In[16718]:=
```
h = 6.58 * 10^-16;
```

In[16719]:=
```
c = 3 * 10^14;
```

In[16720]:=
```
T = 3.4215;
```

In[16721]:=
```
LT = 0.0108;
```

In[16722]:=
```
M = 0.87;
```

In[16723]:=
$$k[y\_] := \frac{y + T}{c * h}$$

In[16724]:=
```
b = 6.16;
```

In[16725]:=
```
EB = 13.6 (*Hidrigen atm energy in eV *);
aB = 0.53 * 10^-4 (* in microns*);
```

In[16727]:=
$$\varkappa[y\_] := b \left(1 - \frac{LT}{y}\right)$$

In[16728]:=
$$\gamma_-[x\_, y\_] := \left(x^2 - \varkappa[y] * (k[y])^2\right)^{1/2}$$

In[16729]:=
```
(*Here I make the formula for the partial derivative of A*)
```

In[16730]:=
$$pA[x\_, y\_] := 1 + \frac{\gamma_-[x, y]}{b * \left(x^2 - (k[y])^2\right)^{1/2}} + y \left(\frac{-\left(\frac{b*LT}{y^2} * (k[y])^2 + \varkappa[y] * \frac{2\,k[y]}{c*h}\right)}{2 * b * \gamma_-[x, y] * \left(x^2 - (k[y])^2\right)^{1/2}} + \frac{\gamma_-[x, y] * k[y]}{b * c * h \left(x^2 - (k[y])^2\right) * \left(x^2 - (k[y])^2\right)^{1/2}} \right)$$

In[16731]:=
```
(*Here I make the formula for the real part of the correction term*)
```

In[16732]:=
$$R[x\_, y\_] := \left(EB * aB^2\right)^{1/2} * \frac{LT * x^2}{b * (M * (LT - y))^{1/2} * \left(x^2 - (k[y])^2\right)^{1/2}} \text{(*Real part of correction*)}$$

In[16733]:=
```
(*Here I make the formula for the imaginary part of the correction term*)
```

In[16734]:=
$$H[x\_, y\_] := \frac{-EB * (aB)^2 * y * x^2}{M\,(y\,(LT - y))^{1/2}} \text{(*Imaginary part of correction*)}$$

In[16735]:=
```
(*Here I make the formula for the real part of the Delta term*)
```

In[16736]:=
```
DR[x_, y_] := -R[x, y] / pA[x, y] (*delta real*)
```

In[16737]:=
```
(*Here I make the formula for the imaginary part of the Delta term*)
```

In[16738]:=
```
DI[x_, y_] := -H[x, y] / pA[x, y] (*delta imaginary*)
```

In[16739]:=
```
(*Here I took the points that were on the
 infinite mass dispersion and put them into a list*)
```

In[16740]:=
```
OriginalPoints = {{17.3342, 0.0000103175}, {20, 0.006627088025911643`},
   {30, 0.008840217552569616`}, {40, 0.009165795779182459`},
   {50, 0.009285462627029003`}, {60, 0.009344152680109123}};
(*These are the points on the infinite mass dispersion x^2==(k[y])^2*κ[y]/(κ[y]+1) *)
```

In[16741]:=
```
(*Here I calculated the delta real for every one of the OrignalPoints*)
```

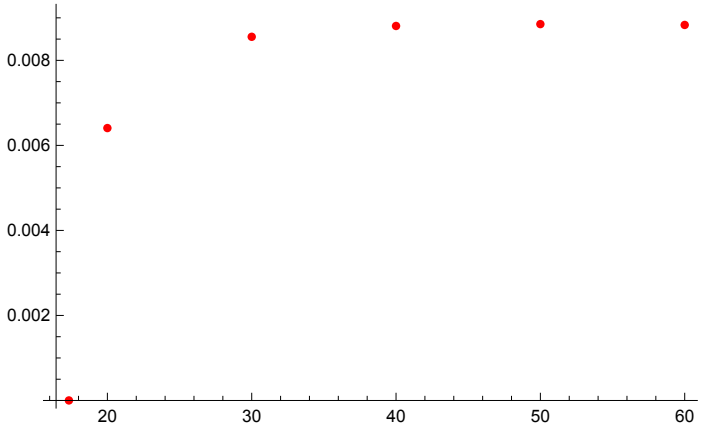
In[16742]:=
```
deltaReal = DR @@@ OriginalPoints;
(*Apply delta real correction function on the points*)
```

In[16743]:=
```
(*Here I apply the delta for the real epsilons and make a new list*)
```

In[16744]:=
```
NewRealPoints = {{17.3342, 0.0000103175 - 9.043030328325271`*^-6},
   {20, 0.006627088025911643` - 0.00021960923428280543`},
   {30, 0.008840217552569616` - 0.0002860101691437566`},
   {40, 0.009165795779182459` - 0.00035695031951755296`},
   {50, 0.009285462627029003` - 0.00043289171951242043`},
   {60, 0.009344152680109123 - 0.0005110903208563196`}};
```

In[16745]:=
```
NewRealPlot = ListPlot[NewRealPoints, PlotStyle → {Red}] (*Correction for Real*)
```

Out[16745]=



In[16746]:=
```
actualReal = yValues + realcorrection
```

Out[16746]=

$$\{-3.35039 + 5.81175 \times 10^{-10}\,i,\ -3.13762 + 9.98834 \times 10^{-9}\,i,\ -2.92486 + 3.3106 \times 10^{-8}\,i,$$
$$-2.71211 + 7.34926 \times 10^{-8}\,i,\ -2.49937 + 1.35841 \times 10^{-7}\,i,\ -2.28665 + 2.26448 \times 10^{-7}\,i,$$
$$-2.07394 + 3.53927 \times 10^{-7}\,i,\ -1.86126 + 5.30354 \times 10^{-7}\,i,\ -1.64862 + 7.73142 \times 10^{-7}\,i,$$
$$-1.43603 + 1.10833 \times 10^{-6}\,i,\ -1.22352 + 1.57669 \times 10^{-6}\,i,\ -1.01113 + 2.24608 \times 10^{-6}\,i,$$
$$-0.798976 + 3.23955 \times 10^{-6}\,i,\ -0.587291 + 4.81083 \times 10^{-6}\,i,\ -0.376831 + 7.60784 \times 10^{-6}\,i,$$
$$-0.171591 + 0.0000141495\,i,\ -0.0232102 + 0.000042578\,i,\ 1.16716 \times 10^{-6},\ 0.00403857,$$
$$0.00566535,\ 0.00652872,\ 0.00706029,\ 0.00741832,\ 0.00767433,\ 0.00786531,$$
$$0.00801235,\ 0.00812831,\ 0.0082215,\ 0.00829753,\ 0.00836031,\ 0.00841264,$$
$$0.00845661,\ 0.00849378,\ 0.00852535,\ 0.00855227,\ 0.00857526,\ 0.00859493,$$
$$0.00861175,\ 0.00862612,\ 0.00863838,\ 0.00864877,\ 0.00865755,\ 0.00866489,$$
$$0.00867097,\ 0.00867592,\ 0.00867987,\ 0.00868291,\ 0.00868515,\ 0.00868665,$$
$$0.00868749,\ 0.00868774,\ 0.00868743,\ 0.00868664,\ 0.00868538,\ 0.00868371,$$
$$0.00868166,\ 0.00867926,\ 0.00867653,\ 0.0086735,\ 0.00867019,\ 0.00866785\}$$

In[16747]:=

```
group = Transpose[{qs, actualReal}]
```

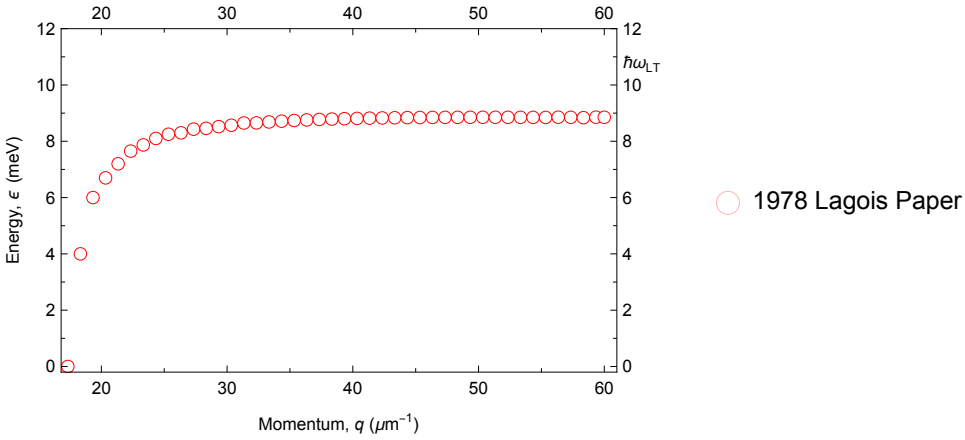
Out[16747]=

$$\Big\{\big\{0.3342, -3.35039 + 5.81175 \times 10^{-10}\, i\big\},$$
$$\big\{1.3342, -3.13762 + 9.98834 \times 10^{-9}\, i\big\}, \big\{2.3342, -2.92486 + 3.3106 \times 10^{-8}\, i\big\},$$
$$\big\{3.3342, -2.71211 + 7.34926 \times 10^{-8}\, i\big\}, \big\{4.3342, -2.49937 + 1.35841 \times 10^{-7}\, i\big\},$$
$$\big\{5.3342, -2.28665 + 2.26448 \times 10^{-7}\, i\big\}, \big\{6.3342, -2.07394 + 3.53927 \times 10^{-7}\, i\big\},$$
$$\big\{7.3342, -1.86126 + 5.30354 \times 10^{-7}\, i\big\}, \big\{8.3342, -1.64862 + 7.73142 \times 10^{-7}\, i\big\},$$
$$\big\{9.3342, -1.43603 + 1.10833 \times 10^{-6}\, i\big\}, \big\{10.3342, -1.22352 + 1.57669 \times 10^{-6}\, i\big\},$$
$$\big\{11.3342, -1.01113 + 2.24608 \times 10^{-6}\, i\big\}, \big\{12.3342, -0.798976 + 3.23955 \times 10^{-6}\, i\big\},$$
$$\big\{13.3342, -0.587291 + 4.81083 \times 10^{-6}\, i\big\}, \big\{14.3342, -0.376831 + 7.60784 \times 10^{-6}\, i\big\},$$
$$\{15.3342, -0.171591 + 0.0000141495\, i\}, \{16.3342, -0.0232102 + 0.000042578\, i\},$$
$$\big\{17.3342, 1.16716 \times 10^{-6}\big\}, \{18.3342, 0.00403857\},$$
$$\{19.3342, 0.00566535\}, \{20.3342, 0.00652872\}, \{21.3342, 0.00706029\},$$
$$\{22.3342, 0.00741832\}, \{23.3342, 0.00767433\}, \{24.3342, 0.00786531\},$$
$$\{25.3342, 0.00801235\}, \{26.3342, 0.00812831\}, \{27.3342, 0.0082215\},$$
$$\{28.3342, 0.00829753\}, \{29.3342, 0.00836031\}, \{30.3342, 0.00841264\},$$
$$\{31.3342, 0.00845661\}, \{32.3342, 0.00849378\}, \{33.3342, 0.00852535\},$$
$$\{34.3342, 0.00855227\}, \{35.3342, 0.00857526\}, \{36.3342, 0.00859493\},$$
$$\{37.3342, 0.00861175\}, \{38.3342, 0.00862612\}, \{39.3342, 0.00863838\},$$
$$\{40.3342, 0.00864877\}, \{41.3342, 0.00865755\}, \{42.3342, 0.00866489\},$$
$$\{43.3342, 0.00867097\}, \{44.3342, 0.00867592\}, \{45.3342, 0.00867987\},$$
$$\{46.3342, 0.00868291\}, \{47.3342, 0.00868515\}, \{48.3342, 0.00868665\},$$
$$\{49.3342, 0.00868749\}, \{50.3342, 0.00868774\}, \{51.3342, 0.00868743\},$$
$$\{52.3342, 0.00868664\}, \{53.3342, 0.00868538\}, \{54.3342, 0.00868371\},$$
$$\{55.3342, 0.00868166\}, \{56.3342, 0.00867926\}, \{57.3342, 0.00867653\},$$
$$\{58.3342, 0.0086735\}, \{59.3342, 0.00867019\}, \{60, 0.00866785\}\Big\}$$

In[16748]:=

```
FakeIt = {{17.3342`, 0}, {18.3342`, 0.0040`},
   {19.3342`, 0.006`}, {20.3342`, 0.0067`}, {21.3342`, 0.0072`},
   {22.3342`, 0.00765`}, {23.3342`, 0.00787`}, {24.3342`, 0.0081`},
   {25.3342`, 0.00825`}, {26.3342`, 0.0083`}, {27.3342`, 0.00843`},
   {28.3342`, 0.00846`}, {29.3342`, 0.00852`}, {30.3342`, 0.00857`},
   {31.3342`, 0.00865`}, {32.334199999999996`, 0.008653789315815051`},
   {33.334199999999996`, 0.00868601711923257`},
   {34.334199999999996`, 0.008713497586259932`},
   {35.334199999999996`, 0.008736985978613214`}, {36.334199999999996`,
    0.008757087561704242`}, {37.334199999999996`, 0.008774292911751996`},
   {38.334199999999996`, 0.00878900371334202`}, {39.334199999999996`,
    0.008801551905861304`}, {40.334199999999996`, 0.0088122140958137`},
   {41.334199999999996`, 0.008821222545628733`}, {42.334199999999996`,
    0.008828773650770082`}, {43.334199999999996`, 0.008835034549659653`},
   {44.334199999999996`, 0.00884014832867124`}, {45.334199999999996`,
    0.008844238158185195`}, {46.334199999999996`, 0.008847410606945992`},
   {47.334199999999996`, 0.00884975831874026`}, {48.334199999999996`,
    0.008851362189809595`}, {49.334199999999996`, 0.00885229315213769`},
   {50.334199999999996`, 0.00885261364321014`}, {51.334199999999996`,
    0.00885237882456305`}, {52.334199999999996`, 0.008851637597689017`},
   {53.334199999999996`, 0.008850433455439875`}, {54.334199999999996`,
    0.00884880519908856`}, {55.334199999999996`, 0.008846787545063229`},
   {56.334199999999996`, 0.008854411640591758`}, {57.334199999999996`,
    0.008851705503761135`}, {58.334199999999996`, 0.008838694400557774`},
   {59.334199999999996`, 0.00885540116912764`}, {60, 0.008853062359252804`}};
f = ListPlot[FakeIt, PlotRange → {{16.8, 61}, {-0.0002, 0.012}},
  PlotMarkers → {Graphics[{EdgeForm[Red], White, Disk[]}], 7},
  FrameLabel → {{Row[{"Energy, ", Style["ϵ", Italic], " (meV)"}], ""},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}} , Frame → True,
  FrameTicks → {{{{0, "0"}, {0.001, "", {0.003, 0}}, {0.002, "2"},
      {0.003, "", {0.003, 0}}, {0.004, "4"}, {0.005, "", {0.003, 0}}, {0.006, "6"},
      {0.007, "", {0.003, 0}}, {0.008, "8"}, {0.009, "", {0.003, 0}}, {0.01, "10"},
      {0.011, "", {0.003, 0}}, {0.012, "12"}}, {{0, "0"}, {0.001, "", {0.003, 0}},
      {0.002, "2"}, {0.003, "", {0.003, 0}}, {0.004, "4"}, {0.005, "", {0.003, 0}},
      {0.006, "6"}, {0.007, "", {0.003, 0}}, {0.008, "8"}, {0.009, "", {0.003, 0}},
      {0.01, "10"}, {0.011, "", {0.003, 0}}, {0.012, "12"}, {LT, "ħω_LT", {0, 0}}}},
    {{{20, "20"}, {25, "", {0.003, 0}}, {30, "30"}, {35, "", {0.003, 0}},
      {40, "40"}, {45, "", {0.003, 0}}, {50, "50"}, {55, "", {0.003, 0}}, {60, "60"}},
     {{20, "20"}, {25, "", {0.003, 0}}, {30, "30"}, {35, "", {0.003, 0}}, {40, "40"},
      {45, "", {0.003, 0}}, {50, "50"}, {55, "", {0.003, 0}}, {60, "60"}}}},
  PlotLegends → {"1978 Lagois Paper"}]
```

