^2\delta_\mu\partial_\mu\varphi_8\mu_I\cos(\alpha)^3-4\,{\delta_\mu}^2\bar{m}^2{\mu_I}^2\varphi_2\sin(\alpha)-8i\,\Delta m^2\delta_\mu\partial_\mu\varphi_2\mu_I\cos(\alpha)^2\sin(\alpha)+\frac{8}{3}\sqrt{3}\Delta m^2\delta_\mu\partial_\mu\varphi_8\mu_I\cos(\alpha)$$

e^2 :

$$6\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{1}}^{2}\cos\left(\alpha\right)^{3}+18\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{2}}^{2}\cos\left(\alpha\right)^{3}+6\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{3}}^{2}\cos\left(\alpha\right)^{3}+3\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{4}}^{2}\cos\left(\alpha\right)^{3}+3\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{5}}^{2}\cos\left(\alpha\right)^{3}+3$$
$$\delta_{\mu}{}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{6}}^{2}\cos\left(\alpha\right)^{3}+3\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{7}}^{2}\cos\left(\alpha\right)^{3}+\frac{2}{3}\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{8}}^{2}\cos\left(\alpha\right)^{3}-\frac{4}{3}\,\sqrt{3}\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}\varphi_{3}\varphi_{8}\cos\left(\alpha\right)^{2}-\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}{\varphi_{4}}^{2}\cos$$
$$\left(\alpha\right)^{2}+\delta_{\mu}{}^{2}{m_{S}}^{2}{\mu_{I}}^{2}{\varphi_{4}}^{2}\cos\left(\alpha\right)^{2}+4\,{\delta_{\mu}}^{2}\bar{m}^{2}\mu_{I}\mu_{S}{\varphi_{4}}^{2}\cos\left(\alpha\right)^{2}-\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}{\varphi_{5}}^{2}\cos\left(\alpha\right)^{2}+\delta_{\mu}{}^{2}{m_{S}}^{2}{\mu_{I}}^{2}{\varphi_{5}}^{2}\cos\left(\alpha\right)^{2}+4$$
$$\delta_{\mu}{}^{2}\bar{m}^{2}\mu_{I}\mu_{S}{\varphi_{5}}^{2}\cos\left(\alpha\right)^{2}+\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}{\varphi_{6}}^{2}\cos\left(\alpha\right)^{2}+\delta_{\mu}{}^{2}{m_{S}}^{2}{\mu_{I}}^{2}{\varphi_{6}}^{2}\cos\left(\alpha\right)^{2}-4\,{\delta_{\mu}}^{2}\bar{m}^{2}\mu_{I}\mu_{S}{\varphi_{6}}^{2}\cos\left(\alpha\right)^{2}+\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}{\varphi_{7}}^{2}\cos\left(\alpha\right)^{2}$$
$$+\,\delta_{\mu}{}^{2}{m_{S}}^{2}{\mu_{I}}^{2}{\varphi_{7}}^{2}\cos\left(\alpha\right)^{2}-4\,{\delta_{\mu}}^{2}\bar{m}^{2}\mu_{I}\mu_{S}{\varphi_{7}}^{2}\cos\left(\alpha\right)^{2}+\frac{16}{3}\,\sqrt{3}\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{8}\mu_{I}\varphi_{2}\cos\left(\alpha\right)^{2}\sin(\alpha)+\frac{8}{3}\,\sqrt{3}\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{2}\mu_{I}\varphi_{8}\cos$$
$$\left(\alpha\right)^{2}\sin(\alpha)+\frac{8}{3}\,\sqrt{3}\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{8}\mu_{I}\cos\left(\alpha\right)^{2}\varphi_{2}\left(x\right)\sin(\alpha)+\frac{8}{3}\,\sqrt{3}\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{2}\mu_{I}\cos\left(\alpha\right)^{2}\varphi_{8}\left(x\right)\sin(\alpha)-2\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{1}}^{2}\cos(\alpha)-14$$
