

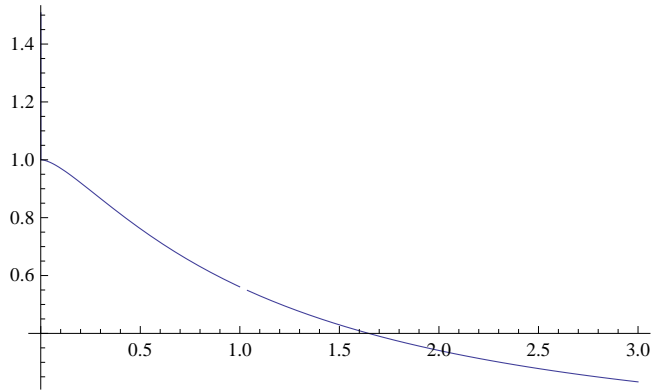
```

gles[x_] := 8 * ArcTanh[Sqrt[(1 - x) / (1 + x)]] / (x * x * Sqrt[1 - x * x]) + 4 / (x * x) * Log[x / 2] -
  2 / (x * x - 1) + 4 * ArcTanh[Sqrt[(1 - x) / (1 + x)]] / ((x * x - 1) * Sqrt[1 - x * x])

gbig[x_] := 8 * ArcTan[Sqrt[(x - 1) / (x + 1)]] / (x * x * Sqrt[x * x - 1]) + 4 / (x * x) * Log[x / 2] -
  2 / (x * x - 1) + 4 * ArcTan[Sqrt[(x - 1) / (x + 1)]] / (Sqrt[(x * x - 1) * (x * x - 1) * (x * x - 1)])

Plot[Piecewise[{{gles[x], x < 1}, {gbig[x], x > 1}}, {x, 0, 3}]

```



In[254]:=

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dat = ReadList["efile.gammacut2.A611.gband.20bins.txt",
  {Number, Number, Number, Number, Number, Number, Number}];
xpos = dat[[All, 1]];
eval = dat[[All, 2]];
esig = dat[[All, 3]];
data = dat[[All, {1, 2}]];
dataer = dat[[All, {1, 2, 3}]];

```

In[1]:=

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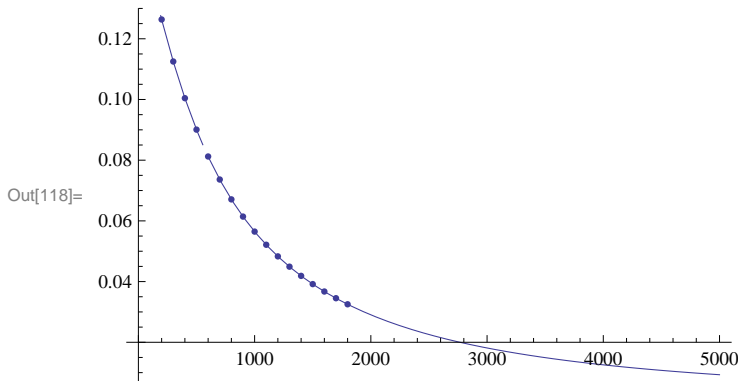
gpctcm = 3.08568025 * 10^(27);
pixtradians = Pi / (180 * 3600) * .2254;
G = 6.673 * 10^(-8);
c1 = 2.99792458 * 10^(10);
Hz = 2.63 * 10^(-18);
Hz2 = Hz * Hz;
rhoc = 3 * Hz2 / (8 * Pi * G);
Dls = 1.09 * gpctcm;
Ds = 1.66 * gpctcm;
Dl = 0.89 * gpctcm;
sigc = c1 * c1 / (4 * Pi * G) * (Ds / (Dls * Dl));
(*p=pixtradians*Dl*)
p = 0.0030010256;
gl[x_, r200_, c_] :=
  (r200 * 10^(24) / c) * (200 / 3) * c * c * c / (Re[Log[1 + c]] - c / (1 + c)) *
  (rhoc / sigc) * Re[(8 * ArcTanh[Sqrt[(1 - x * p * c / r200) / (1 + x * p * c / r200)]] /
  (x * p * c / r200 * x * p * c / r200 * Sqrt[1 - x * p * c / r200 * x * p * c / r200]) +
  4 / (x * p * c / r200 * x * p * c / r200) * Log[x * p * c / r200 / 2] -
  2 / (x * p * c / r200 * x * p * c / r200 - 1) +
  4 * ArcTanh[Sqrt[(1 - x * p * c / r200) / (1 + x * p * c / r200)]] /
  ((x * p * c / r200 * x * p * c / r200 - 1) * Sqrt[1 - x * p * c / r200 * x * p * c / r200]))];
gb[x_, r200_, c_] :=
  (r200 * 10^(24) / c) * (200 / 3) * c * c * c / (Re[Log[1 + c]] - c / (1 + c)) *
  (rhoc / sigc) * Re[8 * ArcTan[Sqrt[(x * p * c / r200 - 1) / (x * p * c / r200 + 1)]] /
  (x * p * c / r200 * x * p * c / r200 * Sqrt[x * p * c / r200 * x * p * c / r200 - 1]) +
  4 / (x * p * c / r200 * x * p * c / r200) * Log[x * p * c / r200 / 2] -
  2 / (x * p * c / r200 * x * p * c / r200 - 1) +
  4 * ArcTan[Sqrt[(x * p * c / r200 - 1) / (x * p * c / r200 + 1)]] /
  (Sqrt[(x * p * c / r200 * x * p * c / r200 - 1) *
  (x * p * c / r200 * x * p * c / r200 - 1) * (x * p * c / r200 * x * p * c / r200 - 1)])];