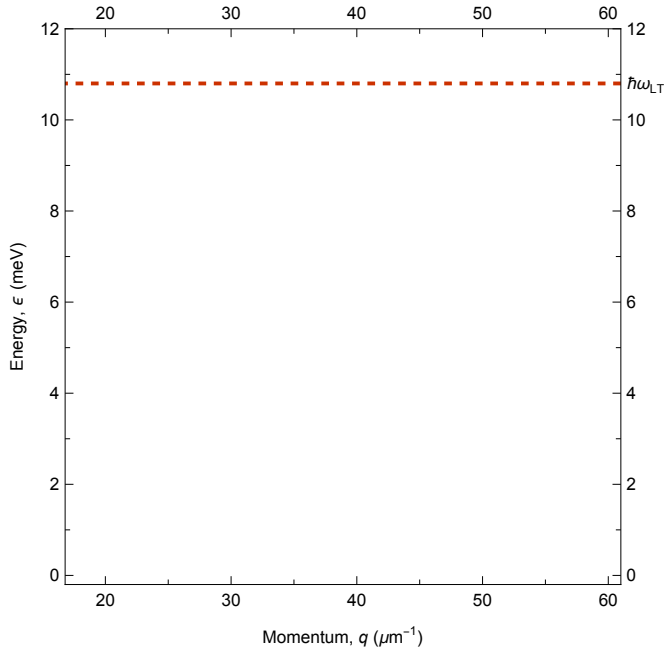
Out[16749]=


20
30
40
50
60
12
10
8
6
4
2
0
$\hbar\omega_{LT}$
Energy, ϵ (meV)
Momentum, q (μm^{-1})
1978 Lagois Paper

In[16750]:=

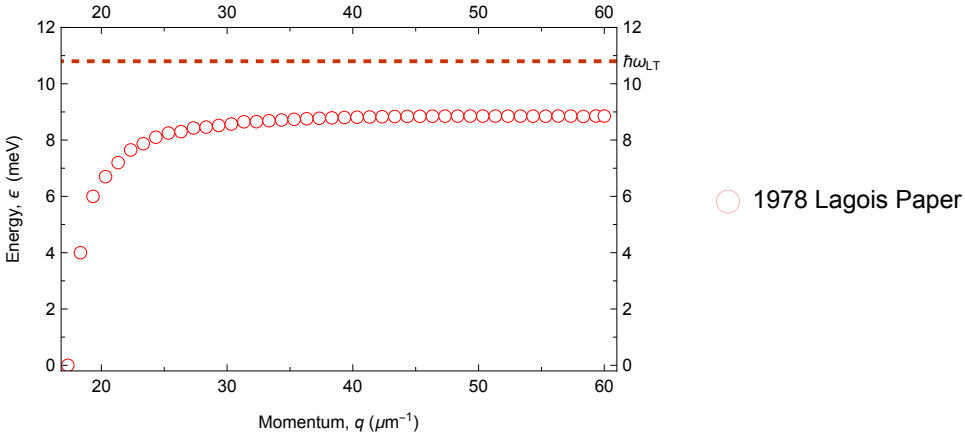
```
showLT = ContourPlot[y == LT, {x, 16.8, 61}, {y, -0.0002, 0.012},
  FrameLabel → {{Row[{"Energy, ", Style["ϵ", Italic], " (meV)"}], ""},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}}, Frame → True,
  FrameTicks → {{{{0, "0"}, {0.001, "", {0.003, 0}}, {0.002, "2"},
      {0.003, "", {0.003, 0}}, {0.004, "4"}, {0.005, "", {0.003, 0}}, {0.006, "6"},
      {0.007, "", {0.003, 0}}, {0.008, "8"}, {0.009, "", {0.003, 0}}, {0.01, "10"},
      {0.011, "", {0.003, 0}}, {0.012, "12"}}, {{0, "0"}, {0.001, "", {0.003, 0}},
      {0.002, "2"}, {0.003, "", {0.003, 0}}, {0.004, "4"}, {0.005, "", {0.003, 0}},
      {0.006, "6"}, {0.007, "", {0.003, 0}}, {0.008, "8"}, {0.009, "", {0.003, 0}},
      {0.01, "10"}, {0.011, "", {0.003, 0}}, {0.012, "12"}, {LT, "ℏω_LT", {0, 0}}}},
    {{{20, "20"}, {25, "", {0.003, 0}}, {30, "30"}, {35, "", {0.003, 0}},
      {40, "40"}, {45, "", {0.003, 0}}, {50, "50"}, {55, "", {0.003, 0}}, {60, "60"}},
     {{20, "20"}, {25, "", {0.003, 0}}, {30, "30"}, {35, "", {0.003, 0}}, {40, "40"},
      {45, "", {0.003, 0}}, {50, "50"}, {55, "", {0.003, 0}}, {60, "60"}}}},
  PlotRange → {{16.8, 61}, {-0.0002, 0.012}},
  ContourStyle → {Dashed, ColorData[80, 1]}]
```

Out[16750]=



In[16751]:=
```
comparison = Show[f, showLT]
```

Out[16751]=



In[16752]:=
```
pE[x_, y_] := 2 * x / (2 k[y]/(c*h) * κ[y]/(κ[y]+1) + (k[y])^2*b*LT/(y^2 (κ[y]+1)^2))
df = D[-R[x, y] / pA[x, y], x];
d[xVal_, yVal_] := df /. {x → xVal, y → yVal}
```

In[16755]:=
```
V[x_, y_] := pE[x, y] + d[x, y]
```

In[16756]:=
```
frontV1 = Range[0.01, 8.9, 0.25];
firstHalfV1 = Range[9, 10, 0.1];
middleV1 = Range[10, 11, 0.02];
thirdV1 = Range[11.1, 12.7, 0.05];
secondHalfV1 = Range[12, 27, 0.07];
qsV1 = Join[frontV1, firstHalfV1, middleV1, thirdV1, secondHalfV1];
yValuesforV1 = middleSolution /@ qsV1;
```

••• Solve : Solve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

••• Solve : Solve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

••• Solve : Solve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

••• General : Further output of Solve::ratnz will be suppressed during this calculation.

In[16763]:=
```
xyPairsForV1 = Transpose[{qsV1, yValuesforV1}];
Velocities1 = V @@@ xyPairsForV1;
VasFuncQ1 = Transpose[{qsV1, Re[Velocities1] / (c * h)}]
```

Out[16765]=
```
{{0.01, 1.07788}, {0.26, 1.07787}, {0.51, 1.07786}, {0.76, 1.07786}, {1.01, 1.07785},
 {1.26, 1.07784}, {1.51, 1.07783}, {1.76, 1.07782}, {2.01, 1.07781},
```

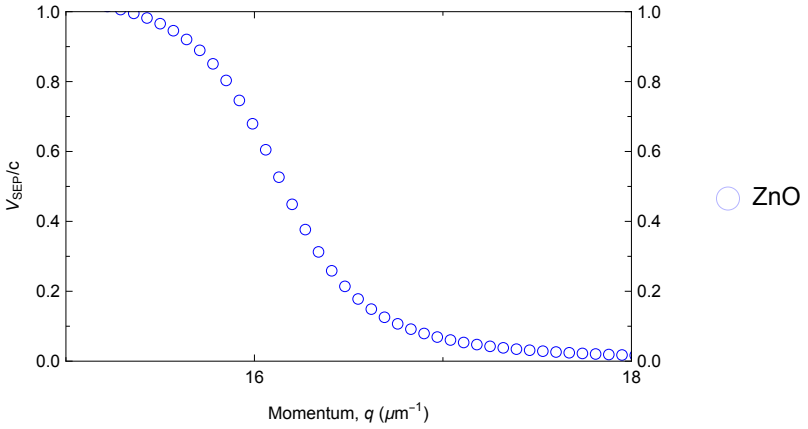
{2.26, 1.0778}, {2.51, 1.07779}, {2.76, 1.07777}, {3.01, 1.07776},
{3.26, 1.07775}, {3.51, 1.07773}, {3.76, 1.07771}, {4.01, 1.0777},
{4.26, 1.07768}, {4.51, 1.07766}, {4.76, 1.07764}, {5.01, 1.07762},
{5.26, 1.0776}, {5.51, 1.07757}, {5.76, 1.07754}, {6.01, 1.07752},
{6.26, 1.07749}, {6.51, 1.07745}, {6.76, 1.07742}, {7.01, 1.07738},
{7.26, 1.07733}, {7.51, 1.07729}, {7.76, 1.07724}, {8.01, 1.07718},
{8.26, 1.07712}, {8.51, 1.07706}, {8.76, 1.07698}, {9., 1.07691}, {9.1, 1.07687},
{9.2, 1.07684}, {9.3, 1.0768}, {9.4, 1.07676}, {9.5, 1.07672}, {9.6, 1.07667},
{9.7, 1.07663}, {9.8, 1.07658}, {9.9, 1.07653}, {10., 1.07648}, {10., 1.07648},
{10.02, 1.07647}, {10.04, 1.07646}, {10.06, 1.07645}, {10.08, 1.07644},
{10.1, 1.07643}, {10.12, 1.07641}, {10.14, 1.0764}, {10.16, 1.07639},
{10.18, 1.07638}, {10.2, 1.07637}, {10.22, 1.07636}, {10.24, 1.07634},
{10.26, 1.07633}, {10.28, 1.07632}, {10.3, 1.07631}, {10.32, 1.0763},
{10.34, 1.07628}, {10.36, 1.07627}, {10.38, 1.07626}, {10.4, 1.07624},
{10.42, 1.07623}, {10.44, 1.07622}, {10.46, 1.0762}, {10.48, 1.07619},
{10.5, 1.07618}, {10.52, 1.07616}, {10.54, 1.07615}, {10.56, 1.07614},
{10.58, 1.07612}, {10.6, 1.07611}, {10.62, 1.07609}, {10.64, 1.07608},
{10.66, 1.07606}, {10.68, 1.07605}, {10.7, 1.07603}, {10.72, 1.07602},
{10.74, 1.076}, {10.76, 1.07599}, {10.78, 1.07597}, {10.8, 1.07595},
{10.82, 1.07594}, {10.84, 1.07592}, {10.86, 1.0759}, {10.88, 1.07589},
{10.9, 1.07587}, {10.92, 1.07585}, {10.94, 1.07584}, {10.96, 1.07582},
{10.98, 1.0758}, {11., 1.07578}, {11.1, 1.07569}, {11.15, 1.07564},
{11.2, 1.07559}, {11.25, 1.07554}, {11.3, 1.07548}, {11.35, 1.07543},
{11.4, 1.07537}, {11.45, 1.07531}, {11.5, 1.07525}, {11.55, 1.07519},
{11.6, 1.07513}, {11.65, 1.07506}, {11.7, 1.07499}, {11.75, 1.07492},
{11.8, 1.07485}, {11.85, 1.07477}, {11.9, 1.07469}, {11.95, 1.07461},
{12., 1.07452}, {12.05, 1.07444}, {12.1, 1.07434}, {12.15, 1.07425},
{12.2, 1.07415}, {12.25, 1.07405}, {12.3, 1.07394}, {12.35, 1.07383},
{12.4, 1.07372}, {12.45, 1.0736}, {12.5, 1.07347}, {12.55, 1.07335},
{12.6, 1.07321}, {12.65, 1.07307}, {12.7, 1.07292}, {12., 1.07452},
{12.07, 1.0744}, {12.14, 1.07427}, {12.21, 1.07413}, {12.28, 1.07399},
{12.35, 1.07383}, {12.42, 1.07367}, {12.49, 1.0735}, {12.56, 1.07332},
{12.63, 1.07313}, {12.7, 1.07292}, {12.77, 1.07271}, {12.84, 1.07248},
{12.91, 1.07223}, {12.98, 1.07197}, {13.05, 1.07169}, {13.12, 1.0714},
{13.19, 1.07108}, {13.26, 1.07074}, {13.33, 1.07037}, {13.4, 1.06997},
{13.47, 1.06955}, {13.54, 1.06909}, {13.61, 1.06859}, {13.68, 1.06805},
{13.75, 1.06746}, {13.82, 1.06683}, {13.89, 1.06613}, {13.96, 1.06537},
{14.03, 1.06453}, {14.1, 1.06361}, {14.17, 1.0626}, {14.24, 1.06147},
{14.31, 1.06022}, {14.38, 1.05883}, {14.45, 1.05727}, {14.52, 1.05552},
{14.59, 1.05355}, {14.66, 1.05131}, {14.73, 1.04877}, {14.8, 1.04585},
{14.87, 1.04249}, {14.94, 1.0386}, {15.01, 1.03407}, {15.08, 1.02875},
{15.15, 1.02247}, {15.22, 1.01499}, {15.29, 1.00601}, {15.36, 0.995152},
{15.43, 0.981913}, {15.5, 0.965648}, {15.57, 0.945533}, {15.64, 0.920533},
{15.71, 0.889405}, {15.78, 0.85076}, {15.85, 0.803266}, {15.92, 0.74605},

```
{15.99, 0.679298}, {16.06, 0.604867}, {16.13, 0.526428}, {16.2, 0.448777},
{16.27, 0.376481}, {16.34, 0.312663}, {16.41, 0.258595}, {16.48, 0.214056},
{16.55, 0.177965}, {16.62, 0.14894}, {16.69, 0.125626}, {16.76, 0.106843},
{16.83, 0.0916255}, {16.9, 0.0792094}, {16.97, 0.0690001}, {17.04, 0.060538},
{17.11, 0.053468}, {17.18, 0.0475154}, {17.25, 0.0424664}, {17.32, 0.0381538},
{17.39, 0.0344217}, {17.46, 0.0313442}, {17.53, 0.0286141}, {17.6, 0.0262072},
{17.67, 0.024081}, {17.74, 0.0221963}, {17.81, 0.0205193}, {17.88, 0.0190216},
{17.95, 0.017679}, {18.02, 0.0164713}, {18.09, 0.0153813}, {18.16, 0.0143945},
{18.23, 0.0134983}, {18.3, 0.0126822}, {18.37, 0.011937}, {18.44, 0.0112548},
{18.51, 0.0106287}, {18.58, 0.0100529}, {18.65, 0.00952202}, {18.72, 0.00903166},
{18.79, 0.0085778}, {18.86, 0.00815692}, {18.93, 0.00776593}, {19., 0.00740206},
{19.07, 0.00706289}, {19.14, 0.00674624}, {19.21, 0.00645017}, {19.28, 0.00617294},
{19.35, 0.00591298}, {19.42, 0.00566891}, {19.49, 0.00543945}, {19.56, 0.00522347},
{19.63, 0.00501994}, {19.7, 0.00482791}, {19.77, 0.00464654}, {19.84, 0.00447506},
{19.91, 0.00431277}, {19.98, 0.00415901}, {20.05, 0.00401321}, {20.12, 0.00387482},
{20.19, 0.00374336}, {20.26, 0.00361836}, {20.33, 0.00349942}, {20.4, 0.00338614},
{20.47, 0.00327818}, {20.54, 0.00317521}, {20.61, 0.00307692}, {20.68, 0.00298304},
{20.75, 0.0028933}, {20.82, 0.00280747}, {20.89, 0.00272533}, {20.96, 0.00264666},
{21.03, 0.00257127}, {21.1, 0.00249899}, {21.17, 0.00242964}, {21.24, 0.00236307},
{21.31, 0.00229913}, {21.38, 0.00223769}, {21.45, 0.00217862}, {21.52, 0.00212179},
{21.59, 0.0020671}, {21.66, 0.00201444}, {21.73, 0.00196371}, {21.8, 0.00191481},
{21.87, 0.00186767}, {21.94, 0.00182219}, {22.01, 0.00177831}, {22.08, 0.00173594},
{22.15, 0.00169502}, {22.22, 0.00165548}, {22.29, 0.00161726}, {22.36, 0.0015803},
{22.43, 0.00154456}, {22.5, 0.00150997}, {22.57, 0.00147648}, {22.64, 0.00144406},
{22.71, 0.00141265}, {22.78, 0.00138221}, {22.85, 0.00135271}, {22.92, 0.00132411},
{22.99, 0.00129637}, {23.06, 0.00126945}, {23.13, 0.00124333}, {23.2, 0.00121797},
{23.27, 0.00119334}, {23.34, 0.00116942}, {23.41, 0.00114618}, {23.48, 0.00112359},
{23.55, 0.00110163}, {23.62, 0.00108028}, {23.69, 0.00105951}, {23.76, 0.0010393},
{23.83, 0.00101964}, {23.9, 0.0010005}, {23.97, 0.00098187}, {24.04, 0.000963725},
{24.11, 0.00094605}, {24.18, 0.00092883}, {24.25, 0.00091205},
{24.32, 0.000895694}, {24.39, 0.000879749}, {24.46, 0.0008642},
{24.53, 0.000849035}, {24.6, 0.000834242}, {24.67, 0.000819808},
{24.74, 0.000805721}, {24.81, 0.000791972}, {24.88, 0.000778548},
{24.95, 0.000765441}, {25.02, 0.000752639}, {25.09, 0.000740134},
{25.16, 0.000727917}, {25.23, 0.000715979}, {25.3, 0.000704311},
{25.37, 0.000692906}, {25.44, 0.000681755}, {25.51, 0.000670851},
{25.58, 0.000660187}, {25.65, 0.000649756}, {25.72, 0.000639552},
{25.79, 0.000629567}, {25.86, 0.000619796}, {25.93, 0.000610232},
{26., 0.00060087}, {26.07, 0.000591703}, {26.14, 0.000582728},
{26.21, 0.000573938}, {26.28, 0.000565328}, {26.35, 0.000556894},
{26.42, 0.000548631}, {26.49, 0.000540533}, {26.56, 0.000532598},
{26.63, 0.00052482}, {26.7, 0.000517196}, {26.77, 0.000509721},
{26.84, 0.000502391}, {26.91, 0.000495204}, {26.98, 0.000488154}}
```