$$\delta_{\mu}{}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{2}}^{2}\cos(\alpha)-6\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{3}}^{2}\cos(\alpha)-\frac{5}{2}\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{4}}^{2}\cos(\alpha)-2\,\Delta m^{2}{\delta_{\mu}}^{2}\mu_{I}\mu_{S}{\varphi_{4}}^{2}\cos(\alpha)+2\,{\delta_{\mu}}^{2}{m_{S}}^{2}\mu_{I}\mu_{S}{\varphi_{4}}^{2}\cos(\alpha)+2$$
$$\delta_{\mu}{}^{2}\bar{m}^{2}{\mu_{S}}^{2}{\varphi_{4}}^{2}\cos(\alpha)-\frac{5}{2}\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{5}}^{2}\cos(\alpha)-2\,\Delta m^{2}{\delta_{\mu}}^{2}\mu_{I}\mu_{S}{\varphi_{5}}^{2}\cos(\alpha)+2\,{\delta_{\mu}}^{2}{m_{S}}^{2}\mu_{I}\mu_{S}{\varphi_{5}}^{2}\cos(\alpha)+2\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{S}}^{2}{\varphi_{5}}^{2}\cos(\alpha)-\frac{5}{2}$$
$$\delta_{\mu}{}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{6}}^{2}\cos(\alpha)-2\,\Delta m^{2}{\delta_{\mu}}^{2}\mu_{I}\mu_{S}{\varphi_{6}}^{2}\cos(\alpha)-2\,{\delta_{\mu}}^{2}{m_{S}}^{2}\mu_{I}\mu_{S}{\varphi_{6}}^{2}\cos(\alpha)+2\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{S}}^{2}{\varphi_{6}}^{2}\cos(\alpha)-\frac{5}{2}\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{7}}^{2}\cos(\alpha)-2$$
$$\Delta m^{2}{\delta_{\mu}}^{2}\mu_{I}\mu_{S}{\varphi_{7}}^{2}\cos(\alpha)-2\,{\delta_{\mu}}^{2}{m_{S}}^{2}\mu_{I}\mu_{S}{\varphi_{7}}^{2}\cos(\alpha)+2\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{S}}^{2}{\varphi_{7}}^{2}\cos(\alpha)-\frac{2}{3}\,{\delta_{\mu}}^{2}\bar{m}^{2}{\mu_{I}}^{2}{\varphi_{8}}^{2}\cos(\alpha)-16i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{2}\mu_{I}\varphi_{2}\cos$$
$$\left(\alpha\right)^{3}-\frac{8}{3}i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{8}\mu_{I}\varphi_{8}\cos\left(\alpha\right)^{3}-8i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{1}\mu_{I}\cos\left(\alpha\right)^{3}\varphi_{1}\left(x\right)-8i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{2}\mu_{I}\cos\left(\alpha\right)^{3}\varphi_{2}\left(x\right)-8i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{3}\mu_{I}\cos$$
$$\left(\alpha\right)^{3}\varphi_{3}\left(x\right)-4i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\cos\left(\alpha\right)^{3}\varphi_{4}\left(x\right)-4i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\cos\left(\alpha\right)^{3}\varphi_{5}\left(x\right)-4i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\cos\left(\alpha\right)^{3}\varphi_{6}\left(x\right)-4i$$
$$\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\cos\left(\alpha\right)^{3}\varphi_{7}\left(x\right)-\frac{8}{3}i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{8}\mu_{I}\cos\left(\alpha\right)^{3}\varphi_{8}\left(x\right)-4\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\cos\left(\alpha\right)^{2}\varphi_{4}\left(x\right)\sin(\alpha)+4\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\cos$$
