

```

In[754]:= Block[{A0, A1, A2, A3, Abtm, Atop, Aτ,
  M1, M2, κ0, κ1, κ2, κ3, σS, MD, ME, ML, MN, MQ, MU, Rsc},
  $MinPrecision = prec;
  A0 = SetPrecision[TeV, prec];
  A1[i_] := SetPrecision[TeV, prec];
  A2 = SetPrecision[TeV, prec];
  A3 = SetPrecision[1 GeV, prec];
  Aτ = SetPrecision[TeV, prec];
  Abtm = SetPrecision[TeV, prec];
  Atop = SetPrecision[TeV, prec];
  κ0 = SetPrecision[0.4, prec];
  κ1[i_] := SetPrecision[10^-6, prec];
  κ2 = SetPrecision[0.5, prec];
  κ3 = SetPrecision[0.6, prec];
  M1 = SetPrecision[350 GeV, prec];
  M2 = SetPrecision[500 GeV, prec];
  σS = SetPrecision[TeV, prec];
  MD[3, 3] = MU[3, 3] = MQ[3, 3] = SetPrecision[TeV, prec];
  ME[3, 3] = SetPrecision[TeV, prec];
  MN[3, 3] = SetPrecision[TeV, prec];
  ML[1, 1] = ML[2, 2] = ML[3, 3] = SetPrecision[TeV, prec];
  ML[1, 2] = ML[1, 3] = ML[2, 3] = SetPrecision[500 GeV, prec];
  Rsc = SetPrecision[500 GeV, prec];
  {valsNe, vecsNe} = Eigensystem[TE3 + TE31];
  {valsNo, vecsNo} = Eigensystem[TO3 + TO31];
  {valSC, vecSC} = Eigensystem[TC3 + TC31];
  valFN = Sqrt[Eigenvalues[Mnχ.Transpose[Conjugate[Mnχ]]]];
  vecFN = Inverse[Transpose[Eigenvectors[Mnχ.Transpose[Conjugate[Mnχ]]]]];
  valFC = Sqrt[Eigenvalues[Conjugate[McχT].Mcχ]];
  vecFCu = Conjugate[Inverse[Transpose[Eigenvectors[Mcχ.Conjugate[McχT]]]]];
  vecFCv = Inverse[Transpose[Eigenvectors[Conjugate[McχT].Mcχ]]];
  $MinPrecision = 0;
  {Im[{N[Sqrt[valsNe] * 10^-9, 4], N[Sqrt[valsNo] * 10^-9, 4]]} // Chop
]

```

```

Out[754]= {{{0, 0, 0, 0, 0, 0, 0}, {0, 0, 0, 0, 0, 0, 0}}}

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In[755]:= Chop[N[vecsNe^2, 2], 0.01] // MatrixForm

```

```

Out[755]//MatrixForm=

```

$$\begin{pmatrix} 0.99 & 0.0099 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.028 & 0.028 & 0.028 & 0.92 \\ 0 & 0 & 0 & 0.31 & 0.31 & 0.31 & 0.083 \\ 0 & 0 & 0 & 0.67 & 0.17 & 0.17 & 0 \\ 0 & 0 & 0 & 0 & 0.50 & 0.50 & 0 \\ 0 & 0 & 1.0 & 0 & 0 & 0 & 0 \\ 0 & 0.99 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

```

In[756]:= N[Sqrt[valsNe] * 10^-9, 4] // Chop

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Out[756]= {3384., 1578., 1185., 863.6, 863.6, 599.9, 132.4}

```

```

In[757]:= Chop[N[vecsNo^2, 2], 0.01] // MatrixForm

```

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Out[757]//MatrixForm=

```

$$\begin{pmatrix} 0.99 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.32 & 0.32 & 0.32 & 0.041 \\ 0 & 0 & 0 & 0 & 0.50 & 0.50 & 0 \\ 0 & 0 & 0 & 0.67 & 0.17 & 0.17 & 0 \\ 0 & 0 & 0 & 0.014 & 0.014 & 0.014 & 0.96 \\ 0 & 0 & 1.0 & 0 & 0 & 0 & 0 \\ 0 & 0.99 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

```

In[758]:= N[Sqrt[valsNo] * 10^-9, 4] // Chop

```

```

Out[758]= {3383., 1248., 863.6, 863.6, 197.2, 37.34, 0}

```

In[759]:= **Chop[N[vecSC^2, 2], 0.01] // MatrixForm**

Out[759]//MatrixForm=

$$\begin{pmatrix} 0.99 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.33 & 0.33 & 0.33 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1.0 \\ 0 & 0 & 0.50 & 0.50 & 0 & 0 \\ 0 & 0 & 0.17 & 0.17 & 0.67 & 0 \\ 0 & 0.99 & 0 & 0 & 0 & 0 \end{pmatrix}$$

In[760]:= **N[Sqrt[valSC] \* 10^-9, 4] // Chop**

Out[760]= {3383., 1226., 1001., 867.3, 867.1, 0}

In[761]:= **N[valFC \* 10^-9, 4] // Chop**

Out[761]= {532.7, 373.0, 1.777, 0, 0}

In[762]:= **Chop[N[vecFN^2, 2], 0.01] // MatrixForm**

Out[762]//MatrixForm=

$$\begin{pmatrix} 0 & 0.012 & 0.039 & 0.018 & 0.93 & 0 & 0 & 0 & 0 \\ 0 & 0.80 & 0.052 & 0.10 & 0.038 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1.0 \\ 0 & 0 & 0.49 & 0.50 & 0 & 0 & 0 & 0 & 0 \\ 0.38 & 0.14 & 0.22 & 0.23 & 0.019 & 0 & 0 & 0 & 0 \\ 0.61 & 0.039 & 0.19 & 0.15 & 0.010 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.33 & 0.33 & 0.33 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.67 & 0.17 & 0.17 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.50 & 0.50 & 0 \end{pmatrix}$$

In[763]:= **N[valFN \* 10^-9, 4] // Chop**

Out[763]= {613.3, 530.2, 500.0, 406.8, 387.5, 325.7,  $1.799 \times 10^{-10}$ , 0, 0}