```
In[268]:= MQF[f_] := {{
             1, 0}, {
             1/f, 1}}
          MQD[f_] := {{
             1, 0}, {
             -1/f, 1}}
          MDrift[s_] := {{
             1, s}, {
             0, 1}}

          MFodoHalfx[fQF_, fQD_, s1_, s2_] := MQF[fQF].MDrift[s1].MQD[fQD].MDrift[s2]
          MFodox[fQF_, fQD_, s1_, s2_] := MFodoHalfx[fQF, fQD, s1, s2].MFodoHalfx[fQF, fQD, s1, s2]
          MFodoHalfy[fQF_, fQD_, s1_, s2_] := MQD[fQD].MDrift[s1].MQF[fQF].MDrift[s2]
          MFodoy[fQF_, fQD_, s1_, s2_] := MFodoHalfy[fQF, fQD, s1, s2].MFodoHalfy[fQF, fQD, s1, s2]
          gamma[alpha_, beta_] := (1 + alpha^2) / beta
          Mbeta0[alpha_, beta_] := {{
             beta, -alpha},
            {-alpha, gamma[alpha, beta]
            }}
          MbetaHalfx[fQF_, fQD_, s1_, s2_, alpha_, beta_] :=
           (MFodoHalfx[fQF, fQD, s1, s2].Mbeta0[alpha, beta]).
            Transpose[MFodoHalfx[fQF, fQD, s1, s2]]
          Mbetax[fQF_, fQD_, s1_, s2_, alpha_, beta_] :=
           MFodox[fQF, fQD, s1, s2].Mbeta0[alpha, beta].Transpose[MFodox[fQF, fQD, s1, s2]]
          MbetaHalfy[fQF_, fQD_, s1_, s2_, alpha_, beta_] :=
           (MFodoHalfy[fQF, fQD, s1, s2].Mbeta0[alpha, beta]).
            Transpose[MFodoHalfy[fQF, fQD, s1, s2]]
          Mbetay[fQF_, fQD_, s1_, s2_, alpha_, beta_] :=
           MFodoy[fQF, fQD, s1, s2].Mbeta0[alpha, beta].Transpose[MFodoy[fQF, fQD, s1, s2]]

          alpha0 = 0;
          alphaHalf = 0;
          alphaEnd = 0;
          MbetaHalfx[fQF, fQD, s1, s2, alpha0, beta0]
          Solve[MbetaHalfx[fQF, fQD, s1, s2, alpha0, beta0] ==
            {{betaStar, 0}, {0, 1/betaStar}}, {fQF, fQD}]
          ChromX = 1/(4 * Pi) * (1/fQF * beta0 - 1/fQD * (beta0 + s1 ** 2/beta0))
```

Out[284]=
$$\left\{\left\{\text{beta0}\left(1-\frac{\text{s1}}{\text{fQD}}\right)^2+\frac{\left(\text{s1}+\left(1-\frac{\text{s1}}{\text{fQD}}\right)\text{s2}\right)^2}{\text{beta0}},\right.\right.$$
$$\left.\text{beta0}\left(1-\frac{\text{s1}}{\text{fQD}}\right)\left(\frac{1}{\text{fQF}}-\frac{1+\frac{\text{s1}}{\text{fQF}}}{\text{fQD}}\right)+\frac{\left(\text{s1}+\left(1-\frac{\text{s1}}{\text{fQD}}\right)\text{s2}\right)\left(1+\frac{\text{s1}}{\text{fQF}}+\left(\frac{1}{\text{fQF}}-\frac{1+\frac{\text{s1}}{\text{fQF}}}{\text{fQD}}\right)\text{s2}\right)}{\text{beta0}}\right\},$$
$$\left\{\text{beta0}\left(1-\frac{\text{s1}}{\text{fQD}}\right)\left(\frac{1}{\text{fQF}}-\frac{1+\frac{\text{s1}}{\text{fQF}}}{\text{fQD}}\right)+\frac{\left(\text{s1}+\left(1-\frac{\text{s1}}{\text{fQD}}\right)\text{s2}\right)\left(1+\frac{\text{s1}}{\text{fQF}}+\left(\frac{1}{\text{fQF}}-\frac{1+\frac{\text{s1}}{\text{fQF}}}{\text{fQD}}\right)\text{s2}\right)}{\text{beta0}},\right.$$
$$\left.\left.\text{beta0}\left(\frac{1}{\text{fQF}}-\frac{1+\frac{\text{s1}}{\text{fQF}}}{\text{fQD}}\right)^2+\frac{\left(1+\frac{\text{s1}}{\text{fQF}}+\left(\frac{1}{\text{fQF}}-\frac{1+\frac{\text{s1}}{\text{fQF}}}{\text{fQD}}\right)\text{s2}\right)^2}{\text{beta0}}\right\}\right\}$$