$$\left(\alpha\right)^{2}\varphi_{5}\left(x\right)\sin(\alpha)+4\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\cos\left(\alpha\right)^{2}\varphi_{6}\left(x\right)\sin(\alpha)-4\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\cos\left(\alpha\right)^{2}\varphi_{7}\left(x\right)\sin(\alpha)+\frac{4}{3}\,\sqrt{3}\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}\varphi_{3}\varphi_{8}-\frac{8}{3}i$$
$$\sqrt{3}\delta_{\mu}\partial_{\mu}\varphi_{3}\bar{m}^{2}\mu_{I}\varphi_{8}\cos\left(\alpha\right)^{2}+\frac{8}{3}i\,\sqrt{3}\delta_{\mu}\partial_{\mu}\varphi_{1}\bar{m}^{2}\mu_{I}\varphi_{8}\cos(\alpha)\sin(\alpha)+\frac{1}{2}\,\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}{\varphi_{4}}^{2}-\frac{1}{2}\,{\delta_{\mu}}^{2}{m_{S}}^{2}{\mu_{I}}^{2}{\varphi_{4}}^{2}-2\,{\delta_{\mu}}^{2}\bar{m}^{2}\mu_{I}\mu_{S}{\varphi_{4}}^{2}-2$$
$$\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{S}}^{2}{\varphi_{4}}^{2}+2\,{\delta_{\mu}}^{2}{m_{S}}^{2}{\mu_{S}}^{2}{\varphi_{4}}^{2}+\frac{1}{2}\,\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}{\varphi_{5}}^{2}-\frac{1}{2}\,{\delta_{\mu}}^{2}{m_{S}}^{2}{\mu_{I}}^{2}{\varphi_{5}}^{2}-2\,{\delta_{\mu}}^{2}\bar{m}^{2}\mu_{I}\mu_{S}{\varphi_{5}}^{2}-2\,\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{S}}^{2}{\varphi_{5}}^{2}+2$$
$$\delta_{\mu}{}^{2}{m_{S}}^{2}{\mu_{S}}^{2}{\varphi_{5}}^{2}-\frac{1}{2}\,\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}{\varphi_{6}}^{2}-\frac{1}{2}\,{\delta_{\mu}}^{2}{m_{S}}^{2}{\mu_{I}}^{2}{\varphi_{6}}^{2}+2\,{\delta_{\mu}}^{2}\bar{m}^{2}\mu_{I}\mu_{S}{\varphi_{6}}^{2}+2\,\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{S}}^{2}{\varphi_{6}}^{2}+2\,{\delta_{\mu}}^{2}{m_{S}}^{2}{\mu_{S}}^{2}{\varphi_{6}}^{2}-\frac{1}{2}$$
$$\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{I}}^{2}{\varphi_{7}}^{2}-\frac{1}{2}\,{\delta_{\mu}}^{2}{m_{S}}^{2}{\mu_{I}}^{2}{\varphi_{7}}^{2}+2\,{\delta_{\mu}}^{2}\bar{m}^{2}\mu_{I}\mu_{S}{\varphi_{7}}^{2}+2\,\Delta m^{2}{\delta_{\mu}}^{2}{\mu_{S}}^{2}{\varphi_{7}}^{2}+2\,{\delta_{\mu}}^{2}{m_{S}}^{2}{\mu_{S}}^{2}{\varphi_{7}}^{2}-3i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\varphi_{4}\cos\left(\alpha\right)^{2}$$
$$+\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\varphi_{4}\cos\left(\alpha\right)^{2}-i\,\delta_{\mu}\partial_{\mu}\varphi_{4}{m_{S}}^{2}\mu_{I}\varphi_{4}\cos\left(\alpha\right)^{2}-\delta_{\mu}\partial_{\mu}\varphi_{5}{m_{S}}^{2}\mu_{I}\varphi_{4}\cos\left(\alpha\right)^{2}+2\,\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}\mu_{I}\varphi_{4}\cos\left(\alpha\right)^{2}+2i$$
$$\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}{\mu_{S}}\varphi_{4}\cos\left(\alpha\right)^{2}-2\,\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}{\mu_{S}}\varphi_{4}\cos\left(\alpha\right)^{2}-\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\varphi_{5}\cos\left(\alpha\right)^{2}-3i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\varphi_{5}\cos\left(\alpha\right)^{2}$$
