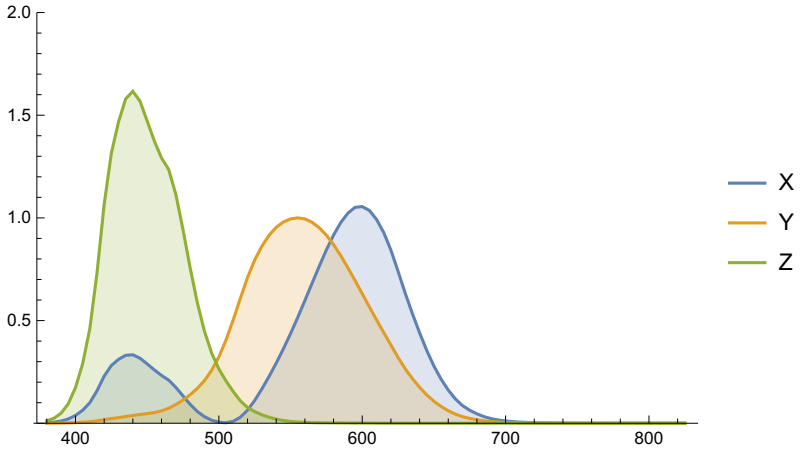
In[2]:=
```
{λ, x, y, z} =
  Import["/mnt/BC4A45D34A458B5A/Dev/mathematica_notebooks/Others/ciexyzjv.csv"]ᵀ;
xyzCieTabPlot = ListLinePlot[{{λ, x}ᵀ, {λ, y}ᵀ, {λ, z}ᵀ},
  PlotLegends → {"X", "Y", "Z"}, PlotRange → {0, 2}, Filling → Axis]
λ //
 N
```

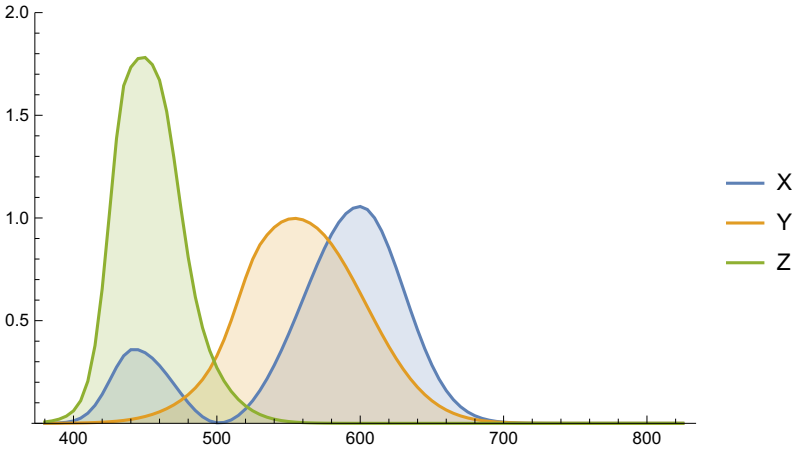
Out[3]=



Out[4]=
```
{380., 385., 390., 395., 400., 405., 410., 415., 420., 425., 430., 435., 440., 445., 450.,
 455., 460., 465., 470., 475., 480., 485., 490., 495., 500., 505., 510., 515., 520., 525.,
 530., 535., 540., 545., 550., 555., 560., 565., 570., 575., 580., 585., 590., 595., 600.,
 605., 610., 615., 620., 625., 630., 635., 640., 645., 650., 655., 660., 665., 670., 675.,
 680., 685., 690., 695., 700., 705., 710., 715., 720., 725., 730., 735., 740., 745., 750.,
 755., 760., 765., 770., 775., 780., 785., 790., 795., 800., 805., 810., 815., 820., 825.}
```