In[16766]:=

```
a = ListPlot[VasFuncQ1,
  PlotMarkers → {Graphics[{EdgeForm[Blue], White, Disk[]}], 6}, FrameLabel →
   {{"V_SEP/c", ""}, {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}},
  Frame → True, FrameTicks → {{{{0.0, "0.0"}, {0.1, "", {0.003, 0}}, {0.2, "0.2"},
      {0.3, "", {0.003, 0}}, {0.4, "0.4"}, {0.5, "", {0.003, 0}}, {0.6, "0.6"},
      {0.7, "", {0.003, 0}}, {0.8, "0.8"}, {0.9, "", {0.003, 0}}, {1.0, "1.0"}},
     {{0.0, "0.0"}, {0.1, "", {0.003, 0}}, {0.2, "0.2"}, {0.3, "", {0.003, 0}},
      {0.4, "0.4"}, {0.5, "", {0.003, 0}}, {0.6, "0.6"}, {0.7, "", {0.003, 0}},
      {0.8, "0.8"}, {0.9, "", {0.003, 0}}, {1.0, "1.0"}}},
    {{{8, "8"}, {9, "", {0.003, 0}}, {10, "10"}, {11, "", {0.003, 0}},
      {12, "12"}, {13, "", {0.003, 0}}, {14, "14"}, {15, "", {0.003, 0}},
      {16, "16"}, {17, "", {0.003, 0}}, {18, "18"}}, {{8, ""}, {9, "", {0.003, 0}},
      {10, ""}, {11, "", {0.003, 0}}, {12, ""}, {13, "", {0.003, 0}}, {14, ""},
      {15, "", {0.003, 0}}, {16, ""}, {17, "", {0.003, 0}}, {18, ""}}}},
  PlotLegends → {"ZnO"}, PlotRange → {{15, 18}, {0, 1}}]
```

Out[16766]=



In[16767]:=

```
Export["HopefullyFinalComparison.svg", comparison]
```

Out[16767]=

HopefullyFinalComparison.svg

In[16768]:=

```
Export["HopefullyFinalZnOVelocity.svg", a]
```

Out[16768]=

HopefullyFinalZnOVelocity.svg

In[16769]:=

```
ImaginaryPoints =
 DI @@@ NewRealPoints (*Apply delta imaginary on the dispersion points*)
```

Out[16769]=

$\{9.65597 \times 10^{-11}, 0.0000202431, 0.0000742563, 0.000135765, 0.000210092, 0.00029686\}$

In[16770]:=
```
(*I create a 3-D point list*)
```

In[16771]:=
```
ThreeDPoints =
 {{17.3342, 0.0000103175 - 9.043030328325271`*^-6, 9.480432091278167`*^-11},
  {20, 0.006627088025911643` - 0.00021960923428280543`, 0.00001959617161787881 3`},
  {30, 0.008840217552569616` - 0.0002860101691437566`, 0.00007093347159114151`},
  {40, 0.009165795779182459` - 0.00035695031951755296`, 0.00012927813123619902`},
  {50, 0.009285462627029003` - 0.00043289171951242043`, 0.00019997414924768475`},
  {60, 0.009344152680109123 - 0.0005110903208563196`, 0.0002827608058210034 7`}}
```

Out[16771]=
$$\left\{\left\{17.3342,\ 1.27447\times 10^{-6},\ 9.48043\times 10^{-11}\right\},\ \{20,\ 0.00640748,\ 0.0000195962\},\ \{30,\ 0.00855421,\ 0.0000709335\},\ \{40,\ 0.00880885,\ 0.000129278\},\ \{50,\ 0.00885257,\ 0.000199974\},\ \{60,\ 0.00883306,\ 0.000282761\}\right\}$$

In[16772]:=
```
(*This is the true surface exciton polariton dispersion*)
```

In[16773]:=
```
qs  = Range[0.3342, 60, 1]
```

Out[16773]=
```
{0.3342, 1.3342, 2.3342, 3.3342, 4.3342, 5.3342, 6.3342, 7.3342, 8.3342, 9.3342,
 10.3342, 11.3342, 12.3342, 13.3342, 14.3342, 15.3342, 16.3342, 17.3342, 18.3342,
 19.3342, 20.3342, 21.3342, 22.3342, 23.3342, 24.3342, 25.3342, 26.3342, 27.3342,
 28.3342, 29.3342, 30.3342, 31.3342, 32.3342, 33.3342, 34.3342, 35.3342,
 36.3342, 37.3342, 38.3342, 39.3342, 40.3342, 41.3342, 42.3342, 43.3342,
 44.3342, 45.3342, 46.3342, 47.3342, 48.3342, 49.3342, 50.3342, 51.3342,
 52.3342, 53.3342, 54.3342, 55.3342, 56.3342, 57.3342, 58.3342, 59.3342}
```

In[16774]:=
```
qs = Append[qs, 60]
```

Out[16774]=
```
{0.3342, 1.3342, 2.3342, 3.3342, 4.3342, 5.3342, 6.3342, 7.3342, 8.3342, 9.3342,
 10.3342, 11.3342, 12.3342, 13.3342, 14.3342, 15.3342, 16.3342, 17.3342, 18.3342,
 19.3342, 20.3342, 21.3342, 22.3342, 23.3342, 24.3342, 25.3342, 26.3342, 27.3342,
 28.3342, 29.3342, 30.3342, 31.3342, 32.3342, 33.3342, 34.3342, 35.3342,
 36.3342, 37.3342, 38.3342, 39.3342, 40.3342, 41.3342, 42.3342, 43.3342,
 44.3342, 45.3342, 46.3342, 47.3342, 48.3342, 49.3342, 50.3342, 51.3342,
 52.3342, 53.3342, 54.3342, 55.3342, 56.3342, 57.3342, 58.3342, 59.3342, 60}
```

In[16775]:=
```
j[x_] := Solve[x^2 == (k[y])^2 * κ[y]/(κ[y] + 1), y]
```

In[16776]:=
```
middleSolution[x_] := y /. j[x][[2]]
```

In[16777]:=
```
(*Here I find the old epsilons for each q*)
```

In[16778]:=
```
yValues = middleSolution /@ qs;
```

Solve : Solve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

Solve : Solve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

Solve : Solve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresponding exact system and numericizing the result.

General : Further output of Solve::ratnz will be suppressed during this calculation.

In[16779]:=
```
xyPairs = Transpose[{qs, yValues}]
```

Out[16779]=
```
{{0.3342, -3.35039}, {1.3342, -3.13762}, {2.3342, -2.92486},
 {3.3342, -2.71211}, {4.3342, -2.49937}, {5.3342, -2.28665},
 {6.3342, -2.07394}, {7.3342, -1.86126}, {8.3342, -1.64862}, {9.3342, -1.43603},
 {10.3342, -1.22352}, {11.3342, -1.01113}, {12.3342, -0.798976},
 {13.3342, -0.587291}, {14.3342, -0.376831}, {15.3342, -0.171591},
 {16.3342, -0.0232102}, {17.3342, 0.0000101369}, {18.3342, 0.00421837},
 {19.3342, 0.00587363}, {20.3342, 0.00674987}, {21.3342, 0.0072897},
 {22.3342, 0.00765438}, {23.3342, 0.00791646}, {24.3342, 0.00811337},
 {25.3342, 0.00826636}, {26.3342, 0.00838838}, {27.3342, 0.00848777},
 {28.3342, 0.00857011}, {29.3342, 0.00863934}, {30.3342, 0.00869825},
 {31.3342, 0.0087489}, {32.3342, 0.00879286}, {33.3342, 0.00883132},
 {34.3342, 0.0088652}, {35.3342, 0.00889524}, {36.3342, 0.00892202},
 {37.3342, 0.00894603}, {38.3342, 0.00896764}, {39.3342, 0.00898718},
 {40.3342, 0.00900492}, {41.3342, 0.00902108}, {42.3342, 0.00903585},
 {43.3342, 0.00904939}, {44.3342, 0.00906184}, {45.3342, 0.00907331},
 {46.3342, 0.00908392}, {47.3342, 0.00909374}, {48.3342, 0.00910285},
 {49.3342, 0.00911133}, {50.3342, 0.00911924}, {51.3342, 0.00912661},
 {52.3342, 0.00913351}, {53.3342, 0.00913998}, {54.3342, 0.00914604},
 {55.3342, 0.00915174}, {56.3342, 0.0091571}, {57.3342, 0.00916215},
 {58.3342, 0.00916691}, {59.3342, 0.00917141}, {60, 0.00917427}}
```

In[16780]:=
```
(*Here I calculate the real correction for each (x,y)*)
```

In[16781]:=

```
realcorrection = DR @@@ xyPairs
```

Out[16781]=

$$\{0. + 5.81175 \times 10^{-10}\,i,\ 0. + 9.98834 \times 10^{-9}\,i,\ 0. + 3.3106 \times 10^{-8}\,i,\ 0. + 7.34926 \times 10^{-8}\,i,$$
$$0. + 1.35841 \times 10^{-7}\,i,\ 0. + 2.26448 \times 10^{-7}\,i,\ 0. + 3.53927 \times 10^{-7}\,i,\ 0. + 5.30354 \times 10^{-7}\,i,$$
$$0. + 7.73142 \times 10^{-7}\,i,\ 0. + 1.10833 \times 10^{-6}\,i,\ 0. + 1.57669 \times 10^{-6}\,i,\ 0. + 2.24608 \times 10^{-6}\,i,$$
$$0. + 3.23955 \times 10^{-6}\,i,\ 0. + 4.81083 \times 10^{-6}\,i,\ 0. + 7.60784 \times 10^{-6}\,i,\ 0. + 0.0000141495\,i,$$
$$0. + 0.000042578\,i,\ -8.96973 \times 10^{-6},\ -0.000179802,\ -0.000208278,\ -0.000221148,$$
$$-0.000229407,\ -0.000236051,\ -0.000242129,\ -0.000248059,\ -0.000254016,$$
$$-0.000260075,\ -0.000266261,\ -0.000272582,\ -0.000279033,\ -0.000285607,$$
$$-0.000292293,\ -0.000299083,\ -0.000305967,\ -0.000312935,\ -0.000319981,$$
$$-0.000327098,\ -0.000334278,\ -0.000341516,\ -0.000348807,\ -0.000356147,$$
$$-0.000363531,\ -0.000370956,\ -0.000378419,\ -0.000385917,\ -0.000393446,$$
$$-0.000401005,\ -0.000408592,\ -0.000416204,\ -0.00042384,\ -0.000431499,$$
$$-0.000439178,\ -0.000446876,\ -0.000454593,\ -0.000462327,\ -0.000470077,$$
$$-0.000477842,\ -0.000485621,\ -0.000493413,\ -0.000501218,\ -0.000506422\}$$

In[16782]:=

```
(*Here I calculate the imaginary coirrection for each (x,y|)*)
```

In[16783]:=

```
imaginarycorrection = DI @@@ xyPairs
```

Out[16783]=

$$\{0. + 1.70929 \times 10^{-11}\,i,\ 0. + 1.1348 \times 10^{-9}\,i,\ 0. + 6.35258 \times 10^{-9}\,i,\ 0. + 1.93945 \times 10^{-8}\,i,$$
$$0. + 4.47272 \times 10^{-8}\,i,\ 0. + 8.77537 \times 10^{-8}\,i,\ 0. + 1.5507 \times 10^{-7}\,i,\ 0. + 2.54811 \times 10^{-7}\,i,$$
$$0. + 3.97116 \times 10^{-7}\,i,\ 0. + 5.94776 \times 10^{-7}\,i,\ 0. + 8.64115 \times 10^{-7}\,i,\ 0. + 1.22621 \times 10^{-6}\,i,$$
$$0. + 1.70844 \times 10^{-6}\,i,\ 0. + 2.3459 \times 10^{-6}\,i,\ 0. + 3.17852 \times 10^{-6}\,i,\ 0. + 4.19806 \times 10^{-6}\,i,$$
$$0. + 4.21512 \times 10^{-6}\,i,\ 7.30689 \times 10^{-10},\ 8.25444 \times 10^{-6},\ 0.000016228,\ 0.000022968,$$
$$0.0000289984,\ 0.0000346485,\ 0.0000401106,\ 0.000045501,\ 0.0000508936,$$
$$0.0000563372,\ 0.0000618649,\ 0.0000675003,\ 0.0000732604,\ 0.0000791578,$$
$$0.0000852021,\ 0.0000914004,\ 0.0000977585,\ 0.000104281,\ 0.000110971,\ 0.000117832,$$
$$0.000124866,\ 0.000132076,\ 0.000139462,\ 0.000147026,\ 0.000154769,\ 0.000162693,$$
$$0.000170797,\ 0.000179084,\ 0.000187552,\ 0.000196204,\ 0.000205039,\ 0.000214058,$$
$$0.000223261,\ 0.000232648,\ 0.000242221,\ 0.000251978,\ 0.00026192,\ 0.000272048,$$
$$0.000282361,\ 0.00029286,\ 0.000303545,\ 0.000314416,\ 0.000325473,\ 0.000332938\}$$

In[16784]:=

```
(*Here I combine the q values and the real corrections to make an (x,y) pair*)
```

In[16785]:=

```
qandreal = Transpose[{qs, realcorrection}]
```

Out[16785]=

$$\{\{0.3342, 0. + 5.81175 \times 10^{-10}\,\mathrm{i}\}, \{1.3342, 0. + 9.98834 \times 10^{-9}\,\mathrm{i}\},$$
$$\{2.3342, 0. + 3.3106 \times 10^{-8}\,\mathrm{i}\}, \{3.3342, 0. + 7.34926 \times 10^{-8}\,\mathrm{i}\},$$
$$\{4.3342, 0. + 1.35841 \times 10^{-7}\,\mathrm{i}\}, \{5.3342, 0. + 2.26448 \times 10^{-7}\,\mathrm{i}\},$$
$$\{6.3342, 0. + 3.53927 \times 10^{-7}\,\mathrm{i}\}, \{7.3342, 0. + 5.30354 \times 10^{-7}\,\mathrm{i}\},$$
$$\{8.3342, 0. + 7.73142 \times 10^{-7}\,\mathrm{i}\}, \{9.3342, 0. + 1.10833 \times 10^{-6}\,\mathrm{i}\},$$
$$\{10.3342, 0. + 1.57669 \times 10^{-6}\,\mathrm{i}\}, \{11.3342, 0. + 2.24608 \times 10^{-6}\,\mathrm{i}\},$$
$$\{12.3342, 0. + 3.23955 \times 10^{-6}\,\mathrm{i}\}, \{13.3342, 0. + 4.81083 \times 10^{-6}\,\mathrm{i}\},$$
$$\{14.3342, 0. + 7.60784 \times 10^{-6}\,\mathrm{i}\}, \{15.3342, 0. + 0.0000141495\,\mathrm{i}\},$$
$$\{16.3342, 0. + 0.000042578\,\mathrm{i}\}, \{17.3342, -8.96973 \times 10^{-6}\}, \{18.3342, -0.000179802\},$$
$$\{19.3342, -0.000208278\}, \{20.3342, -0.000221148\}, \{21.3342, -0.000229407\},$$
$$\{22.3342, -0.000236051\}, \{23.3342, -0.000242129\}, \{24.3342, -0.000248059\},$$
$$\{25.3342, -0.000254016\}, \{26.3342, -0.000260075\}, \{27.3342, -0.000266261\},$$
$$\{28.3342, -0.000272582\}, \{29.3342, -0.000279033\}, \{30.3342, -0.000285607\},$$
$$\{31.3342, -0.000292293\}, \{32.3342, -0.000299083\}, \{33.3342, -0.000305967\},$$
$$\{34.3342, -0.000312935\}, \{35.3342, -0.000319981\}, \{36.3342, -0.000327098\},$$
$$\{37.3342, -0.000334278\}, \{38.3342, -0.000341516\}, \{39.3342, -0.000348807\},$$
$$\{40.3342, -0.000356147\}, \{41.3342, -0.000363531\}, \{42.3342, -0.000370956\},$$
$$\{43.3342, -0.000378419\}, \{44.3342, -0.000385917\}, \{45.3342, -0.000393446\},$$
$$\{46.3342, -0.000401005\}, \{47.3342, -0.000408592\}, \{48.3342, -0.000416204\},$$
$$\{49.3342, -0.00042384\}, \{50.3342, -0.000431499\}, \{51.3342, -0.000439178\},$$
$$\{52.3342, -0.000446876\}, \{53.3342, -0.000454593\}, \{54.3342, -0.000462327\},$$
$$\{55.3342, -0.000470077\}, \{56.3342, -0.000477842\}, \{57.3342, -0.000485621\},$$
$$\{58.3342, -0.000493413\}, \{59.3342, -0.000501218\}, \{60, -0.000506422\}\}$$