$$+\,\delta_{\mu}\partial_{\mu}\varphi_{4}{m_{S}}^{2}\mu_{I}\varphi_{5}\cos\left(\alpha\right)^{2}-i\,\delta_{\mu}\partial_{\mu}\varphi_{5}{m_{S}}^{2}\mu_{I}\varphi_{5}\cos\left(\alpha\right)^{2}-2\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}\mu_{I}\varphi_{5}\cos\left(\alpha\right)^{2}+2\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}{\mu_{S}}\varphi_{5}\cos\left(\alpha\right)^{2}+2i$$
$$\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}{\mu_{S}}\varphi_{5}\cos\left(\alpha\right)^{2}-3i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\varphi_{6}\cos\left(\alpha\right)^{2}+\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\varphi_{6}\cos\left(\alpha\right)^{2}+i\,\delta_{\mu}\partial_{\mu}\varphi_{6}{m_{S}}^{2}\mu_{I}\varphi_{6}\cos\left(\alpha\right)^{2}$$
$$+\,\delta_{\mu}\partial_{\mu}\varphi_{7}{m_{S}}^{2}\mu_{I}\varphi_{6}\cos\left(\alpha\right)^{2}-2\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}\mu_{I}\varphi_{6}\cos\left(\alpha\right)^{2}+2i\,\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}{\mu_{S}}\varphi_{6}\cos\left(\alpha\right)^{2}-2\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}{\mu_{S}}\varphi_{6}\cos\left(\alpha\right)$$
$$-\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\varphi_{7}\cos\left(\alpha\right)^{2}-3i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\varphi_{7}\cos\left(\alpha\right)^{2}-\delta_{\mu}\partial_{\mu}\varphi_{6}{m_{S}}^{2}\mu_{I}\varphi_{7}\cos\left(\alpha\right)^{2}+i\,\delta_{\mu}\partial_{\mu}\varphi_{7}{m_{S}}^{2}\mu_{I}\varphi_{7}\cos\left(\alpha\right)^{2}+2$$
$$\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}\mu_{I}\varphi_{7}\cos\left(\alpha\right)^{2}+2\,\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}{\mu_{S}}\varphi_{7}\cos\left(\alpha\right)^{2}+2i\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}{\mu_{S}}\varphi_{7}\cos\left(\alpha\right)^{2}+i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\varphi_{4}\cos(\alpha)\sin(\alpha)-3$$
$$\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\varphi_{4}\cos(\alpha)\sin(\alpha)-i\,\delta_{\mu}\partial_{\mu}\varphi_{6}{m_{S}}^{2}\mu_{I}\varphi_{4}\cos(\alpha)\sin(\alpha)-\delta_{\mu}\partial_{\mu}\varphi_{7}{m_{S}}^{2}\mu_{I}\varphi_{4}\cos(\alpha)\sin(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}\mu_{I}\varphi_{4}\cos(\alpha)\sin$$
$$\left(\alpha\right)-2i\,\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}{\mu_{S}}\varphi_{4}\cos(\alpha)\sin(\alpha)+2\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}{\mu_{S}}\varphi_{4}\cos(\alpha)\sin(\alpha)+3\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\varphi_{5}\cos(\alpha)\sin(\alpha)+i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\varphi_{5}\cos$$
$$\left(\alpha\right)\sin(\alpha)+\delta_{\mu}\partial_{\mu}\varphi_{6}{m_{S}}^{2}\mu_{I}\varphi_{5}\cos(\alpha)\sin(\alpha)-i\,\delta_{\mu}\partial_{\mu}\varphi_{7}{m_{S}}^{2}\mu_{I}\varphi_{5}\cos(\alpha)\sin(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}\mu_{I}\varphi_{5}\cos(\alpha)\sin(\alpha)-2$$