```

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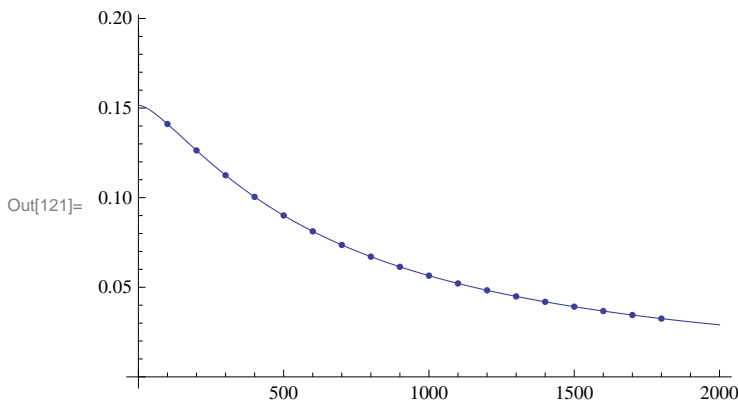
r2 = 6.12165;
cv = 3.67029;
sw = 1 / (p * cv / r2);
xval1 = {100, 200, 300, 400, 500};
xval2 = {600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800};
yval1 = gl[xval1, r2, cv];
yval2 = gb[xval2, r2, cv];
Lval = {{100, 0.1411256}, {200, 0.126355}, {300, 0.112514},
        {400, 0.1004288}, {500, 0.0900693}, {600, 0.081215}, {700, 0.07362566},
        {800, 0.0670857}, {900, 0.0614165}, {1000, 0.05647}, {1100, 0.052133159},
        {1200, 0.04830452}, {1300, 0.04490785}, {1400, 0.041879324}, {1500, 0.0391664},
        {1600, 0.0367257}, {1700, 0.034521098}, {1800, 0.03252214}};
Show[Plot[Piecewise[{{gl[x, r2, cv], x * p * cv / r2 < 1}, {gb[x, r2, cv], x * p * cv / r2 > 1}},
          {x, 0, 5000}], ListPlot[Lval]]
nlm = NonlinearModelFit[Lval, Piecewise[{{gl[n, fr2, fcv], n * p * fcv / fr2 < 1},
          {gb[n, fr2, fcv], n * p * fcv / fr2 > 1}}, {{fr2, 3.0}, {fcv, 15}}, n]
nlm["ParameterConfidenceIntervalTable"]
Show[{ListPlot[Lval]}, {Plot[Normal[nlm], {n, 0, 2000}]}]

```



Out[119]= FittedModel[{<<1>>}]

	Estimate	Standard Error	Confidence Interval
Out[120]= fr2	6.12164	0.0000109651	{6.12161, 6.12166}
fcv	3.67029	0.0000127272	{3.67027, 3.67032}



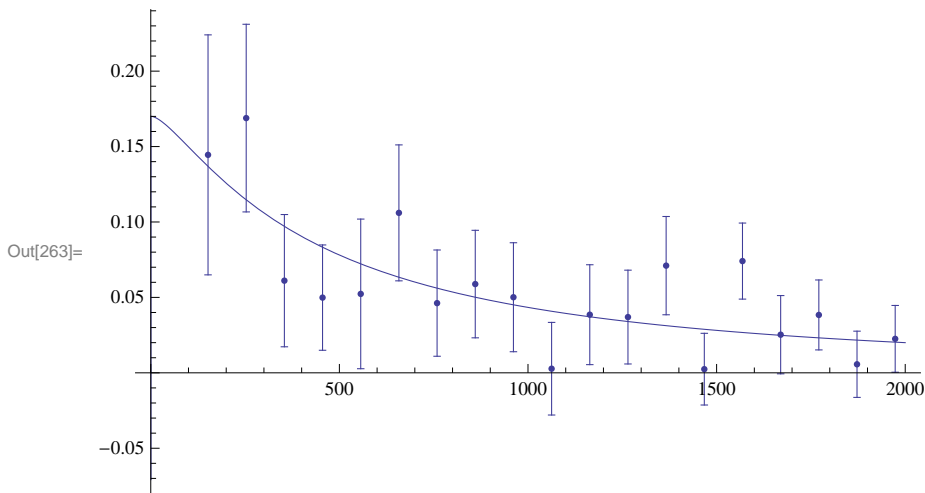
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In[260]:= nlm = NonlinearModelFit[data, gl[n, r2, cv], {{r2, 3.0}, {cv, 15}}, n, Weights -> 1 / esig]
nlm["ParameterConfidenceIntervalTable"]
Needs["ErrorBarPlots`"]
Show[{ErrorListPlot[dataer]}, {Plot[Normal[nlm], {n, 0, 2000}]}]
```