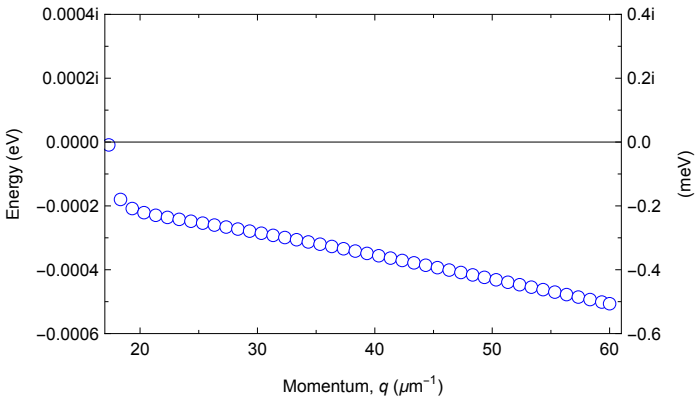
In[16786]:=

```
(*Here I plot real correction as a function of q*)
```

In[16787]:=

```
qversusreal =
 ListPlot[qandreal, PlotMarkers → {Graphics[{EdgeForm[Blue], White, Disk[]}], 7},
  FrameLabel → {{"Energy (eV)", "(meV)"},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}} , Frame → True,
  FrameTicks → {{{{-0.0006, "-0.0006"}, {-0.0005, "", {0.003, 0}},
      {-0.0004, "-0.0004"}, {-0.0003, "", {0.003, 0}}, {-0.0002, "-0.0002"},
      {-0.0001, "", {0.003, 0}}, {0, "0.0000"}, {0.0001, "", {0.003, 0}},
      {0.0002, "0.0002i"}, {0.0003, "", {0.003, 0}}, {0.0004, "0.0004i"}},
     {{-0.0006, "-0.6"}, {-0.0005, "", {0.003, 0}}, {-0.0004, "-0.4"},
      {-0.0003, "", {0.003, 0}}, {-0.0002, "-0.2"},
      {-0.0001, "", {0.003, 0}}, {0, "0.0"}, {0.0001, "", {0.003, 0}},
      {0.0002, "0.2i"}, {0.0003, "", {0.003, 0}}, {0.0004, "0.4i"}}},
    {{{20, "20"}, {25, "", {0.003, 0}}, {30, "30"}, {35, "", {0.003, 0}},
      {40, "40"}, {45, "", {0.003, 0}}, {50, "50"}, {55, "", {0.003, 0}}, {60, "60"},
      {65, "", {0.003, 0}}, {70, "70"}}, {{20, ""}, {25, "", {0.003, 0}},
      {30, ""}, {35, "", {0.003, 0}}, {40, ""}, {45, "", {0.003, 0}}, {50, ""},
      {55, "", {0.003, 0}}, {60, ""}, {65, "", {0.003, 0}}, {70, ""}}}},
  PlotRange → {{17, 61}, {-0.0006, 0.0004}}]
```

Out[16787]=



In[16788]:=

```
Export["RealCorrection.svg", qversusreal]
```

Out[16788]=

RealCorrection.svg

In[16789]:=

```
(*Here I combined the q and imaginary correction to make an (x,y) fair*)
```

In[16790]:=

```
qandimaginary = Transpose[{qs, imaginarycorrection}]
```

Out[16790]=

$$\{\{0.3342, 0. + 1.70929 \times 10^{-11}\,\mathrm{i}\}, \{1.3342, 0. + 1.1348 \times 10^{-9}\,\mathrm{i}\},$$
$$\{2.3342, 0. + 6.35258 \times 10^{-9}\,\mathrm{i}\}, \{3.3342, 0. + 1.93945 \times 10^{-8}\,\mathrm{i}\},$$
$$\{4.3342, 0. + 4.47272 \times 10^{-8}\,\mathrm{i}\}, \{5.3342, 0. + 8.77537 \times 10^{-8}\,\mathrm{i}\},$$
$$\{6.3342, 0. + 1.5507 \times 10^{-7}\,\mathrm{i}\}, \{7.3342, 0. + 2.54811 \times 10^{-7}\,\mathrm{i}\},$$
$$\{8.3342, 0. + 3.97116 \times 10^{-7}\,\mathrm{i}\}, \{9.3342, 0. + 5.94776 \times 10^{-7}\,\mathrm{i}\},$$
$$\{10.3342, 0. + 8.64115 \times 10^{-7}\,\mathrm{i}\}, \{11.3342, 0. + 1.22621 \times 10^{-6}\,\mathrm{i}\},$$
$$\{12.3342, 0. + 1.70844 \times 10^{-6}\,\mathrm{i}\}, \{13.3342, 0. + 2.3459 \times 10^{-6}\,\mathrm{i}\},$$
$$\{14.3342, 0. + 3.17852 \times 10^{-6}\,\mathrm{i}\}, \{15.3342, 0. + 4.19806 \times 10^{-6}\,\mathrm{i}\},$$
$$\{16.3342, 0. + 4.21512 \times 10^{-6}\,\mathrm{i}\}, \{17.3342, 7.30689 \times 10^{-10}\}, \{18.3342, 8.25444 \times 10^{-6}\},$$
$$\{19.3342, 0.000016228\}, \{20.3342, 0.000022968\}, \{21.3342, 0.0000289984\},$$
$$\{22.3342, 0.0000346485\}, \{23.3342, 0.0000401106\}, \{24.3342, 0.000045501\},$$
$$\{25.3342, 0.0000508936\}, \{26.3342, 0.0000563372\}, \{27.3342, 0.0000618649\},$$
$$\{28.3342, 0.0000675003\}, \{29.3342, 0.0000732604\}, \{30.3342, 0.0000791578\},$$
$$\{31.3342, 0.0000852021\}, \{32.3342, 0.0000914004\}, \{33.3342, 0.0000977585\},$$
$$\{34.3342, 0.000104281\}, \{35.3342, 0.000110971\}, \{36.3342, 0.000117832\},$$
$$\{37.3342, 0.000124866\}, \{38.3342, 0.000132076\}, \{39.3342, 0.000139462\},$$
$$\{40.3342, 0.000147026\}, \{41.3342, 0.000154769\}, \{42.3342, 0.000162693\},$$
$$\{43.3342, 0.000170797\}, \{44.3342, 0.000179084\}, \{45.3342, 0.000187552\},$$
$$\{46.3342, 0.000196204\}, \{47.3342, 0.000205039\}, \{48.3342, 0.000214058\},$$
$$\{49.3342, 0.000223261\}, \{50.3342, 0.000232648\}, \{51.3342, 0.000242221\},$$
$$\{52.3342, 0.000251978\}, \{53.3342, 0.00026192\}, \{54.3342, 0.000272048\},$$
$$\{55.3342, 0.000282361\}, \{56.3342, 0.00029286\}, \{57.3342, 0.000303545\},$$
$$\{58.3342, 0.000314416\}, \{59.3342, 0.000325473\}, \{60, 0.000332938\}\}$$

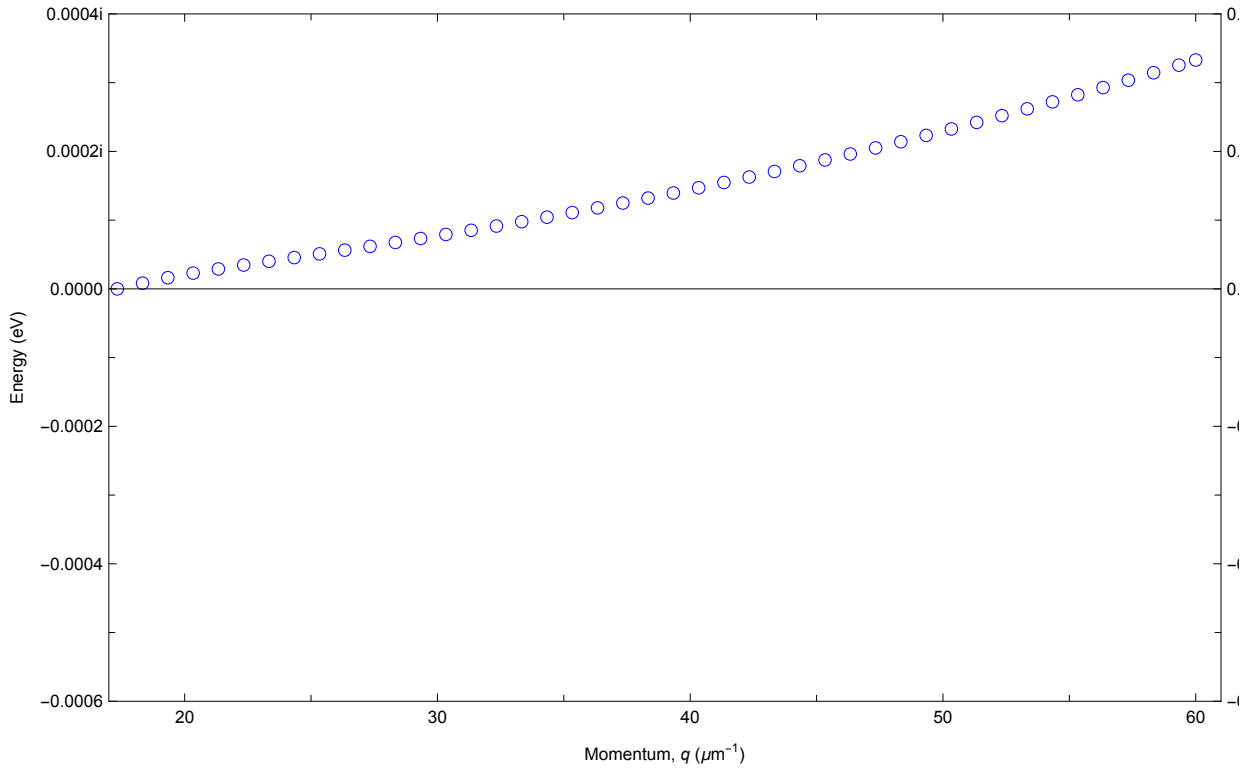
In[16791]:=

```
(*Here I am going to plot the imaginary correction as a function of q*)
```

In[16792]:=

```
qversusimaginary = ListPlot[qandimaginary,
  PlotMarkers → {Graphics[{EdgeForm[Blue], White, Disk[]}], 7},
  FrameLabel → {{"Energy (eV)", "(meV)"},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}} , Frame → True,
  FrameTicks → {{{{-0.0006, "-0.0006"}, {-0.0005, "", {0.003, 0}},
      {-0.0004, "-0.0004"}, {-0.0003, "", {0.003, 0}}, {-0.0002, "-0.0002"},
      {-0.0001, "", {0.003, 0}}, {0, "0.0000"}, {0.0001, "", {0.003, 0}},
      {0.0002, "0.0002i"}, {0.0003, "", {0.003, 0}}, {0.0004, "0.0004i"}},
     {{-0.0006, "-0.6"}, {-0.0005, "", {0.003, 0}}, {-0.0004, "-0.4"},
      {-0.0003, "", {0.003, 0}}, {-0.0002, "-0.2"},
      {-0.0001, "", {0.003, 0}}, {0, "0.0"}, {0.0001, "", {0.003, 0}},
      {0.0002, "0.2i"}, {0.0003, "", {0.003, 0}}, {0.0004, "0.4i"}}},
    {{{20, "20"}, {25, "", {0.003, 0}}, {30, "30"}, {35, "", {0.003, 0}},
      {40, "40"}, {45, "", {0.003, 0}}, {50, "50"}, {55, "", {0.003, 0}}, {60, "60"},
      {65, "", {0.003, 0}}, {70, "70"}}, {{20, ""}, {25, "", {0.003, 0}},
      {30, ""}, {35, "", {0.003, 0}}, {40, ""}, {45, "", {0.003, 0}}, {50, ""},
      {55, "", {0.003, 0}}, {60, ""}, {65, "", {0.003, 0}}, {70, ""}}}},
  PlotRange → {{17, 61}, {-0.0006, 0.0004}}]
```

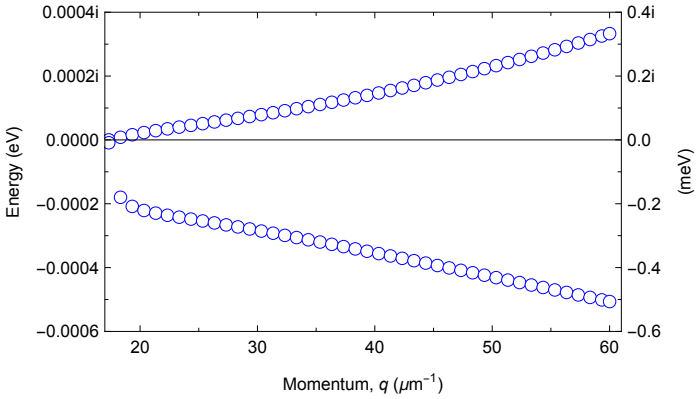
Out[16792]=



In[16793]:=

```
corr = Show[qversusimaginary, qversusreal]
```

Out[16793]=



In[16794]:=

```
Export["corr.svg", corr]
```

Out[16794]=

corr.svg

In[16795]:=

```
Export["ImaginaryCorrection.svg", qversusimaginary]
```

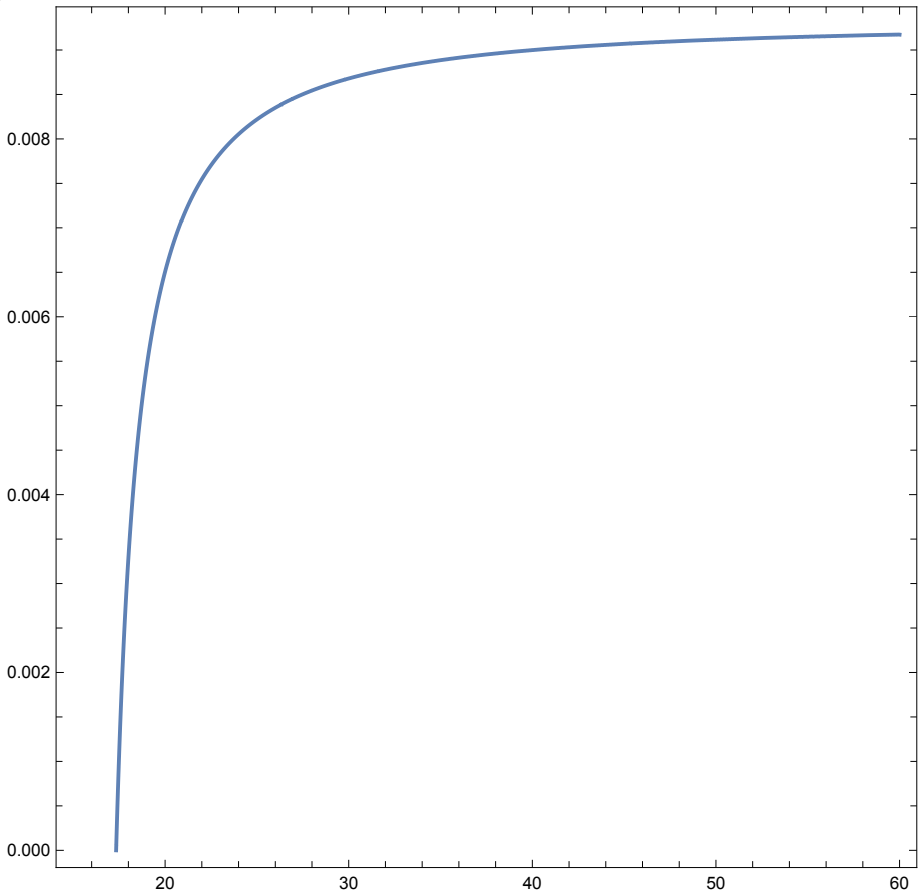
Out[16795]=

ImaginaryCorrection.svg

In[16796]:=

$$\texttt{inf = ContourPlot}\left[x^2 == (k[y])^2 * \frac{\varkappa[y]}{\varkappa[y]+1},\ \{x, 15, 60\},\ \left\{y, 0, \frac{b * LT}{b+1}\right\},\ \texttt{PlotPoints} \to \{150\}\right]$$