$$\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}{\mu_{S}}\varphi_{5}\cos(\alpha)\sin(\alpha)-2i\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}{\mu_{S}}\varphi_{5}\cos(\alpha)\sin(\alpha)-i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\varphi_{6}\cos(\alpha)\sin(\alpha)+3\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\varphi_{6}\cos(\alpha)\sin$$
$$\left(\alpha\right)-i\,\delta_{\mu}\partial_{\mu}\varphi_{4}{m_{S}}^{2}\mu_{I}\varphi_{6}\cos(\alpha)\sin(\alpha)-\delta_{\mu}\partial_{\mu}\varphi_{5}{m_{S}}^{2}\mu_{I}\varphi_{6}\cos(\alpha)\sin(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}\mu_{I}\varphi_{6}\cos(\alpha)\sin(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}{\mu_{S}}\varphi_{6}\cos$$
$$\left(\alpha\right)\sin(\alpha)-2\,\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}{\mu_{S}}\varphi_{6}\cos(\alpha)\sin(\alpha)-3\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\varphi_{7}\cos(\alpha)\sin(\alpha)-i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\varphi_{7}\cos(\alpha)\sin(\alpha)$$
$$+\,\delta_{\mu}\partial_{\mu}\varphi_{4}{m_{S}}^{2}\mu_{I}\varphi_{7}\cos(\alpha)\sin(\alpha)-i\,\delta_{\mu}\partial_{\mu}\varphi_{5}{m_{S}}^{2}\mu_{I}\varphi_{7}\cos(\alpha)\sin(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}\mu_{I}\varphi_{7}\cos(\alpha)\sin(\alpha)+2\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}{\mu_{S}}\varphi_{7}\cos(\alpha)\sin$$
$$\left(\alpha\right)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}{\mu_{S}}\varphi_{7}\cos(\alpha)\sin(\alpha)-\frac{8}{3}\,\sqrt{3}\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{8}\mu_{I}\varphi_{2}\sin(\alpha)-\frac{8}{3}\,\sqrt{3}\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{2}\mu_{I}\varphi_{8}\sin(\alpha)-8i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{1}\mu_{I}\varphi_{1}\cos$$
$$\left(\alpha\right)+8i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{2}\mu_{I}\varphi_{2}\cos(\alpha)-i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\varphi_{4}\cos(\alpha)-\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\varphi_{4}\cos(\alpha)-i\,\delta_{\mu}\partial_{\mu}\varphi_{4}{m_{S}}^{2}\mu_{I}\varphi_{4}\cos(\alpha)$$
$$+\,\delta_{\mu}\partial_{\mu}\varphi_{5}{m_{S}}^{2}\mu_{I}\varphi_{4}\cos(\alpha)+i\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}\mu_{I}\varphi_{4}\cos(\alpha)-\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}\mu_{I}\varphi_{4}\cos(\alpha)-2i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{S}\varphi_{4}\cos(\alpha)+2$$
$$\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{S}\varphi_{4}\cos(\alpha)-2i\,\delta_{\mu}\partial_{\mu}\varphi_{4}{m_{S}}^{2}\mu_{S}\varphi_{4}\cos(\alpha)-2\,\delta_{\mu}\partial_{\mu}\varphi_{5}{m_{S}}^{2}\mu_{S}\varphi_{4}\cos(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}{\mu_{S}}\varphi_{4}\cos(\alpha)+2$$