Out[285]=
$$\left\{\left\{\text{fQF}\to\left(-\text{beta0}^2\,\text{betaStar s1}+\text{beta0 betaStar}^2\,\text{s1}-\text{betaStar s1}^2\,\text{s2}-\right.\right.\right.$$
$$\text{betaStar s1 s2}^2+\frac{\text{beta0}^4\,\text{betaStar s1}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}-$$
$$\frac{\text{beta0}^3\,\text{betaStar}^2\,\text{s1}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}+$$
$$\frac{\text{beta0}^2\,\text{betaStar s1}^3}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}+$$
$$\frac{3\,\text{beta0}^2\,\text{betaStar s1}^2\,\text{s2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}-$$
$$\frac{\text{beta0 betaStar}^2\,\text{s1}^2\,\text{s2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}+$$
$$\frac{\text{betaStar s1}^4\,\text{s2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}+$$
$$\frac{2\,\text{beta0}^2\,\text{betaStar s1 s2}^2}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}-$$
$$\frac{\text{beta0 betaStar}^2\,\text{s1 s2}^2}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}+$$
$$\frac{3\,\text{betaStar s1}^3\,\text{s2}^2}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}+$$
$$\frac{3\,\text{betaStar s1}^2\,\text{s2}^3}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}+$$
$$\frac{\text{betaStar s1 s2}^4}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}-$$
$$\frac{\text{beta0}^2\,\text{betaStar}\sqrt{\text{beta0}^3\,\text{betaStar s1}^2-\text{beta0}^2\,\text{s1}^4+\text{beta0 betaStar s1}^2\,\text{s2}^2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}+$$
$$\frac{\text{beta0 betaStar}^2\sqrt{\text{beta0}^3\,\text{betaStar s1}^2-\text{beta0}^2\,\text{s1}^4+\text{beta0 betaStar s1}^2\,\text{s2}^2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}-$$
$$\frac{\text{betaStar s1}^2\sqrt{\text{beta0}^3\,\text{betaStar s1}^2-\text{beta0}^2\,\text{s1}^4+\text{beta0 betaStar s1}^2\,\text{s2}^2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}-$$
$$\frac{2\,\text{betaStar s1 s2}\sqrt{\text{beta0}^3\,\text{betaStar s1}^2-\text{beta0}^2\,\text{s1}^4+\text{beta0 betaStar s1}^2\,\text{s2}^2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}-$$
$$\left.\frac{\text{betaStar s2}^2\sqrt{\text{beta0}^3\,\text{betaStar s1}^2-\text{beta0}^2\,\text{s1}^4+\text{beta0 betaStar s1}^2\,\text{s2}^2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}\right)\Big/$$
$$\left(\text{beta0}^2\,\text{betaStar}-\text{beta0 betaStar}^2-\text{beta0 s1}^2+\text{betaStar s2}^2\right),\ \text{fQD}\to$$
$$\left.\frac{\text{beta0}^2\,\text{s1}+\text{s1}^2\,\text{s2}+\text{s1 s2}^2-\sqrt{\text{beta0}^3\,\text{betaStar s1}^2-\text{beta0}^2\,\text{s1}^4+\text{beta0 betaStar s1}^2\,\text{s2}^2}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}\right\},$$
$$\left\{\text{fQF}\to\left(-\text{beta0}^2\,\text{betaStar s1}+\text{beta0 betaStar}^2\,\text{s1}-\text{betaStar s1}^2\,\text{s2}-\right.\right.$$
$$\text{betaStar s1 s2}^2+\frac{\text{beta0}^4\,\text{betaStar s1}}{\text{beta0}^2-\text{beta0 betaStar}+\text{s1}^2+2\,\text{s1 s2}+\text{s2}^2}-$$

$$\frac{\mathrm{beta0}^3\ \mathrm{betaStar}^2\ \mathrm{s1}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{\mathrm{beta0}^2\ \mathrm{betaStar}\ \mathrm{s1}^3}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{3\ \mathrm{beta0}^2\ \mathrm{betaStar}\ \mathrm{s1}^2\ \mathrm{s2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}-$$

$$\frac{\mathrm{beta0}\ \mathrm{betaStar}^2\ \mathrm{s1}^2\ \mathrm{s2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{\mathrm{betaStar}\ \mathrm{s1}^4\ \mathrm{s2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{2\ \mathrm{beta0}^2\ \mathrm{betaStar}\ \mathrm{s1}\ \mathrm{s2}^2}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}-$$