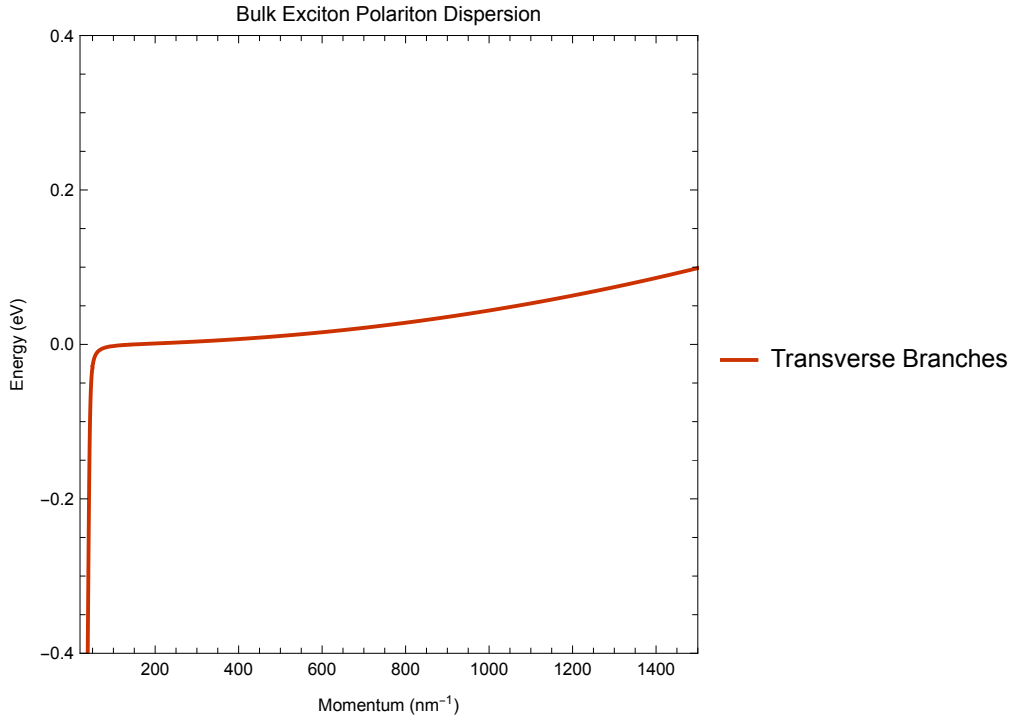
Out[16796]=



In[16797]:=

```
BulkDispersionTop = ContourPlot[EB * aB^2 / M x^2 - y ==
  b * EB * aB^2 * (k[y])^2 / (2 * M) - y/2 + (((EB * aB^2 * (k[y])^2 * b / (2 * M) - y/2)^2 + EB * aB^2 * (k[y])^2 / M * b * LT)^(1/2),
  {x, 20, 1500}, {y, -0.4, 0.4}, FrameLabel → {"Momentum (nm^-1)", "Energy (eV)"},
  ContourLabels → All, ContourStyle → {ColorData[80, 1]},
  PlotLabel → "Bulk Exciton Polariton Dispersion",
  PlotLegends → {"Transverse Branches"},
  PlotPoints → {150}, PlotRange → {{20, 1500}, {-0.4, 0.4}}]
```

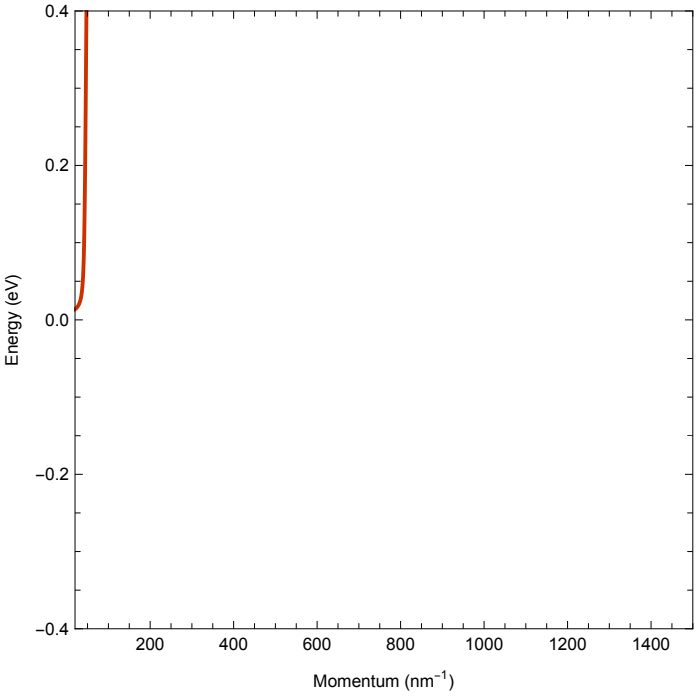
Out[16797]=



In[16798]:=

```
BulkDispersionBottom = ContourPlot[EB * aB^2/M x^2 - y ==
  b * EB * aB^2 * (k[y])^2/(2 * M) - y/2 - (((EB * aB^2 * (k[y])^2 * b)/(2 * M) - y/2)^2 + EB * aB^2 * (k[y])^2/M * b * LT)^(1/2),
 {x, 20, 1500}, {y, -0.4, 0.4}, FrameLabel → {"Momentum (nm^-1)", "Energy (eV)"},
 ContourLabels → All, ContourStyle → {ColorData[80, 1]},
 PlotPoints → {150}, PlotRange → {{20, 1500}, {-0.4, 0.4}}]
```

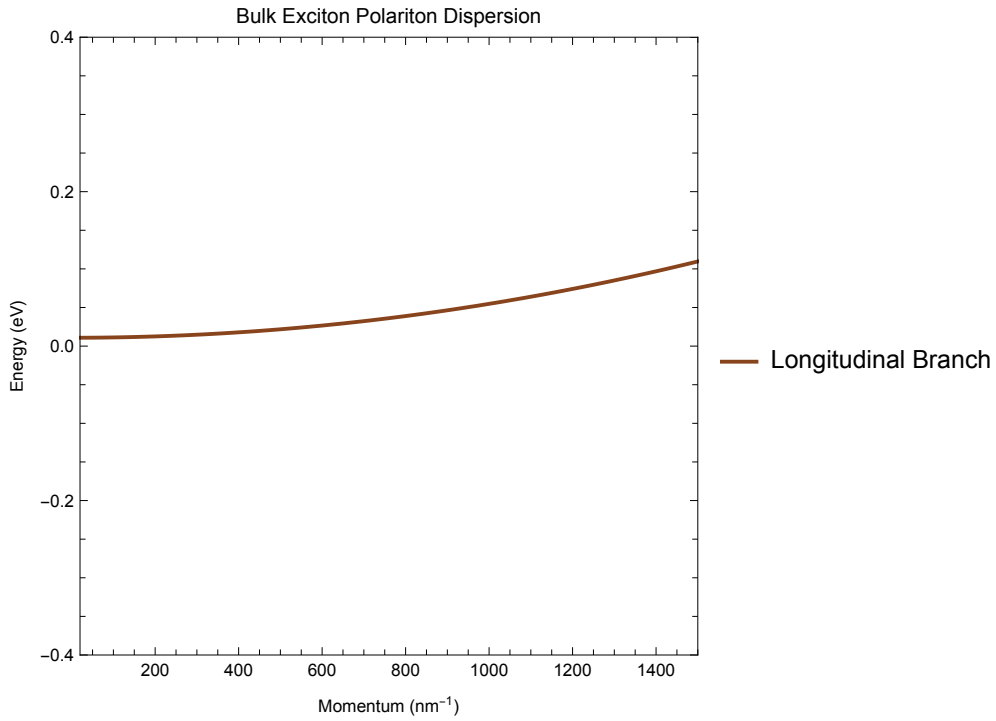
Out[16798]=



In[16799]:=

```
LongitudinalBranch = ContourPlot[y == LT + (EB * aB^2)/M x^2, {x, 20, 1500},
  {y, -0.4, 0.4}, FrameLabel → {"Momentum (nm^-1)", "Energy (eV)"},
  ContourLabels → All, ContourStyle → {ColorData[30, 30]},
  PlotLabel → "Bulk Exciton Polariton Dispersion",
  PlotLegends → {"Longitudinal Branch"}, PlotRange → {{20, 1500}, {-0.4, 0.4}}]
```

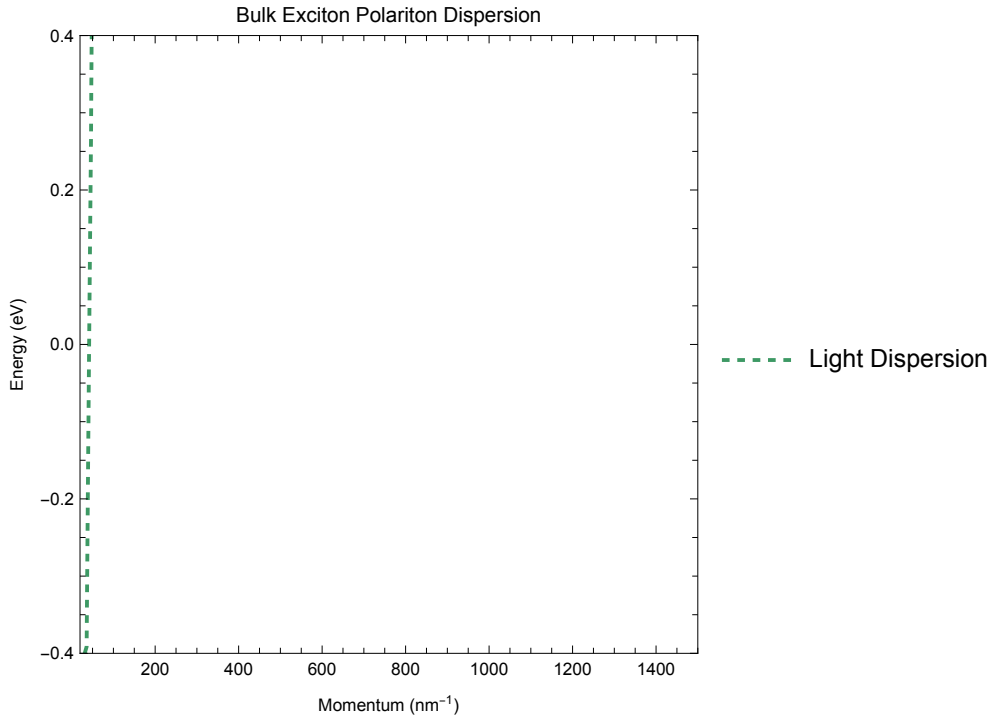
Out[16799]=



In[16800]:=

```
LightDispersion = ContourPlot[x^2 == (k[y])^2 * b, {x, 20, 1500},
  {y, -0.4, 0.4}, FrameLabel → {"Momentum (nm^-1)", "Energy (eV)"},
  ContourLabels → All, ContourStyle → {ColorData[1, 38], Dashed},
  PlotLabel → "Bulk Exciton Polariton Dispersion",
  PlotLegends → {"Light Dispersion"}, PlotRange → {{20, 1500}, {-0.4, 0.4}}]
```

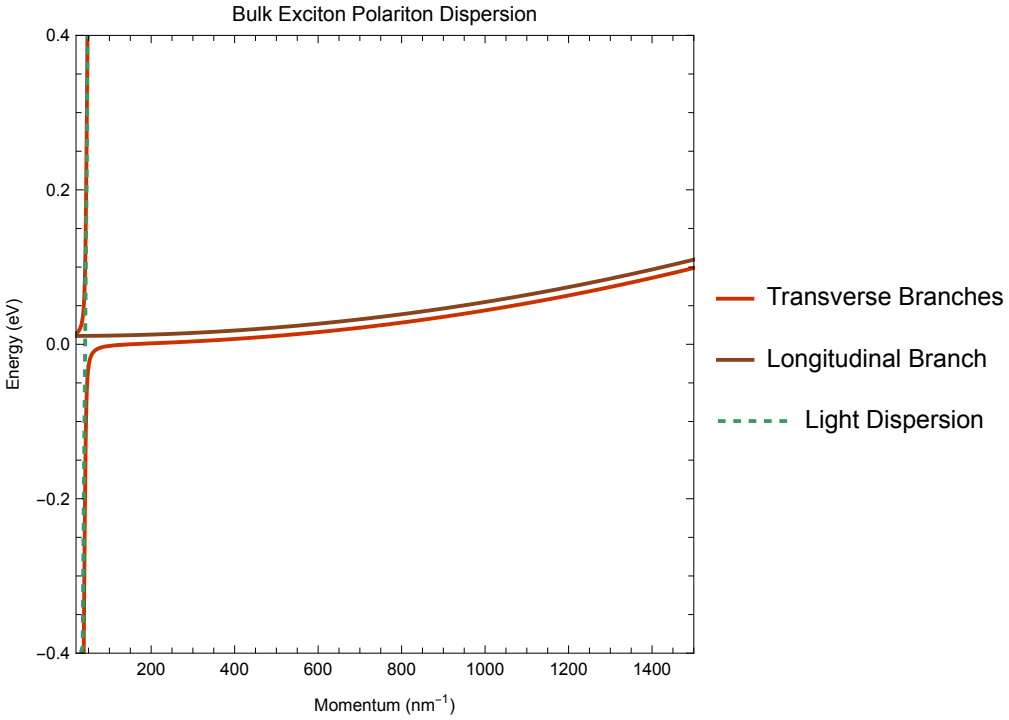
Out[16800]=



In[16801]:=

```
Bulk = Show[BulkDispersionTop,
  BulkDispersionBottom, LongitudinalBranch, LightDispersion]
```

Out[16801]=



In[16802]:=

```
Export["Bulk.svg", Bulk]
```

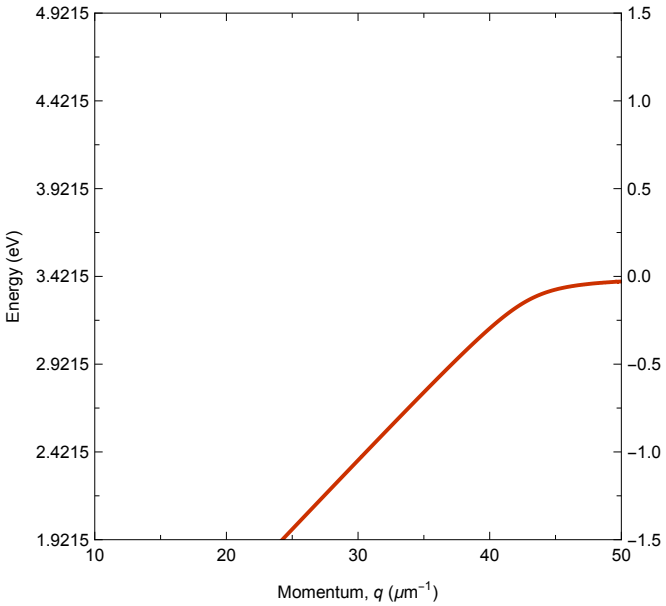
Out[16802]=

```
Bulk.svg
```

In[16803]:=

```
TestTop = ContourPlot[EB * aB^2/M x^2 - y ==
    b * EB * aB^2 * (k[y])^2/(2 * M) - y/2 + (((EB * aB^2 * (k[y])^2 * b)/(2 * M) - y/2)^2 + EB * aB^2 * (k[y])^2/M * b * LT)^(1/2),
  {x, 10, 50}, {y, -1.5, 1.5}, FrameLabel → {{"Energy (eV)", ""},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}}, Frame → True,
  FrameTicks → {{{{-1.5, "1.9215"}, {-1.25, "", {0.003, 0}}, {-1.0, "2.4215"},
      {-0.75, "", {0.003, 0}}, {-0.5, "2.9215"}, {-0.25, "", {0.003, 0}},
      {0, "3.4215"}, {0.25, "", {0.003, 0}}, {0.5, "3.9215"}, {0.75, "", {0.003, 0}},
      {1, "4.4215"}, {1.25, "", {0.003, 0}}, {1.5, "4.9215"}},
     {{-1.5, "-1.5"}, {-1.25, "", {0.003, 0}}, {-1.0, "-1.0"},
      {-0.75, "", {0.003, 0}}, {-0.5, "-0.5"}, {-0.25, "", {0.003, 0}},
      {0, "0.0"}, {0.25, "", {0.003, 0}}, {0.5, "0.5"}, {0.75, "", {0.003, 0}},
      {1, "1.0"}, {1.25, "", {0.003, 0}}, {1.5, "1.5"}}},
    {{{10, "10"}, {15, "", {0.003, 0}}, {20, "20"}, {25, "", {0.003, 0}},
      {30, "30"}, {35, "", {0.003, 0}}, {40, "40"}, {45, "", {0.003, 0}}, {50, "50"},
      {55, "", {0.003, 0}}, {60, "60"}, {65, "", {0.003, 0}}, {70, "70"}},
     {{10, ""}, {15, "", {0.003, 0}}, {20, ""}, {25, "", {0.003, 0}}, {30, ""},
      {35, "", {0.003, 0}}, {40, ""}, {45, "", {0.003, 0}}, {50, ""},
      {55, "", {0.003, 0}}, {60, ""}, {65, "", {0.003, 0}}, {70, ""}}}},
  ContourLabels → All, ContourStyle → {ColorData[80, 1]},
  PlotPoints → {150},
  PlotRange → {{10, 50}, {-1.5, 1.5}}]
```