$$\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}{\mu_{S}}\varphi_{4}\cos(\alpha)+\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\varphi_{5}\cos(\alpha)-i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\varphi_{5}\cos(\alpha)-\delta_{\mu}\partial_{\mu}\varphi_{4}{m_{S}}^{2}\mu_{I}\varphi_{5}\cos(\alpha)-i\,\delta_{\mu}\partial_{\mu}\varphi_{5}{m_{S}}^{2}\mu_{I}\varphi_{5}\cos(\alpha)$$
$$+\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}\mu_{I}\varphi_{5}\cos(\alpha)+i\,\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}\mu_{I}\varphi_{5}\cos(\alpha)-2\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{S}\varphi_{5}\cos(\alpha)-2i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{S}\varphi_{5}\cos(\alpha)+2$$
$$\delta_{\mu}\partial_{\mu}\varphi_{4}{m_{S}}^{2}\mu_{S}\varphi_{5}\cos(\alpha)-2i\,\delta_{\mu}\partial_{\mu}\varphi_{5}{m_{S}}^{2}\mu_{S}\varphi_{5}\cos(\alpha)-2\,\delta_{\mu}\partial_{\mu}\varphi_{4}\bar{m}^{2}{\mu_{S}}\varphi_{5}\cos(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{5}\bar{m}^{2}{\mu_{S}}\varphi_{5}\cos(\alpha)-i$$
$$\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\varphi_{6}\cos(\alpha)-\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\varphi_{6}\cos(\alpha)+i\,\delta_{\mu}\partial_{\mu}\varphi_{6}{m_{S}}^{2}\mu_{I}\varphi_{6}\cos(\alpha)-\delta_{\mu}\partial_{\mu}\varphi_{7}{m_{S}}^{2}\mu_{I}\varphi_{6}\cos(\alpha)-i\,\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}\mu_{I}\varphi_{6}\cos(\alpha)$$
$$+\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}\mu_{I}\varphi_{6}\cos(\alpha)+2i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{S}\varphi_{6}\cos(\alpha)-2\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{S}\varphi_{6}\cos(\alpha)-2i\,\delta_{\mu}\partial_{\mu}\varphi_{6}{m_{S}}^{2}\mu_{S}\varphi_{6}\cos(\alpha)-2$$
$$\delta_{\mu}\partial_{\mu}\varphi_{7}{m_{S}}^{2}\mu_{S}\varphi_{6}\cos(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}{\mu_{S}}\varphi_{6}\cos(\alpha)+2\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}{\mu_{S}}\varphi_{6}\cos(\alpha)+\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\varphi_{7}\cos(\alpha)-i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\varphi_{7}\cos$$
$$\left(\alpha\right)+\delta_{\mu}\partial_{\mu}\varphi_{6}{m_{S}}^{2}\mu_{I}\varphi_{7}\cos(\alpha)+i\,\delta_{\mu}\partial_{\mu}\varphi_{7}{m_{S}}^{2}\mu_{I}\varphi_{7}\cos(\alpha)-\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}\mu_{I}\varphi_{7}\cos(\alpha)-i\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}\mu_{I}\varphi_{7}\cos(\alpha)+2$$
$$\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{S}\varphi_{7}\cos(\alpha)+2i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{S}\varphi_{7}\cos(\alpha)+2\,\delta_{\mu}\partial_{\mu}\varphi_{6}{m_{S}}^{2}\mu_{S}\varphi_{7}\cos(\alpha)-2i\,\delta_{\mu}\partial_{\mu}\varphi_{7}{m_{S}}^{2}\mu_{S}\varphi_{7}\cos(\alpha)-2$$