$$\frac{\mathrm{beta0}\ \mathrm{betaStar}^2\ \mathrm{s1}\ \mathrm{s2}^2}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{3\ \mathrm{betaStar}\ \mathrm{s1}^3\ \mathrm{s2}^2}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{3\ \mathrm{betaStar}\ \mathrm{s1}^2\ \mathrm{s2}^3}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{\mathrm{betaStar}\ \mathrm{s1}\ \mathrm{s2}^4}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{\mathrm{beta0}^2\ \mathrm{betaStar}\ \sqrt{\mathrm{beta0}^3\ \mathrm{betaStar}\ \mathrm{s1}^2-\mathrm{beta0}^2\ \mathrm{s1}^4+\mathrm{beta0}\ \mathrm{betaStar}\ \mathrm{s1}^2\ \mathrm{s2}^2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}-$$

$$\frac{\mathrm{beta0}\ \mathrm{betaStar}^2\ \sqrt{\mathrm{beta0}^3\ \mathrm{betaStar}\ \mathrm{s1}^2-\mathrm{beta0}^2\ \mathrm{s1}^4+\mathrm{beta0}\ \mathrm{betaStar}\ \mathrm{s1}^2\ \mathrm{s2}^2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{\mathrm{betaStar}\ \mathrm{s1}^2\ \sqrt{\mathrm{beta0}^3\ \mathrm{betaStar}\ \mathrm{s1}^2-\mathrm{beta0}^2\ \mathrm{s1}^4+\mathrm{beta0}\ \mathrm{betaStar}\ \mathrm{s1}^2\ \mathrm{s2}^2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\frac{2\ \mathrm{betaStar}\ \mathrm{s1}\ \mathrm{s2}\ \sqrt{\mathrm{beta0}^3\ \mathrm{betaStar}\ \mathrm{s1}^2-\mathrm{beta0}^2\ \mathrm{s1}^4+\mathrm{beta0}\ \mathrm{betaStar}\ \mathrm{s1}^2\ \mathrm{s2}^2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}+$$

$$\left.\frac{\mathrm{betaStar}\ \mathrm{s2}^2\ \sqrt{\mathrm{beta0}^3\ \mathrm{betaStar}\ \mathrm{s1}^2-\mathrm{beta0}^2\ \mathrm{s1}^4+\mathrm{beta0}\ \mathrm{betaStar}\ \mathrm{s1}^2\ \mathrm{s2}^2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}\right)\Big/$$

$$\left(\mathrm{beta0}^2\ \mathrm{betaStar}-\mathrm{beta0}\ \mathrm{betaStar}^2-\mathrm{beta0}\ \mathrm{s1}^2+\mathrm{betaStar}\ \mathrm{s2}^2\right),\ \mathrm{fQD}\to$$

$$\left.\frac{\mathrm{beta0}^2\ \mathrm{s1}+\mathrm{s1}^2\ \mathrm{s2}+\mathrm{s1}\ \mathrm{s2}^2+\sqrt{\mathrm{beta0}^3\ \mathrm{betaStar}\ \mathrm{s1}^2-\mathrm{beta0}^2\ \mathrm{s1}^4+\mathrm{beta0}\ \mathrm{betaStar}\ \mathrm{s1}^2\ \mathrm{s2}^2}}{\mathrm{beta0}^2-\mathrm{beta0}\ \mathrm{betaStar}+\mathrm{s1}^2+2\ \mathrm{s1}\ \mathrm{s2}+\mathrm{s2}^2}\right\}\right\}$$

Out[286]= $$\frac{\frac{\mathrm{beta0}}{\mathrm{fQF}}-\frac{\mathrm{beta0}+\frac{\mathrm{s1**2}}{\mathrm{beta0}}}{\mathrm{fQD}}}{4\,\pi}$$

$$\left\{\left\{\mathrm{Cos}[\mathrm{omega}]^2\ \mathrm{Cosh}[\mathrm{omega}],\ \frac{\mathrm{l}^2\ \mathrm{Sin}[\mathrm{omega}]^2\ \mathrm{Sinh}[\mathrm{omega}]}{\mathrm{Abs}[\mathrm{k}]^{3/2}},\ 0,\ 0\right\},\right.$$

$$\left\{0,\ \mathrm{Cos}[\mathrm{omega}]^2\ \mathrm{Cosh}[\mathrm{omega}],\ 0,\ 0\right\},$$

$$\left\{0,\ 0,\ \mathrm{Cos}[\mathrm{omega}]\ \mathrm{Cosh}[\mathrm{omega}]^2,\ \frac{\mathrm{l}^2\ \mathrm{Sin}[\mathrm{omega}]\ \mathrm{Sinh}[\mathrm{omega}]^2}{\mathrm{Abs}[\mathrm{k}]^{3/2}}\right\},$$

$$\left.\left\{0,\ 0,\ 0,\ \mathrm{Cos}[\mathrm{omega}]\ \mathrm{Cosh}[\mathrm{omega}]^2\right\}\right\}$$