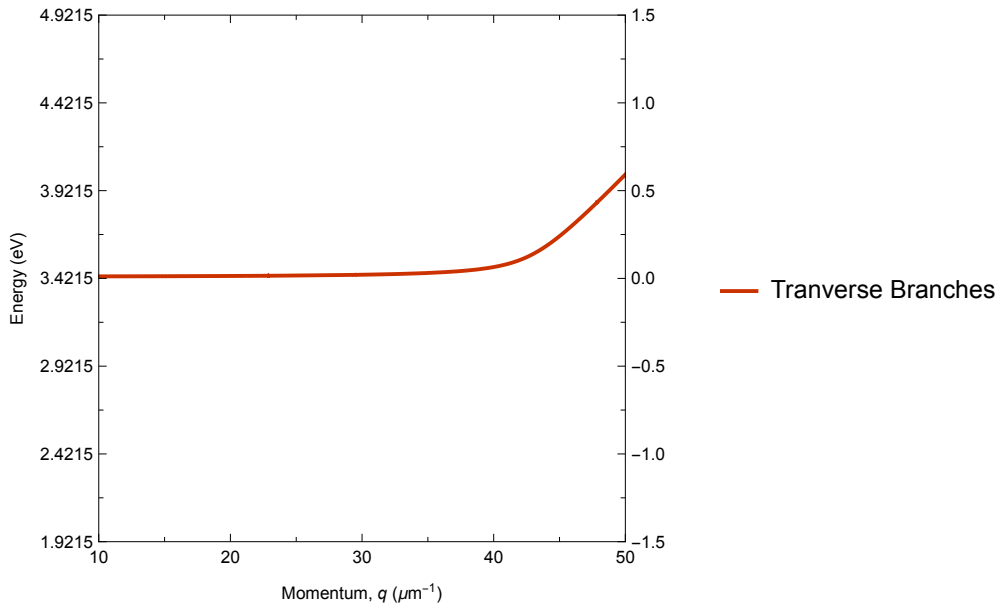
Out[16803]=



In[16804]:=

```
TestBottom = ContourPlot[EB * aB^2 / M x^2 - y ==
  b * EB * aB^2 * (k[y])^2 / (2 * M) - y/2 - (((EB * aB^2 * (k[y])^2 * b / (2 * M) - y/2)^2 + EB * aB^2 * (k[y])^2 / M * b * LT)^(1/2),
 {x, 10, 50}, {y, -1.5, 1.5}, FrameLabel → {{"Energy (eV)", ""},
  {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}}, Frame → True,
 FrameTicks → {{{{-1.5, "1.9215"}, {-1.25, "", {0.003, 0}}, {-1.0, "2.4215"},
    {-0.75, "", {0.003, 0}}, {-0.5, "2.9215"}, {-0.25, "", {0.003, 0}},
    {0, "3.4215"}, {0.25, "", {0.003, 0}}, {0.5, "3.9215"}, {0.75, "", {0.003, 0}},
    {1, "4.4215"}, {1.25, "", {0.003, 0}}, {1.5, "4.9215"}},
   {{-1.5, "-1.5"}, {-1.25, "", {0.003, 0}}, {-1.0, "-1.0"},
    {-0.75, "", {0.003, 0}}, {-0.5, "-0.5"}, {-0.25, "", {0.003, 0}},
    {0, "0.0"}, {0.25, "", {0.003, 0}}, {0.5, "0.5"}, {0.75, "", {0.003, 0}},
    {1, "1.0"}, {1.25, "", {0.003, 0}}, {1.5, "1.5"}}},
  {{{10, "10"}, {15, "", {0.003, 0}}, {20, "20"}, {25, "", {0.003, 0}},
    {30, "30"}, {35, "", {0.003, 0}}, {40, "40"}, {45, "", {0.003, 0}}, {50, "50"},
    {55, "", {0.003, 0}}, {60, "60"}, {65, "", {0.003, 0}}, {70, "70"}},
   {{10, ""}, {15, "", {0.003, 0}}, {20, ""}, {25, "", {0.003, 0}}, {30, ""},
    {35, "", {0.003, 0}}, {40, ""}, {45, "", {0.003, 0}}, {50, ""},
    {55, "", {0.003, 0}}, {60, ""}, {65, "", {0.003, 0}}, {70, ""}}}},
 ContourLabels → All, ContourStyle → {ColorData[80, 1]},
 PlotLegends → {"Tranverse Branches"},
 PlotPoints → {150},
 PlotRange → {{10, 50}, {-1.5, 1.5}}]
```

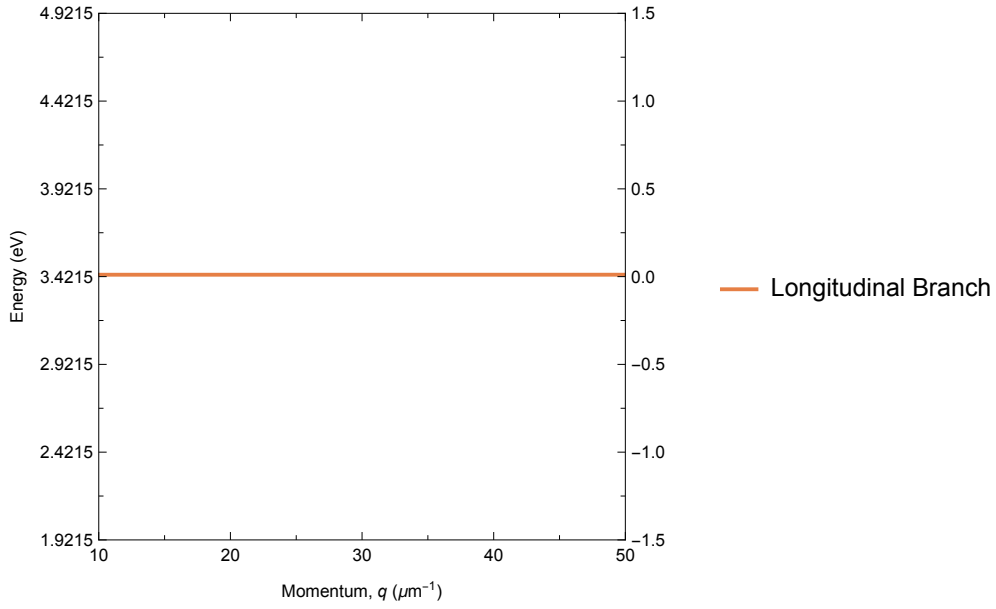
Out[16804]=



In[16805]:=

```
TestBranch =
 ContourPlot[y == LT + (EB * aB^2)/M x^2, {x, 10, 50}, {y, -1.5, 1.5}, FrameLabel →
   {{"Energy (eV)", ""}, {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}},
  Frame → True, FrameTicks → {{{{-1.5, "1.9215"}, {-1.25, "", {0.003, 0}},
      {-1.0, "2.4215"}, {-0.75, "", {0.003, 0}}, {-0.5, "2.9215"},
      {-0.25, "", {0.003, 0}}, {0, "3.4215"}, {0.25, "", {0.003, 0}},
      {0.5, "3.9215"}, {0.75, "", {0.003, 0}}, {1, "4.4215"}, {1.25, "", {0.003, 0}},
      {1.5, "4.9215"}}, {{-1.5, "-1.5"}, {-1.25, "", {0.003, 0}},
      {-1.0, "-1.0"}, {-0.75, "", {0.003, 0}}, {-0.5, "-0.5"},
      {-0.25, "", {0.003, 0}}, {0, "0.0"}, {0.25, "", {0.003, 0}}, {0.5, "0.5"},
      {0.75, "", {0.003, 0}}, {1, "1.0"}, {1.25, "", {0.003, 0}}, {1.5, "1.5"}}},
    {{{10, "10"}, {15, "", {0.003, 0}}, {20, "20"}, {25, "", {0.003, 0}},
      {30, "30"}, {35, "", {0.003, 0}}, {40, "40"}, {45, "", {0.003, 0}}, {50, "50"},
      {55, "", {0.003, 0}}, {60, "60"}, {65, "", {0.003, 0}}, {70, "70"}},
     {{10, ""}, {15, "", {0.003, 0}}, {20, ""}, {25, "", {0.003, 0}}, {30, ""},
      {35, "", {0.003, 0}}, {40, ""}, {45, "", {0.003, 0}}, {50, ""},
      {55, "", {0.003, 0}}, {60, ""}, {65, "", {0.003, 0}}, {70, ""}}}},
  ContourLabels → All, ContourStyle → {ColorData[70, 70]},
  PlotLegends → {"Longitudinal Branch"},
  PlotPoints → {150},
  PlotRange → {{10, 50}, {-1.5, 1.5}}]
```

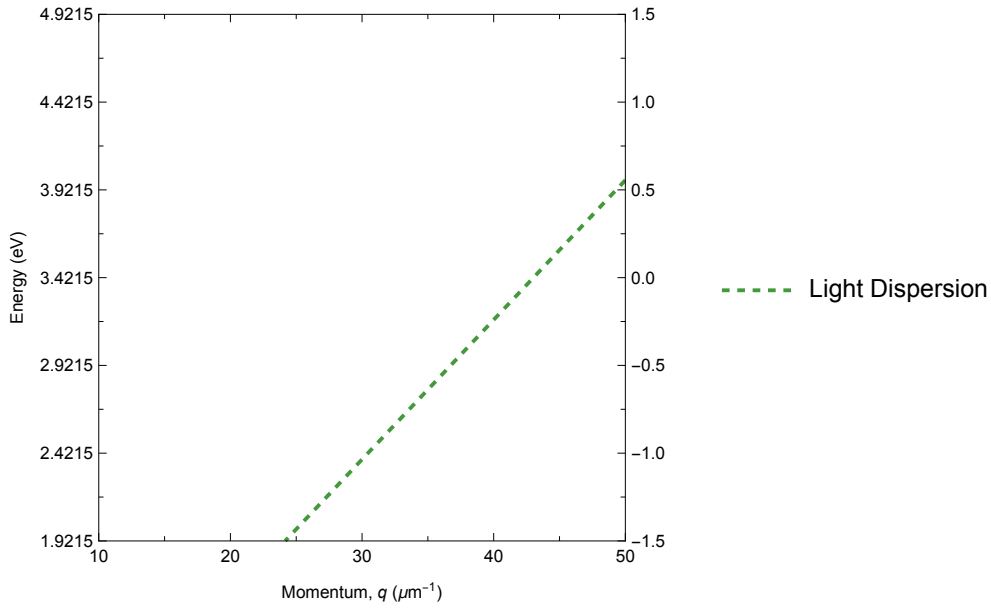
Out[16805]=



In[16806]:=

```
FirstLightDispersion =
 ContourPlot[x^2 == (k[y])^2 * b, {x, 10, 50}, {y, -1.5, 1.5}, FrameLabel →
   {{"Energy (eV)", ""}, {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}},
  Frame → True, FrameTicks → {{{{-1.5, "1.9215"}, {-1.25, "", {0.003, 0}},
      {-1.0, "2.4215"}, {-0.75, "", {0.003, 0}}, {-0.5, "2.9215"},
      {-0.25, "", {0.003, 0}}, {0, "3.4215"}, {0.25, "", {0.003, 0}},
      {0.5, "3.9215"}, {0.75, "", {0.003, 0}}, {1, "4.4215"}, {1.25, "", {0.003, 0}},
      {1.5, "4.9215"}}, {{-1.5, "-1.5"}, {-1.25, "", {0.003, 0}},
      {-1.0, "-1.0"}, {-0.75, "", {0.003, 0}}, {-0.5, "-0.5"},
      {-0.25, "", {0.003, 0}}, {0, "0.0"}, {0.25, "", {0.003, 0}}, {0.5, "0.5"},
      {0.75, "", {0.003, 0}}, {1, "1.0"}, {1.25, "", {0.003, 0}}, {1.5, "1.5"}}},
    {{{10, "10"}, {15, "", {0.003, 0}}, {20, "20"}, {25, "", {0.003, 0}},
      {30, "30"}, {35, "", {0.003, 0}}, {40, "40"}, {45, "", {0.003, 0}}, {50, "50"},
      {55, "", {0.003, 0}}, {60, "60"}, {65, "", {0.003, 0}}, {70, "70"}},
     {{10, ""}, {15, "", {0.003, 0}}, {20, ""}, {25, "", {0.003, 0}}, {30, ""},
      {35, "", {0.003, 0}}, {40, ""}, {45, "", {0.003, 0}}, {50, ""},
      {55, "", {0.003, 0}}, {60, ""}, {65, "", {0.003, 0}}, {70, ""}}}},
  ContourLabels → All, ContourStyle → {ColorData[1, 80], Dashed},
  PlotLegends → {"Light Dispersion"},
  PlotPoints → {150},
  PlotRange → {{10, 50}, {-1.5, 1.5}}]
```

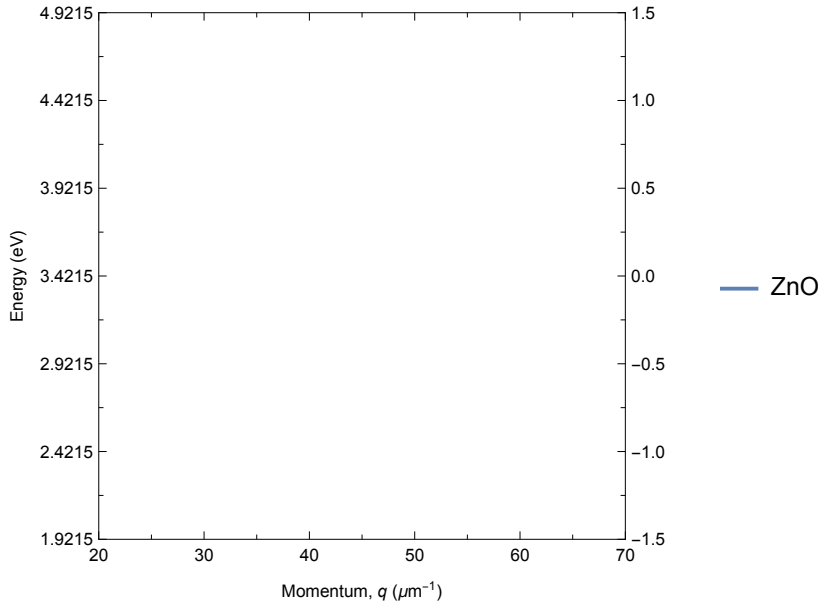
Out[16806]=



In[16807]:=

```
misc = ContourPlot[x == -1, {x, 20, 70},
  {y, -1.5, 1.5}, FrameLabel → {{"Energy (eV)", ""},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}} , Frame → True,
  FrameTicks → {{{{-1.5, "1.9215"}, {-1.25, "", {0.003, 0}}, {-1.0, "2.4215"},
      {-0.75, "", {0.003, 0}}, {-0.5, "2.9215"}, {-0.25, "", {0.003, 0}},
      {0, "3.4215"}, {0.25, "", {0.003, 0}}, {0.5, "3.9215"}, {0.75, "", {0.003, 0}},
      {1, "4.4215"}, {1.25, "", {0.003, 0}}, {1.5, "4.9215"}},
     {{-1.5, "-1.5"}, {-1.25, "", {0.003, 0}}, {-1.0, "-1.0"},
      {-0.75, "", {0.003, 0}}, {-0.5, "-0.5"}, {-0.25, "", {0.003, 0}},
      {0, "0.0"}, {0.25, "", {0.003, 0}}, {0.5, "0.5"}, {0.75, "", {0.003, 0}},
      {1, "1.0"}, {1.25, "", {0.003, 0}}, {1.5, "1.5"}}},
    {{{20, "20"}, {25, "", {0.003, 0}}, {30, "30"}, {35, "", {0.003, 0}},
      {40, "40"}, {45, "", {0.003, 0}}, {50, "50"}, {55, "", {0.003, 0}}, {60, "60"},
      {65, "", {0.003, 0}}, {70, "70"}}, {{20, ""}, {25, "", {0.003, 0}},
      {30, ""}, {35, "", {0.003, 0}}, {40, ""}, {45, "", {0.003, 0}}, {50, ""},
      {55, "", {0.003, 0}}, {60, ""}, {65, "", {0.003, 0}}, {70, ""}}}},
  ContourLabels → All, PlotLegends → {"ZnO"}, PlotPoints → {150},
  PlotRange → {{20, 70}, {-1.5, 1.5}}]
```