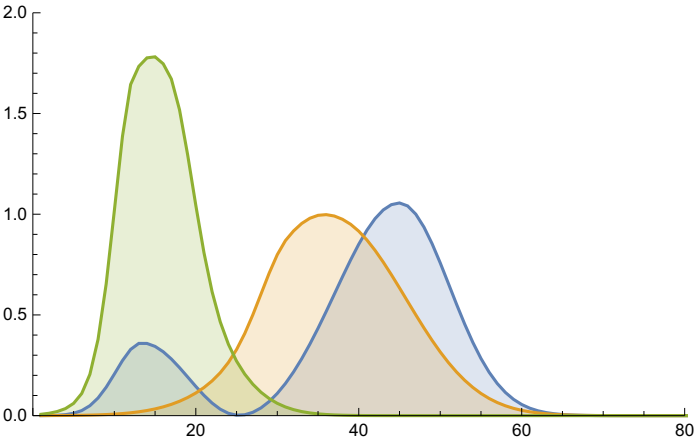
In[5]:=
```
xFit1931[wave_Real] := Block[{t1, t2, t3},
   t1 = (wave - 442.0) * If[wave < 442.0, 0.0624, 0.0374];
   t2 = (wave - 599.8) * If[wave < 599.8, 0.0264, 0.0323];
   t3 = (wave - 501.1) * If[wave < 501.1, 0.0490, 0.0382];
   0.362 Exp[-0.5 * t1 * t1] + 1.056 Exp[-0.5 * t2 * t2] - 0.065 * Exp[-0.5 * t3 * t3]
  ];
yFit1931[wave_Real] := Block[{t1, t2},
   t1 = (wave - 568.8) * If[wave < 568.8, 0.0213, 0.0247];
   t2 = (wave - 530.9) * If[wave < 530.9, 0.0613, 0.0322];
   0.821 Exp[-0.5 * t1 * t1] + 0.286 Exp[-0.5 * t2 * t2]
  ];
zFit1931[wave_Real] := Block[{t1, t2},
   t1 = (wave - 437.0) * If[wave < 437.0, 0.0845, 0.0278];
   t2 = (wave - 459.0) * If[wave < 459.0, 0.0385, 0.0725];
   1.217 Exp[-0.5 * t1 * t1] + 0.681 Exp[-0.5 * t2 * t2]
  ];

SetAttributes[{xFit1931, yFit1931, zFit1931}, Listable];
xx = Map[xFit1931, λ];
yy = Map[yFit1931, λ];
zz = Map[zFit1931, λ];
ListLinePlot[{{λ, xx}ᵀ, {λ, yy}ᵀ, {λ, zz}ᵀ},
 PlotLegends → {"X", "Y", "Z"}, PlotRange → {0, 2}, Filling → Axis]
```

Out[12]=



In[13]:=
```
ListLinePlot[Through[{xFit1931, yFit1931, zFit1931}[λ]],
 Filling → Axis, PlotRange → {{0, 80}, {0, 2}}]
```

Out[13]=



In[14]:=
```
(*Piecewise fit*)
SetAttributes[{cieX, cieY, cieZ}, Listable];
cieX[λ_] :=
 {0.362, 1.056, -0.065}.Exp[-MapThread[(λ - #1) Piecewise[{{#2, λ < #1}, {#3, True}}] &,
       {{442.0, 599.8, 501.1}, {0.0624, 0.0264, 0.0490}, {0.0374, 0.0323, 0.0382}}]^2 / 2]

cieY[λ_] := {0.821, 0.286}.
  Exp[-MapThread[(λ - #1) Piecewise[{{#2, λ < #1}, {#3, True}}] &, {{568.8, 530.9},
       {0.0213, 0.0613}, {0.0247, 0.0322}}]^2 / 2]

cieZ[λ_] := {1.217, 0.681}.Exp[-MapThread[(λ - #1) Piecewise[{{#2, λ < #1}, {#3, True}}] &,
       {{437.0, 459.0}, {0.0845, 0.0385}, {0.0278, 0.0725}}]^2 / 2]
```

In[18]:=
```
xxx = Map[cieX, λ]; yyy = Map[cieY, λ]; zzz = Map[cieZ, λ];
```

In[19]:=
```
xSE = Power[(x - xxx), 2]; ySE = Power[(y - yyy), 2]; zSE = Power[(z - zzz), 2];
xMSE = Mean[xSE]
yMSE = Mean[ySE]
zMSE = Mean[zSE]
Mean[{xMSE, yMSE, zMSE}] // ScientificForm
```