NonlinearModelFit::sszero :
 The step size in the search has become less than the tolerance prescribed by the PrecisionGoal option, but the gradient is larger than the tolerance specified by the AccuracyGoal option. There is a possibility that the method has stalled at a point that is not a local minimum. >>

Out[260]= FittedModel[

$$0.170069 \operatorname{Re} \left[-\frac{2}{-1 + \langle\langle 22 \rangle\rangle n^2} + \frac{\langle\langle 22 \rangle\rangle \langle\langle 1 \rangle\rangle \langle\langle 1 \rangle\rangle}{\langle\langle 1 \rangle\rangle \langle\langle 1 \rangle\rangle} + \langle\langle 1 \rangle\rangle + \frac{534137. \langle\langle 1 \rangle\rangle \langle\langle 1 \rangle\rangle}{n^2} \right]$$

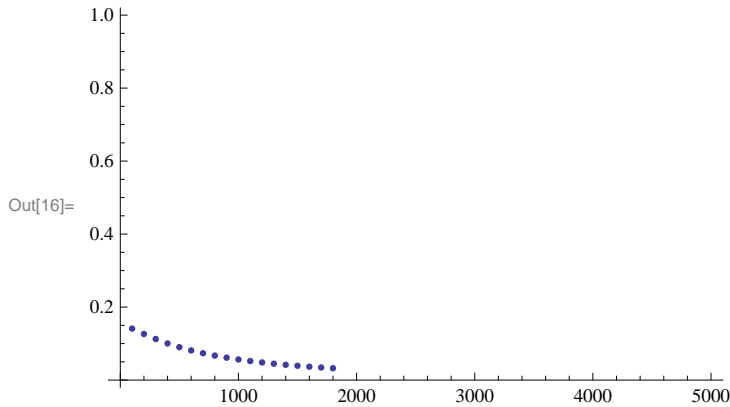
	Estimate	Standard Error	Confidence Interval
Out[261]= r2	5.12165	0.60353	{3.84832, 6.39499}
cv	4.67029	1.51155	{1.48121, 7.85938}



```
In[15]= Lval = {{100, 0.1411256}, {200, 0.126355}, {300, 0.112514}, {400, 0.1004288}, {500, 0.0900693},
  {600, 0.081215}, {700, 0.07362566}, {800, 0.0670857}, {900, 0.0614165}, {1000, 0.05647},
  {1100, 0.052133159}, {1200, 0.04830452}, {1300, 0.04490785}, {1400, 0.041879324},
  {1500, 0.0391664}, {1600, 0.0367257}, {1700, 0.034521098}, {1800, 0.03252214}};
Show[Plot[Piecewise[{{gl[x, r2, cv], x*p*cv/r2 < 1}, {gb[x, r2, cv], x*p*cv/r2 > 1}}],
  {x, 0, 5000}], ListPlot[Lval]]
nlm = NonlinearModelFit[Lval, Piecewise[{{gl[n, fr2, fcv], n*p*fcv/fr2 < 1},
  {gb[n, fr2, fcv], n*p*fcv/fr2 > 1}}], {{fr2, 3.0}, {fcv, 15}}, n]
nlm["ParameterConfidenceIntervalTable"]
Show[{{ListPlot[Lval]}, {Plot[Normal[nlm], {n, 0, 2000}]}}
```

Plot::exclul :

$\left\{9.00615 \times 10^{-6} \operatorname{Im}\left[\frac{cv^2 x^2}{r^2}\right] - 0, \ll 9 \gg, \ll 6 \gg\right\}$ must be a list of equalities or real-valued functions. >>



Out[17]= FittedModel[{ <<1>> }]

	Estimate	Standard Error	Confidence Interval
Out[18]= fr2	6.12164	0.0000109651	{6.12161, 6.12166}
fcv	3.67029	0.0000127273	{3.67027, 3.67032}