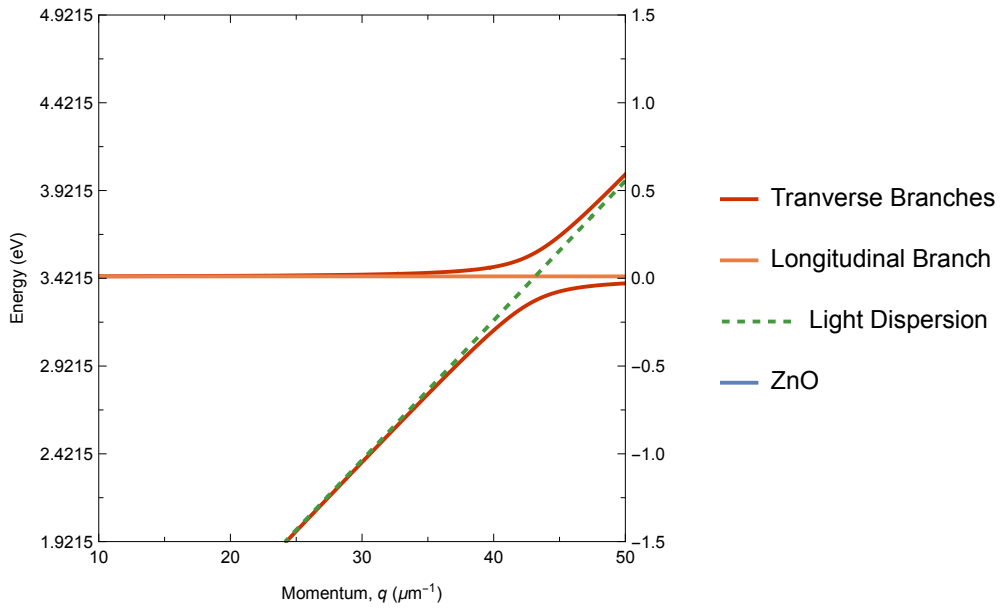
Out[16807]=



In[16808]:=

```
p1 = Show[TestBottom, TestTop, TestBranch, FirstLightDispersion, misc]
```

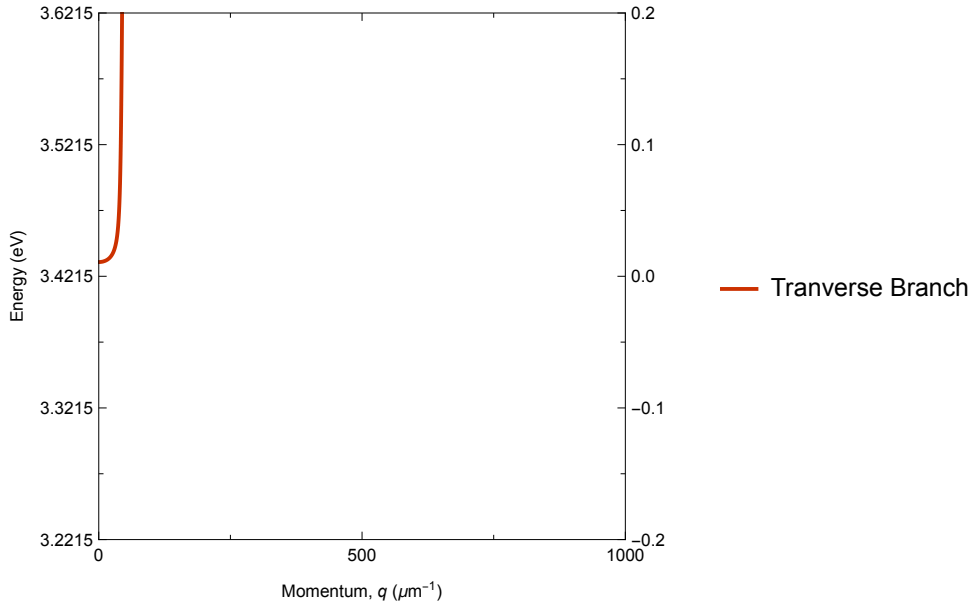
Out[16808]=



In[16809]:=

```
OnlyBottom = ContourPlot[EB * aB^2/M x^2 - y ==
  b * EB * aB^2 * (k[y])^2/(2 * M) - y/2 - (((EB * aB^2 * (k[y])^2 * b)/(2 * M) - y/2)^2 + EB * aB^2 * (k[y])^2/M * b * LT)^(1/2),
 {x, 0, 1000}, {y, -0.2, 0.2}, FrameLabel →
  {{"Energy (eV)", ""}, {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}},
 Frame → True, FrameTicks → {{{{-0.2, "3.2215"}, {-0.15, "", {0.003, 0}},
     {-0.1, "3.3215"}, {-0.05, "", {0.003, 0}}, {0, "3.4215"},
     {0.05, "", {0.003, 0}}, {0.1, "3.5215"}, {0.15, "", {0.003, 0}},
     {0.2, "3.6215"}, {0.25, "", {0.003, 0}}, {0.3, "3.7215"}},
    {{-0.2, "-0.2"}, {-0.15, "", {0.003, 0}}, {-0.1, "-0.1"},
     {-0.05, "", {0.003, 0}}, {0, "0.0"}, {0.05, "", {0.003, 0}}, {0.1, "0.1"},
     {0.15, "", {0.003, 0}}, {0.2, "0.2"}, {0.25, "", {0.003, 0}}, {0.3, "0.3"}}},
   {{{0, "0"}, {250, "", {0.003, 0}}, {500, "500"}, {750, "", {0.003, 0}},
     {1000, "1000"}, {1500, "", {0.003, 0}}, {2000, "2000"}},
    {{0, ""}, {250, "", {0.003, 0}}, {500, ""}, {750, "", {0.003, 0}},
     {1000, ""}, {1500, "", {0.003, 0}}, {2000, ""}}}},
 ContourLabels → All, ContourStyle → {ColorData[80, 1]},
 PlotLegends → {"Tranverse Branch"},
 PlotPoints → {150},
 PlotRange → {{0, 1000}, {-0.2, 0.2}}]
```

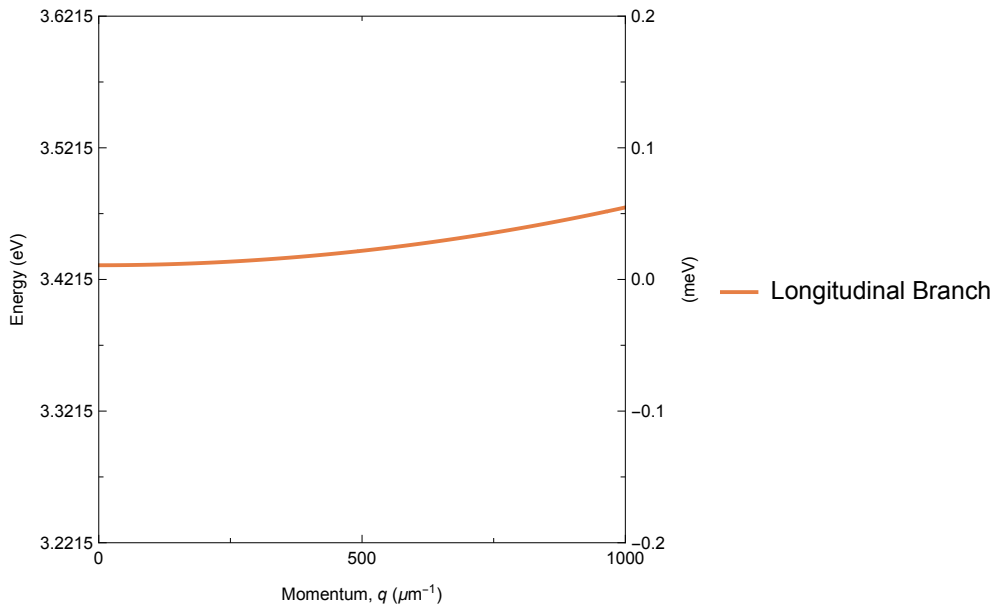
Out[16809]=



In[16810]:=

```
OnlyBranch = ContourPlot[y == LT + (EB * aB^2)/M x^2, {x, 0, 1000},
  {y, -0.2, 0.2}, FrameLabel → {{"Energy (eV)", "(meV)"},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}},
  Frame → True, FrameTicks → {{{{-0.2, "3.2215"}, {-0.15, "", {0.003, 0}},
      {-0.1, "3.3215"}, {-0.05, "", {0.003, 0}}, {0, "3.4215"},
      {0.05, "", {0.003, 0}}, {0.1, "3.5215"}, {0.15, "", {0.003, 0}},
      {0.2, "3.6215"}, {0.25, "", {0.003, 0}}, {0.3, "3.7215"}},
     {{-0.2, "-0.2"}, {-0.15, "", {0.003, 0}}, {-0.1, "-0.1"},
      {-0.05, "", {0.003, 0}}, {0, "0.0"}, {0.05, "", {0.003, 0}}, {0.1, "0.1"},
      {0.15, "", {0.003, 0}}, {0.2, "0.2"}, {0.25, "", {0.003, 0}}, {0.3, "0.3"}}},
    {{{0, "0"}, {250, "", {0.003, 0}}, {500, "500"}, {750, "", {0.003, 0}},
      {1000, "1000"}, {1500, "", {0.003, 0}}, {2000, "2000"}}, {{0, ""},
      {500, "", {0.003, 0}}, {1000, ""}, {1500, "", {0.003, 0}}, {2000, ""}}}},
  ContourLabels → All, ContourStyle → {ColorData[70, 70]},
  PlotLegends → {"Longitudinal Branch"},
  PlotPoints → {150},
  PlotRange → {{0, 1000}, {-0.2, 0.2}}]
```

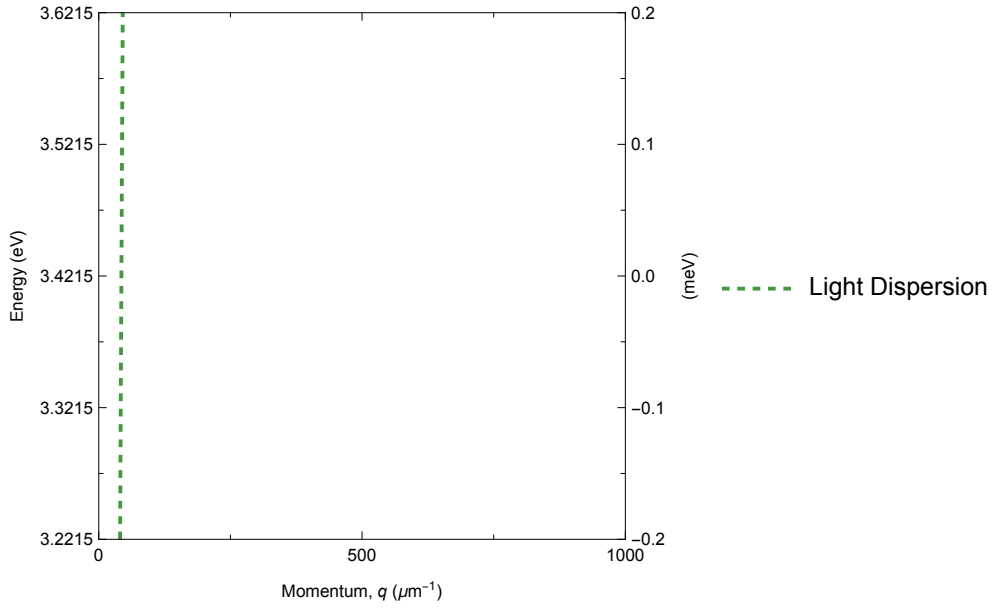
Out[16810]=



In[16811]:=

```
OnlyLightDispersion = ContourPlot[x^2 == (k[y])^2 * b,
  {x, 0, 1000}, {y, -0.2, 0.2}, FrameLabel → {{"Energy (eV)", "(meV)"},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}},
  Frame → True, FrameTicks → {{{{-0.2, "3.2215"}, {-0.15, "", {0.003, 0}},
      {-0.1, "3.3215"}, {-0.05, "", {0.003, 0}}, {0, "3.4215"},
      {0.05, "", {0.003, 0}}, {0.1, "3.5215"}, {0.15, "", {0.003, 0}},
      {0.2, "3.6215"}, {0.25, "", {0.003, 0}}, {0.3, "3.7215"}},
     {{-0.2, "-0.2"}, {-0.15, "", {0.003, 0}}, {-0.1, "-0.1"},
      {-0.05, "", {0.003, 0}}, {0, "0.0"}, {0.05, "", {0.003, 0}}, {0.1, "0.1"},
      {0.15, "", {0.003, 0}}, {0.2, "0.2"}, {0.25, "", {0.003, 0}}, {0.3, "0.3"}}},
    {{{0, "0"}, {250, "", {0.003, 0}}, {500, "500"}, {750, "", {0.003, 0}},
      {1000, "1000"}, {1500, "", {0.003, 0}}, {2000, "2000"}},
     {{0, ""}, {250, "", {0.003, 0}}, {500, ""}, {750, "", {0.003, 0}},
      {1000, ""}, {1500, "", {0.003, 0}}, {2000, ""}}}},
  ContourLabels → All, ContourStyle → {ColorData[1, 80], Dashed},
  PlotLegends → {"Light Dispersion"},
  PlotPoints → {150},
  PlotRange → {{0, 1000}, {-0.2, 0.2}}]
```