Out[20]= 0.000448017

Out[21]= 0.0000284617

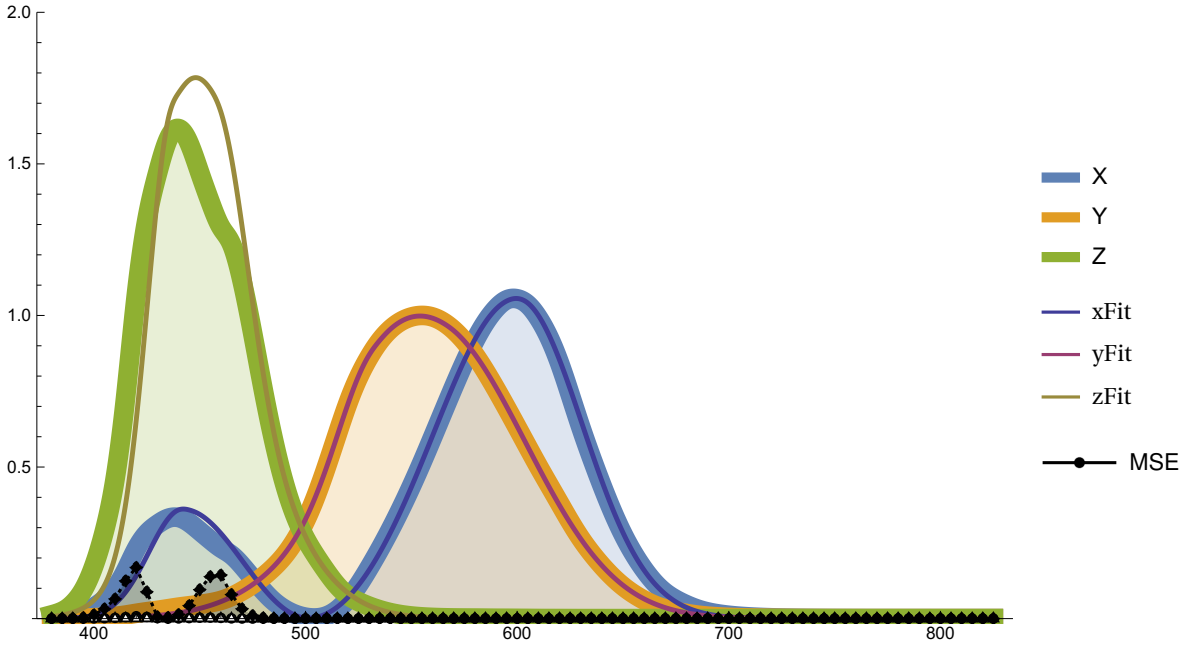
Out[22]= 0.01191

Out[23]//ScientificForm=

4.12883×10^{-3}

In[24]:=
```
Show[
 ListLinePlot[{{λ, x}^T, {λ, y}^T, {λ, z}^T}, PlotLegends → {"X", "Y", "Z"}, PlotRange → {0, 2},
  Filling → Axis, PlotStyle → Directive[Thickness[0.02]], InterpolationOrder → 3],
 ListLinePlot[{{λ, xxx}^T, {λ, yyy}^T, {λ, zzz}^T}, PlotRange → {0, 2},
  PlotStyle → Directive[Thickness[0.005]], PlotTheme → "Classic",
  InterpolationOrder → 3, PlotLegends → {"xFit", "yFit", "zFit"}],
 ListLinePlot[{{λ, xSE}^T, {λ, ySE}^T, {λ, zSE}^T}, PlotRange → {0, 2},
  Filling → Axis, PlotTheme → "Monochrome", PlotLegends → {"MSE"}]
 , ImageSize -> Large]
```

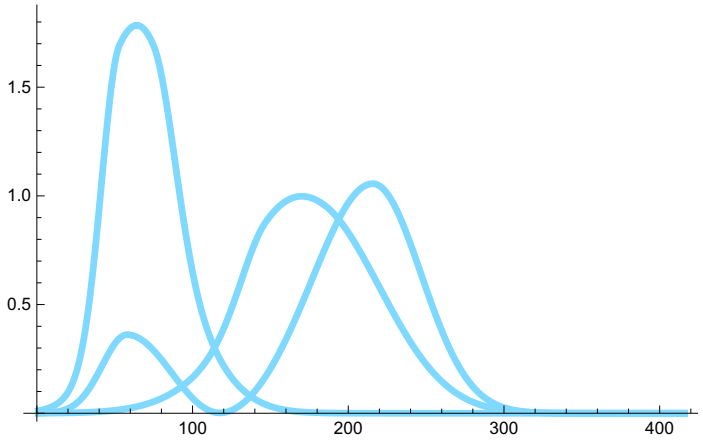
Out[24]=



In[25]:=
```
sRGBGamma = Function[x, With[{z = Abs[x]},
    Sign[x] Piecewise[{{12.92 z, z ≤ 0.0031308}}, 1.055 z^(1 / 2.4) - 0.055]], Listable];

myVisibleSpectrum[λ_] := RGBColor @@ Clip[
   sRGBGamma[{{3.2404542, -1.5371385, -0.49853141}, {-0.96926603, 1.8760108, 0.041556017},
      {0.055643431, -0.20402591, 1.0572252}}.Through[{cieX, cieY, cieZ}[λ]]], {0, 1}]
```

In[27]:=
```
cieXYZ = Through[XYZColor[cieX, cieY, cieZ][#]] &;

{d1, d2} =
  Transpose /@ Table[List @@ fn[λ], {fn, {cieXYZ, newVisibleSpectrum}}, {λ, 385, 800}];

Show[ListLinePlot[d1, PlotStyle → Directive[Thickness[0.01], Hue[0.55, 0.5, 1]],
  PlotTheme → "Pastel", InterpolationOrder → 3],
 ListLinePlot[d2, PlotStyle → Directive[Black, Dashed]]]
```

Out[29]=



In[30]:=
```
λ = λ 10^-9;(*wavelength is given in nm*)

XYZ[t_] := Module[{h = 6.62607 * 10^-34, c = 2.998 * 10^8, k = 1.38065 * 10^-23},
  {x, y, z}.((2 h c^2) / ((-1 + E^((h c / k) / (t λ))) λ^5)) // # / #[[2]] &]

Graphics[Table[{ColorConvert[XYZColor @@ XYZ[i], "RGB"], Rectangle[{i, 0}, {i + 50, 5000}]},
  {i, 100, 10 000, 50}], Frame → True, FrameTicks → {Automatic, None, None, None},
 FrameLabel → {"Black body temperature (K)", "", "", ""}]
```

Out[32]=