$$\delta_{\mu}\partial_{\mu}\varphi_{6}\bar{m}^{2}{\mu_{S}}\varphi_{7}\cos(\alpha)+2i\,\delta_{\mu}\partial_{\mu}\varphi_{7}\bar{m}^{2}{\mu_{S}}\varphi_{7}\cos(\alpha)+\frac{8}{3}i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{8}\mu_{I}\varphi_{8}\cos(\alpha)+8i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{1}\mu_{I}\cos(\alpha)\varphi_{1}\left(x\right)+8i$$
$$\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{2}\mu_{I}\cos(\alpha)\varphi_{2}\left(x\right)+8i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{3}\mu_{I}\cos(\alpha)\varphi_{3}\left(x\right)+4i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{4}\mu_{I}\cos(\alpha)\varphi_{4}\left(x\right)+4i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{5}\mu_{I}\cos(\alpha)\varphi_{5}\left(x\right)$$
$$+\,4i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{6}\mu_{I}\cos(\alpha)\varphi_{6}\left(x\right)+4i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\cos(\alpha)\varphi_{7}\left(x\right)+\frac{8}{3}i\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{8}\mu_{I}\cos(\alpha)\varphi_{8}\left(x\right)+2\,\Delta m^{2}\delta_{\mu}\partial_{\mu}\varphi_{7}\mu_{I}\varphi_{4}\sin(\alpha)$$

$$+ i\,\delta_\mu\partial_\mu\varphi_6\bar{m}^2\mu_I\varphi_4\sin(\alpha) + \delta_\mu\partial_\mu\varphi_7\bar{m}^2\mu_I\varphi_4\sin(\alpha) + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_6\mu_S\varphi_4\sin(\alpha) - 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_7\mu_S\varphi_4\sin(\alpha) - 2i$$
$$\delta_\mu\partial_\mu\varphi_6{m_S}^2\mu_S\varphi_4\sin(\alpha) - 2\,\delta_\mu\partial_\mu\varphi_7{m_S}^2\mu_S\varphi_4\sin(\alpha) - 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_6\mu_I\varphi_5\sin(\alpha) - \delta_\mu\partial_\mu\varphi_6\bar{m}^2\mu_I\varphi_5\sin(\alpha) + i\,\delta_\mu\partial_\mu\varphi_7\bar{m}^2\mu_I\varphi_5\sin(\alpha)$$
$$+ 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_6\mu_S\varphi_5\sin(\alpha) + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_7\mu_S\varphi_5\sin(\alpha) + 2\,\delta_\mu\partial_\mu\varphi_6{m_S}^2\mu_S\varphi_5\sin(\alpha) - 2i\,\delta_\mu\partial_\mu\varphi_7{m_S}^2\mu_S\varphi_5\sin(\alpha) - 2$$
$$\Delta m^2\delta_\mu\partial_\mu\varphi_5\mu_I\varphi_6\sin(\alpha) + i\,\delta_\mu\partial_\mu\varphi_4\bar{m}^2\mu_I\varphi_6\sin(\alpha) + \delta_\mu\partial_\mu\varphi_5\bar{m}^2\mu_I\varphi_6\sin(\alpha) + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_4\mu_S\varphi_6\sin(\alpha) - 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_5\mu_S\varphi_6\sin$$
$$(\alpha) + 2i\,\delta_\mu\partial_\mu\varphi_4{m_S}^2\mu_S\varphi_6\sin(\alpha) + 2\,\delta_\mu\partial_\mu\varphi_5{m_S}^2\mu_S\varphi_6\sin(\alpha) + 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_4\mu_I\varphi_7\sin(\alpha) - \delta_\mu\partial_\mu\varphi_4\bar{m}^2\mu_I\varphi_7\sin(\alpha) + i$$
$$\delta_\mu\partial_\mu\varphi_5\bar{m}^2\mu_I\varphi_7\sin(\alpha) + 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_4\mu_S\varphi_7\sin(\alpha) + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_5\mu_S\varphi_7\sin(\alpha) - 2\,\delta_\mu\partial_\mu\varphi_4{m_S}^2\mu_S\varphi_7\sin(\alpha) + 2i$$