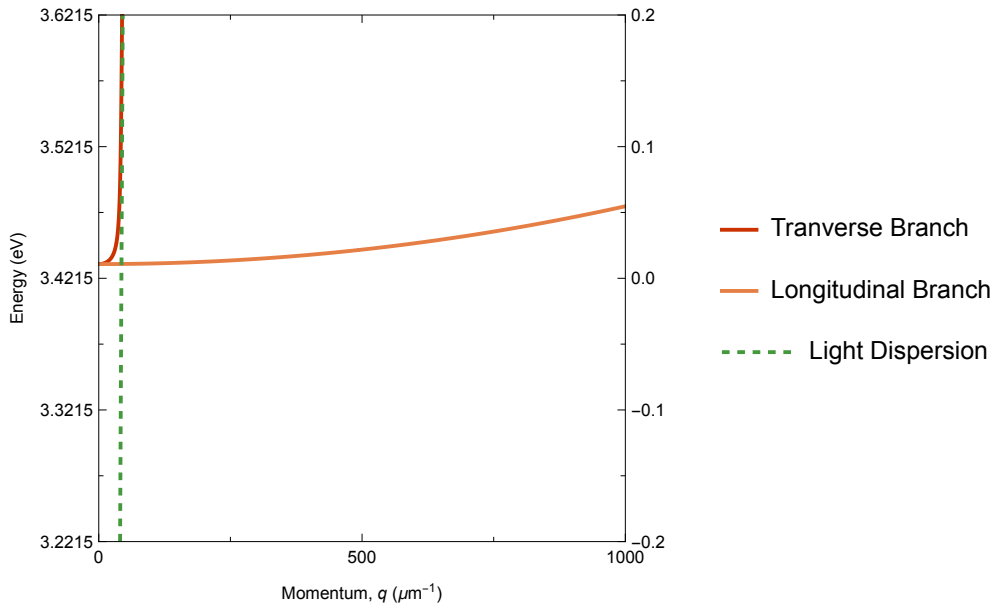
Out[16811]=



In[16812]:=

```
p2 = Show[OnlyBottom, OnlyBranch, OnlyLightDispersion]
```

Out[16812]=

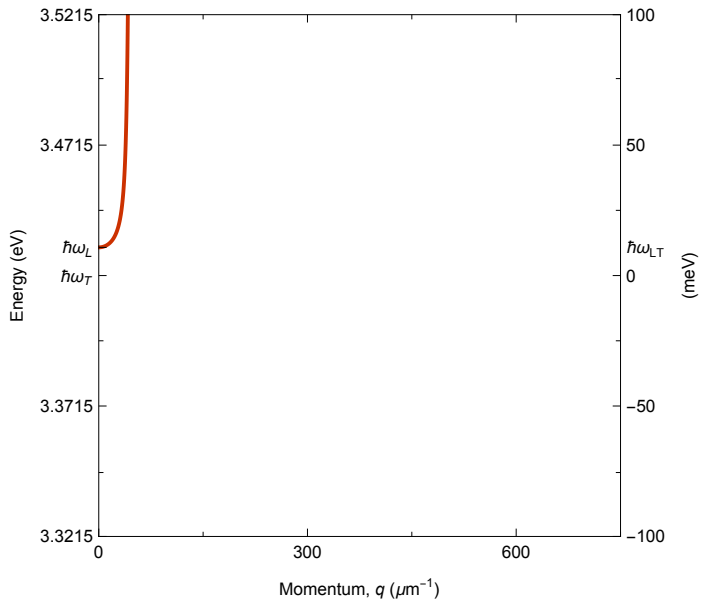


In[16813]:=

In[16814]:=

```
FinalBottom = ContourPlot[EB * aB^2/M x^2 - y ==
  b * EB * aB^2 * (k[y])^2/(2 * M) - y/2 - (((EB * aB^2 * (k[y])^2 * b/(2 * M) - y/2)^2 + EB * aB^2 * (k[y])^2/M * b * LT)^(1/2),
 {x, 0, 750}, {y, -0.1, 0.1}, FrameLabel → {{"Energy (eV)", "(meV)"},
   {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}}, Frame → True,
 FrameTicks → {{{{-0.1, "3.3215"}, {-0.0755, "", {0.003, 0}}, {-0.05, "3.3715"},
     {-0.025, "", {0.003, 0}}, {LT, "ħω_L"}, {0, "ħω_T"}, {0.025, "", {0.003, 0}},
     {0.05, "3.4715"}, {0.0755, "", {0.003, 0}}, {0.1, "3.5215"}},
    {{-0.1, "-100"}, {-0.0755, "", {0.003, 0}}, {-0.05, "-50"},
     {-0.025, "", {0.003, 0}}, {0, "0"}, {LT, "ħω_LT", {0, 0}}, {0.025, "",
      {0.003, 0}}, {0.05, "50"}, {0.0755, "", {0.003, 0}}, {0.1, "100"}}},
   {{{0, "0"}, {150, "", {0.003, 0}}, {300, "300"}, {450, "", {0.003, 0}},
     {600, "600"}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
     {900, "900"}, {1200, "1200"}, {1350, "", {0.003, 0}}, {1500, "1500"}},
    {{0, ""}, {150, "", {0.003, 0}}, {300, ""}, {450, "", {0.003, 0}},
     {600, ""}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
     {900, ""}, {1200, ""}, {1350, "", {0.003, 0}}, {1500, ""}}}},
 ContourLabels → All, ContourStyle → {ColorData[80, 1]},
 PlotPoints → {150},
 PlotRange → {{0, 750}, {-0.1, 0.1}}]
```

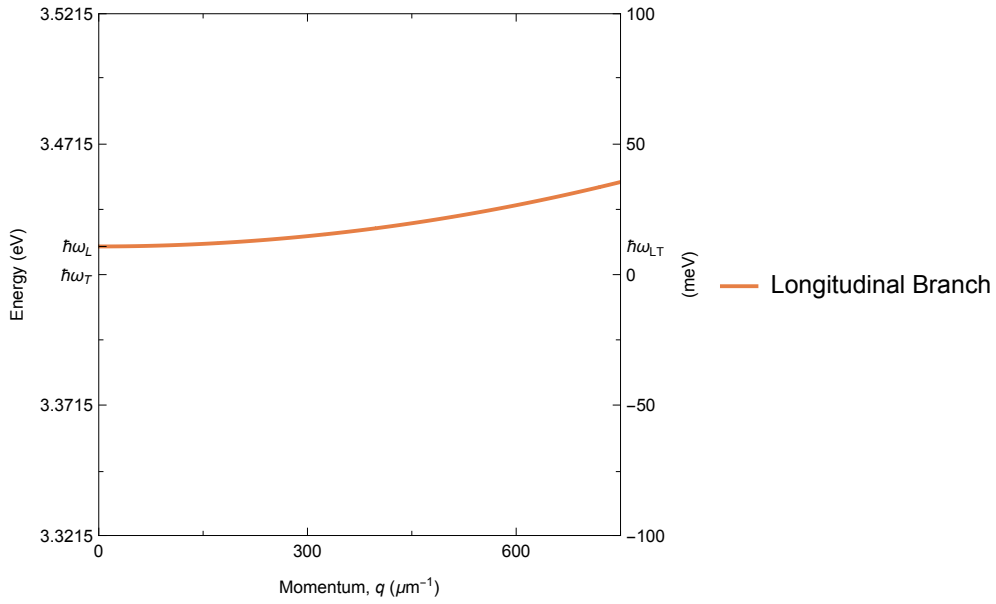
Out[16814]=



In[16815]:=

```
FinalBranch = ContourPlot[y == LT + (EB * aB^2)/M x^2, {x, 0, 750},
  {y, -0.1, 0.1}, FrameLabel → {{"Energy (eV)", "(meV)"},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}}, Frame → True,
  FrameTicks → {{{{-0.1, "3.3215"}, {-0.0755, "", {0.003, 0}}, {-0.05, "3.3715"},
      {-0.025, "", {0.003, 0}}, {LT, "ħω_L"}, {0, "ħω_T"}, {0.025, "", {0.003, 0}},
      {0.05, "3.4715"}, {0.0755, "", {0.003, 0}}, {0.1, "3.5215"}},
     {{-0.1, "-100"}, {-0.0755, "", {0.003, 0}}, {-0.05, "-50"},
      {-0.025, "", {0.003, 0}}, {0, "0"}, {LT, "ħω_LT", {0, 0}}, {0.025, "",
       {0.003, 0}}, {0.05, "50"}, {0.0755, "", {0.003, 0}}, {0.1, "100"}}},
    {{{0, "0"}, {150, "", {0.003, 0}}, {300, "300"}, {450, "", {0.003, 0}},
      {600, "600"}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
      {900, "900"}, {1200, "1200"}, {1350, "", {0.003, 0}}, {1500, "1500"}},
     {{0, ""}, {150, "", {0.003, 0}}, {300, ""}, {450, "", {0.003, 0}},
      {600, ""}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
      {900, ""}, {1200, ""}, {1350, "", {0.003, 0}}, {1500, ""}}}},
  ContourLabels → All, ContourStyle → {ColorData[70, 70]},
  PlotLegends → {"Longitudinal Branch"},
  PlotPoints → {150},
  PlotRange → {{0, 750}, {-0.1, 0.1}}]
```

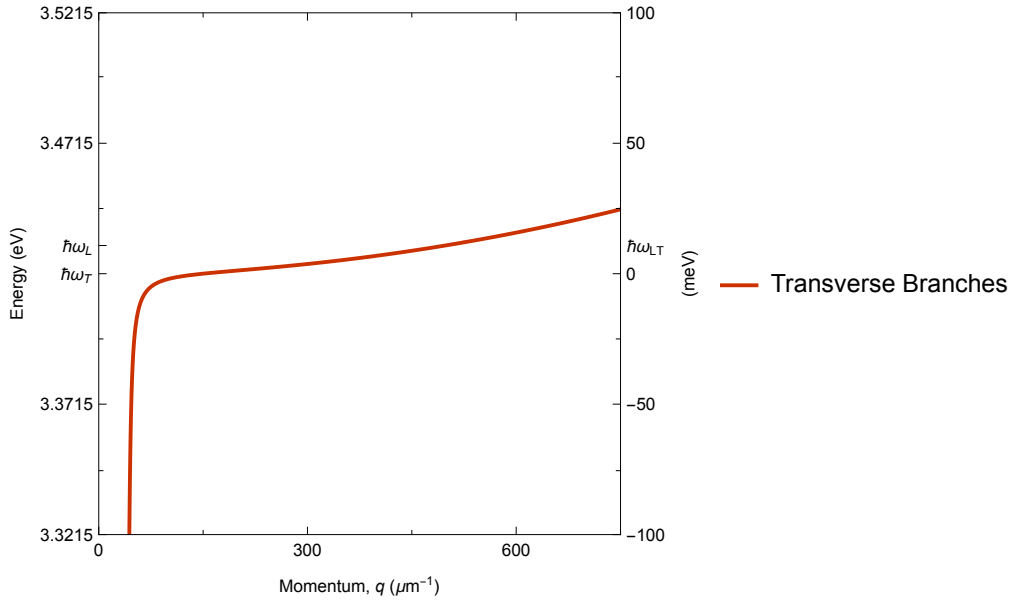
Out[16815]=



In[16816]:=

```
FinalTop = ContourPlot[EB * aB^2/M x^2 - y ==
  b * EB * aB^2 * (k[y])^2/(2 * M) - y/2 + (((EB * aB^2 * (k[y])^2 * b)/(2 * M) - y/2)^2 + EB * aB^2 * (k[y])^2/M * b * LT)^(1/2),
 {x, 0, 750}, {y, -0.1, 0.1}, FrameLabel → {{"Energy (eV)", "(meV)"},
   {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}}, Frame → True,
 FrameTicks → {{{{-0.1, "3.3215"}, {-0.0755, "", {0.003, 0}}, {-0.05, "3.3715"},
     {-0.025, "", {0.003, 0}}, {LT, "ħω_L"}, {0, "ħω_T"}, {0.025, "", {0.003, 0}},
     {0.05, "3.4715"}, {0.0755, "", {0.003, 0}}, {0.1, "3.5215"}},
    {{-0.1, "-100"}, {-0.0755, "", {0.003, 0}}, {-0.05, "-50"},
     {-0.025, "", {0.003, 0}}, {0, "0"}, {LT, "ħω_LT", {0, 0}}, {0.025, "",
      {0.003, 0}}, {0.05, "50"}, {0.0755, "", {0.003, 0}}, {0.1, "100"}}},
   {{{0, "0"}, {150, "", {0.003, 0}}, {300, "300"}, {450, "", {0.003, 0}},
     {600, "600"}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
     {900, "900"}, {1200, "1200"}, {1350, "", {0.003, 0}}, {1500, "1500"}},
    {{0, ""}, {150, "", {0.003, 0}}, {300, ""}, {450, "", {0.003, 0}},
     {600, ""}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
     {900, ""}, {1200, ""}, {1350, "", {0.003, 0}}, {1500, ""}}}},
 ContourLabels → All, ContourStyle → {ColorData[80, 1]},
 PlotLegends → {"Transverse Branches"},
 PlotPoints → {150},
 PlotRange → {{0, 750}, {-0.1, 0.1}}]
```

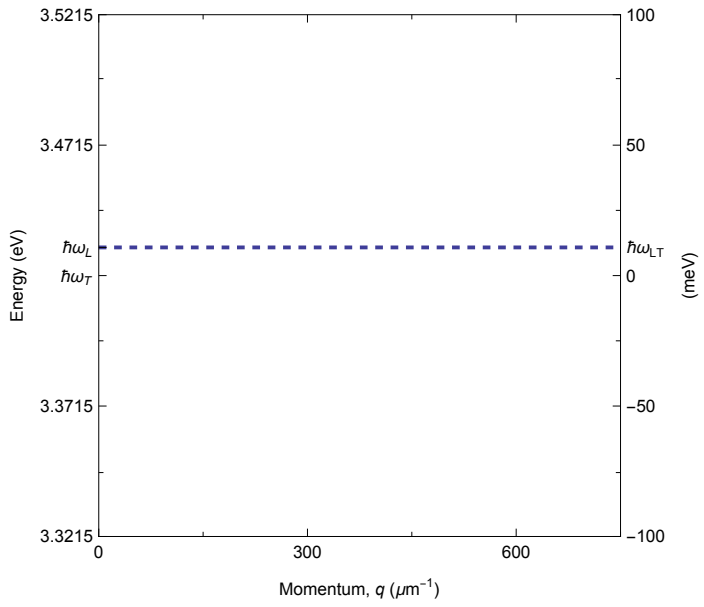
Out[16816]=



In[16817]:=

```
putLT = ContourPlot[y == LT, {x, 0, 750},
  {y, -0.1, 0.1}, FrameLabel → {{"Energy (eV)", "(meV)"},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}}, Frame → True,
  FrameTicks → {{{{-0.1, "3.3215"}, {-0.0755, "", {0.003, 0}}, {-0.05, "3.3715"},
      {-0.025, "", {0.003, 0}}, {LT, "ħω_L"}, {0, "ħω_T"}, {0.025, "", {0.003, 0}},
      {0.05, "3.4715"}, {0.0755, "", {0.003, 0}}, {0.1, "3.5215"}},
     {{-0.1, "-100"}, {-0.0755, "", {0.003, 0}}, {-0.05, "-50"},
      {-0.025, "", {0.003, 0}}, {0, "0"}, {LT, "ħω_LT", {0, 0}}, {0.025, "",
       {0.003, 0}}, {0.05, "50"}, {0.0755, "", {0.003, 0}}, {0.1, "100"}}},
    {{{0, "0"}, {150, "", {0.003, 0}}, {300, "300"}, {450, "", {0.003, 0}},
      {600, "600"}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
      {900, "900"}, {1200, "1200"}, {1350, "", {0.003, 0}}, {1500, "1500"}},
     {{0, ""}, {150, "", {0.003, 0}}, {300, ""}, {450, "", {0.003, 0}},
      {600, ""}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
      {900, ""}, {1200, ""}, {1350, "", {0.003, 0}}, {1500, ""}}}},
  ContourLabels → All, ContourStyle → {ColorData[1, 1], Dashed}
  , PlotPoints → {150}, PlotRange → {{0, 750}, {-0.1, 0.1}}]
```

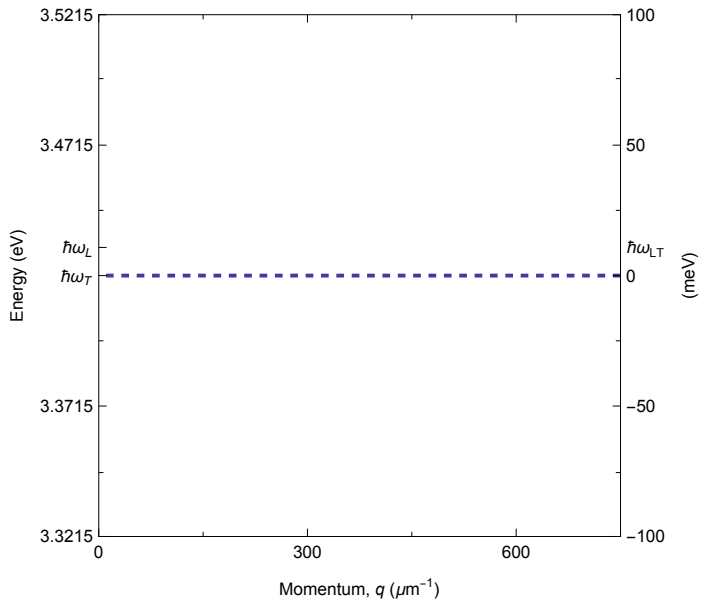
Out[16817]=



In[16818]:=

```
putT = ContourPlot[y == 0, {x, 0, 750},
  {y, -0.1, 0.1}, FrameLabel → {{"Energy (eV)", "(meV)"},
    {Row[{"Momentum, ", Style["q", Italic], " (μm^-1)"}], ""}}, Frame → True,
  FrameTicks → {{{{-0.1, "3.3215"}, {-0.0755, "", {0.003, 0}}, {-0.05, "3.3715"},
      {-0.025, "", {0.003, 0}}, {LT, "ħω_L"}, {0, "ħω_T"}, {0.025, "", {0.003, 0}},
      {0.05, "3.4715"}, {0.0755, "", {0.003, 0}}, {0.1, "3.5215"}},
     {{-0.1, "-100"}, {-0.0755, "", {0.003, 0}}, {-0.05, "-50"},
      {-0.025, "", {0.003, 0}}, {0, "0"}, {LT, "ħω_LT", {0, 0}}, {0.025, "",
       {0.003, 0}}, {0.05, "50"}, {0.0755, "", {0.003, 0}}, {0.1, "100"}}},
    {{{0, "0"}, {150, "", {0.003, 0}}, {300, "300"}, {450, "", {0.003, 0}},
      {600, "600"}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
      {900, "900"}, {1200, "1200"}, {1350, "", {0.003, 0}}, {1500, "1500"}},
     {{0, ""}, {150, "", {0.003, 0}}, {300, ""}, {450, "", {0.003, 0}},
      {600, ""}, {750, "", {0.003, 0}}, {1050, "", {0.003, 0}},
      {900, ""}, {1200, ""}, {1350, "", {0.003, 0}}, {1500, ""}}}},
  ContourLabels → All, ContourStyle → {ColorData[1, 1], Dashed}
  , PlotPoints → {150}, PlotRange → {{0, 750}, {-0.1, 0.1}}]
```

Out[16818]=



In[16819]:=

```
p3 = Show[FinalBottom, FinalBranch, FinalTop, putLT, putT]
```

Out[16819]=