$$\delta_\mu\partial_\mu\varphi_5{m_S}^2\mu_S\varphi_7\sin(\alpha) + \frac{8}{3}i\,\sqrt{3}\delta_\mu\partial_\mu\varphi_3\bar{m}^2\mu_I\varphi_8 + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_4\mu_I\varphi_4 + i\,\delta_\mu\partial_\mu\varphi_4\bar{m}^2\mu_I\varphi_4 - \delta_\mu\partial_\mu\varphi_5\bar{m}^2\mu_I\varphi_4 - 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_4\mu_S\varphi_4$$
$$- 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_5\mu_S\varphi_4 - 2i\,\delta_\mu\partial_\mu\varphi_4{m_S}^2\mu_S\varphi_4 + 2\,\delta_\mu\partial_\mu\varphi_5{m_S}^2\mu_S\varphi_4 + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_5\mu_I\varphi_5 + \delta_\mu\partial_\mu\varphi_4\bar{m}^2\mu_I\varphi_5 + i\,\delta_\mu\partial_\mu\varphi_5\bar{m}^2\mu_I\varphi_5 + 2$$
$$\Delta m^2\delta_\mu\partial_\mu\varphi_4\mu_S\varphi_5 - 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_5\mu_S\varphi_5 - 2\,\delta_\mu\partial_\mu\varphi_4{m_S}^2\mu_S\varphi_5 - 2i\,\delta_\mu\partial_\mu\varphi_5{m_S}^2\mu_S\varphi_5 + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_6\mu_I\varphi_6 - i\,\delta_\mu\partial_\mu\varphi_6\bar{m}^2\mu_I\varphi_6$$
$$+ \delta_\mu\partial_\mu\varphi_7\bar{m}^2\mu_I\varphi_6 + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_6\mu_S\varphi_6 + 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_7\mu_S\varphi_6 - 2i\,\delta_\mu\partial_\mu\varphi_6{m_S}^2\mu_S\varphi_6 + 2\,\delta_\mu\partial_\mu\varphi_7{m_S}^2\mu_S\varphi_6 + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_7\mu_I\varphi_7$$
$$- \delta_\mu\partial_\mu\varphi_6\bar{m}^2\mu_I\varphi_7 - i\,\delta_\mu\partial_\mu\varphi_7\bar{m}^2\mu_I\varphi_7 - 2\,\Delta m^2\delta_\mu\partial_\mu\varphi_6\mu_S\varphi_7 + 2i\,\Delta m^2\delta_\mu\partial_\mu\varphi_7\mu_S\varphi_7 - 2\,\delta_\mu\partial_\mu\varphi_6{m_S}^2\mu_S\varphi_7 - 2i\,\delta_\mu\partial_\mu\varphi_7{m_S}^2\mu_S\varphi_7 + 4$$
$$\partial_\mu{\varphi_1}^2\bar{m}^2\cos(\alpha) + 4\,\partial_\mu{\varphi_2}^2\bar{m}^2\cos(\alpha) + 4\,\partial_\mu{\varphi_3}^2\bar{m}^2\cos(\alpha) + 2\,\partial_\mu{\varphi_4}^2\bar{m}^2\cos(\alpha) + 2\,\partial_\mu{\varphi_5}^2\bar{m}^2\cos(\alpha) + 2\,\partial_\mu{\varphi_6}^2\bar{m}^2\cos(\alpha) + 2$$
$$\partial_\mu{\varphi_7}^2\bar{m}^2\cos(\alpha) + \frac{4}{3}\,\partial_\mu{\varphi_8}^2\bar{m}^2\cos(\alpha) - \frac{8}{3}\,\sqrt{3}\Delta m^2\partial_\mu\varphi_3\partial_\mu\varphi_8 - 2\,\Delta m^2\partial_\mu{\varphi_4}^2 - 2\,\Delta m^2\partial_\mu{\varphi_5}^2 + 2\,\Delta m^2\partial_\mu{\varphi_6}^2 + 2\,\Delta m^2\partial_\mu{\varphi_7}^2 + 2$$
$$\partial_\mu{\varphi_4}^2{m_S}^2 + 2\,\partial_\mu{\varphi_5}^2{m_S}^2 + 2\,\partial_\mu{\varphi_6}^2{m_S}^2 + 2\,\partial_\mu{\varphi_7}^2{m_S}^2 + \frac{8}{3}\,\partial_\mu{\varphi_8}^2{m_S}^2$$

In [14]:
```
H1 = (chi*chi.T).trace().expand()
pprint(H1)
```

$$2\,\Delta m^4 + {m_S}^4 + 2\,\bar{m}^4$$

In [ ]: