```
Clear["Global`*"]
<< Notation`
(*Physical constants in cgs units*)
G = 6.67 × 10^-8; (*Newton's constant in cgs*)
c = 3 × 10^10 ; (*Speed of light in cgs*)
κr = 1.6 × 10^24;
kb = 1.38 × 10^-16;
mp = 1.67 × 10^-24;
(*Stefan-Boltzmann constant in cgs*)
σ = 5.67 × 10^-5;
h = 6.63 × 10^-27;
Msun = 2 × 10^33;
(*Special symbols*)
Symbolize[ M_7 ]
Symbolize[ ϵ_0.1 ]
Symbolize[ κ̂ ]
Symbolize[ α_0.3 ]
```

```
γ = 4. / 3.;
κr = 1.6 × 10^24;
M7 = 1;
M = 10^7 Msun M7;
Rs = 2 G M/c^2;
r3 = Range[0.1, 2, 0.1]
R = r3 1000 Rs;
Ω = Sqrt[G M/R^3];
μ0 = 0.615;
μe = 1;
κ̂ = 1;
κes = 0.4 μe;
Sqrt[140 c κr/(γ σ κes)]
fT = 3 / 8;
α0.3 = 1;
ϵ0.1 = 1;
LEdd = 4 π G M7/(κes κ̂) c 10^7 Msun;

ṀEdd = LEdd/(c^2 ϵ0.1 0.1);
ṁ = 0.1;
Ṁ = ṁ * ṀEdd;
Print["Ṁ= ", Ṁ]
(*Constant out front is probably slightly
 difference if the μe dependence is not include*)
Σ = (169123 μ0^(4/5) (ṁ/ϵ0.1)^(3/5))/(μe^(4/5) κ̂^(6/5) ((r3^3 fT)/M7)^(1/5) (α0.3)^(4/5));
Print["Σ= ", Σ]

ν = Ṁ/(3 π Σ);
Print["ν= ", ν]
Export["Parameters",
 Table[{Round[ Σ[[i]], 1], 0.1, Round[1000 r3[[i]], 1]}, {i, 1, Σ // Length} ], "Table"]
```

{0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1., 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.}

4.71405×10^{20}

$\dot{M}$= 1.39696 × 10^24

Σ= {139 475., 92 019.2, 72 147.9, 60 710., 53 102.4, 47 599.9, 43 394.8, 40 053.7, 37 320.8, 35 034.5, 33 087.3, 31 404.2, 29 931.6, 28 629.9, 27 468.9, 26 425.6, 25 481.6, 24 622.5, 23 836.6, 23 114.2}

ν= $\{1.06271\times10^{18}, 1.61077\times10^{18}, 2.05442\times10^{18}, 2.44148\times10^{18}, 2.79125\times10^{18}, 3.11392\times10^{18}, 3.41567\times10^{18}, 3.70059\times10^{18}, 3.97157\times10^{18}, 4.23074\times10^{18}, 4.47974\times10^{18}, 4.71982\times10^{18}, 4.95202\times10^{18}, 5.17718\times10^{18}, 5.396\times10^{18}, 5.60904\times10^{18}, 5.81683\times10^{18}, 6.01978\times10^{18}, 6.21826\times10^{18}, 6.41261\times10^{18}\}$

Parameters

$$\kappa s = \text{Table}\left[4.7\times10^{20}\,\Omega[[i]]\,\text{Tp1}^{-15/4},\ \{i, 1, \Sigma\,//\,\text{Length}\}\right];$$

(*κs=1.83 10^9 Ω (Tp)^-9/4*)

$$\epsilon s = \frac{\kappa s}{\kappa s + \kappa es};$$

$$\Xi = \frac{0.873\,\epsilon s^{-1/6}}{1 - 0.127\,\epsilon s^{5/6}}\ \frac{1}{1 + \left(\epsilon s^{-1} - 1\right)^{2/3}};$$

$$r1 = \text{Table}\left[\text{FindRoot}\left[\frac{9}{8}\nu[[i]]\,\Sigma[[i]]\,\Omega[[i]]^2 == \Xi[[i]]\,\sigma\,\text{Tp1}^4,\ \left\{\text{Tp1},\ \left(\frac{9}{8}\nu[[i]]\,\Sigma[[i]]\,\frac{\Omega[[i]]^2}{\sigma}\right)^{0.25}\right\}\right],\ \{i, 1, \text{Length}[\Sigma]\}\right];$$

Tp = Tp1 /. r1

$$\kappa s = \text{Table}\left[4.7\times10^{20}\,\Omega[[i]]\,\text{Tp}[[i]]^{-15/4},\ \{i, 1, \Sigma\,//\,\text{Length}\}\right];$$

(*κs=1.83 10^9 Ω (Tp)^-9/4*)

$$\epsilon s = \frac{\kappa s}{\kappa s + \kappa es};$$

$$x = \left(1 + \frac{1}{\epsilon s}\right)^{-1};$$

$$\xi = h\,\frac{\nu 1}{kb\,\text{Tp}};$$

$$f = \xi^{-3}\left(1 - e^{-\xi}\right);$$

$$K\nu = -\frac{1}{3} + \frac{2^{1/3}}{3\left(-2 + 27\,f\,x^2 + \sqrt{-4 + \left(-2 + 27\,f\,x^2\right)^2}\right)^{1/3}} + \frac{\left(-2 + 27\,f\,x^2 + \sqrt{-4 + \left(-2 + 27\,f\,x^2\right)^2}\right)^{1/3}}{3\times2^{1/3}};$$

$$\epsilon\nu = \left(1 + \frac{1}{K\nu}\right)^{-1};$$

(*Peak freqency. Note this is approximate,
as it it is technically only applicable in for a blackbody. *)

$$\nu max = 2.82\,kb\,\frac{\text{Tp}}{h};$$

```
FindRoot::lstol :
 The line search decreased the step size to within tolerance specified by AccuracyGoal
     and PrecisionGoal but was unable to find a sufficient decrease
     in the merit function. You may need more than MachinePrecision
     digits of working precision to meet these tolerances. >>

FindRoot::lstol :
 The line search decreased the step size to within tolerance specified by AccuracyGoal
     and PrecisionGoal but was unable to find a sufficient decrease
     in the merit function. You may need more than MachinePrecision
     digits of working precision to meet these tolerances. >>

FindRoot::lstol :
 The line search decreased the step size to within tolerance specified by AccuracyGoal
     and PrecisionGoal but was unable to find a sufficient decrease
     in the merit function. You may need more than MachinePrecision
     digits of working precision to meet these tolerances. >>

General::stop :
 Further output of FindRoot::lstol will be suppressed during this calculation. >>

{26 071., 13 883.7, 9771.02, 7670.37, 6380.59, 5500.91, 4858.7, 4367.03, 3977.15, 3659.54,
 3395.2, 3171.36, 2979.06, 2811.87, 2664.98, 2534.79, 2418.49, 2313.9, 2219.27, 2133.18}
```

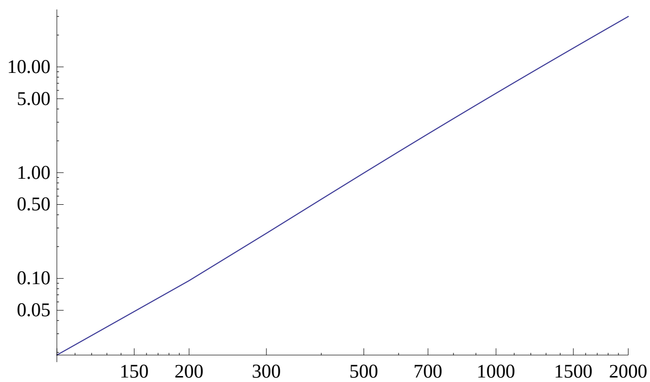
$$\rho\mathbf{p} = \mathbf{Table}\left[\frac{3\,\mathbf{c}\,\Omega[[\mathbf{i}]]^2}{4\,\gamma\,\sigma\,\mathbf{Tp}[[\mathbf{i}]]^4\;\mathbf{K}\nu[[\mathbf{i}]]\;\kappa\mathbf{es}^2\,(1+\mathbf{K}\nu[[\mathbf{i}]])}\;/.\;\nu\mathbf{1}\to\nu\mathbf{max}[[\mathbf{i}]],\;\{\mathbf{i},\,1,\,\Sigma\,//\,\mathbf{Length}\}\right];$$

$$\mathbf{p1} = \mathbf{Transpose}\left[\left\{\frac{\mathbf{R}}{\mathbf{Rs}},\;\left(\rho\mathbf{p}\;\mathbf{kb}\;\frac{\mathbf{Tp}}{\mu\mathbf{0}\;\mathbf{mp}}\right)\Big/\left(4\,\sigma\,\frac{\mathbf{Tp}^4}{3\,\mathbf{c}}\right)\right\}\right]\;//$$

$$\quad\mathbf{ListLogLogPlot}[\#,\;\mathbf{PlotRange}\to\{\{\mathbf{100},\,\mathbf{2000}\},\,\mathbf{Automatic}\},\;\mathbf{Joined}\to\mathbf{True}]\;\&$$

$$(*\mathbf{p2}=\mathbf{Transpose}\left[\left\{\frac{\mathbf{R}}{\mathbf{Rs}},\;4\;\sigma\;\frac{\mathbf{Tp}^4}{3\mathbf{c}}\right\}\right]//\mathbf{ListLinePlot}[\#,\;\mathbf{PlotStyle}\to\mathbf{Directive}[\mathbf{Red}]]\&;$$

$$\mathbf{Show}[\mathbf{p1},\mathbf{p2}]*)$$



```
Σtmp = Σ
Σ = Σ[[1 ;; 4]];
Ωtmp = Ω
Ω = Ω[[1 ;; 4]];
νtmp = ν
ν = ν[[1 ;; 4]];
Tp = Tp[[1 ;; 4]];
Kν = Kν[[1 ;; 4]];
ϵν = ϵν[[1 ;; 4]];
```

$$\text{Tpblack} = \left(\frac{9}{8}\,\nu\,\Sigma\,\frac{\Omega^2}{\sigma}\right)^{1/4};$$

```
(*Peak freqency. Note this is approximate,
as it it is technically only applicable in for a blackbody. *)
```

$$\nu\text{max} = 2.82\,\text{kb}\,\frac{\text{Tp}}{\text{h}};$$

$$\text{B1} = \frac{\left(2\,\text{h}\,\nu 1^3 / \text{c}^2\right)}{\text{E}^{(\text{h}\,\nu 1)/(\text{kb Tpblack})} - 1};$$

$$\text{B2} = \frac{\left(2\,\text{h}\,\nu 1^3 / \text{c}^2\right)}{\text{E}^{(\text{h}\,\nu 1)/(\text{kb Tp})} - 1};$$

$$\text{Table}\Big[\text{LogLogPlot}\Big[\Big\{\text{B1[[i]]}\,\nu 1,\ 2\,\frac{\epsilon\nu\text{[[i]]}^{1/2}}{1+\epsilon\nu\text{[[i]]}^{1/2}}\,\text{B2[[i]]}\,\nu 1\ \text{// Re}\Big\},$$

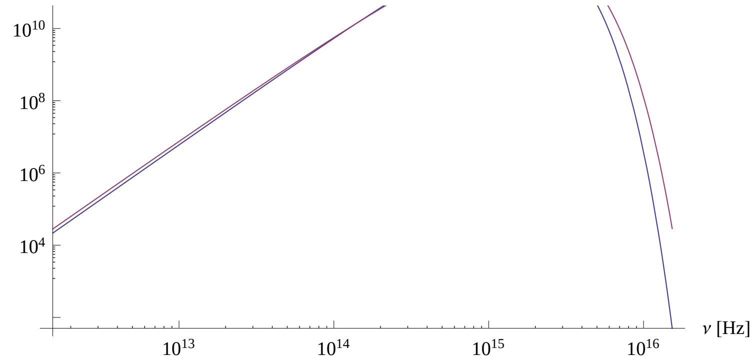
```
  {ν1, 0.001 νmax[[i]], 10 νmax[[i]]}, ImageSize → Medium,
  AxesLabel → {"ν [Hz]", "Fν  [erg cm^-2 s^-1]"}], {i, 1, Σ // Length}]
ν = νtmp;
Ω = Ωtmp;
Σ = Σtmp;
```

{139 475., 92 019.2, 72 147.9, 60 710., 53 102.4, 47 599.9, 43 394.8, 40 053.7, 37 320.8, 35 034.5, 33 087.3, 31 404.2, 29 931.6, 28 629.9, 27 468.9, 26 425.6, 25 481.6, 24 622.5, 23 836.6, 23 114.2}

$\{7.15588\times10^{-6}, 2.52999\times10^{-6}, 1.37715\times10^{-6}, 8.94485\times10^{-7}, 6.40041\times10^{-7}, 4.86896\times10^{-7}, 3.86381\times10^{-7}, 3.16248\times10^{-7}, 2.65033\times10^{-7}, 2.26289\times10^{-7}, 1.96143\times10^{-7}, 1.72144\times10^{-7}, 1.52668\times10^{-7}, 1.36606\times10^{-7}, 1.23176\times10^{-7}, 1.11811\times10^{-7}, 1.02091\times10^{-7}, 9.37031\times10^{-8}, 8.64037\times10^{-8}, 8.00052\times10^{-8}\}$

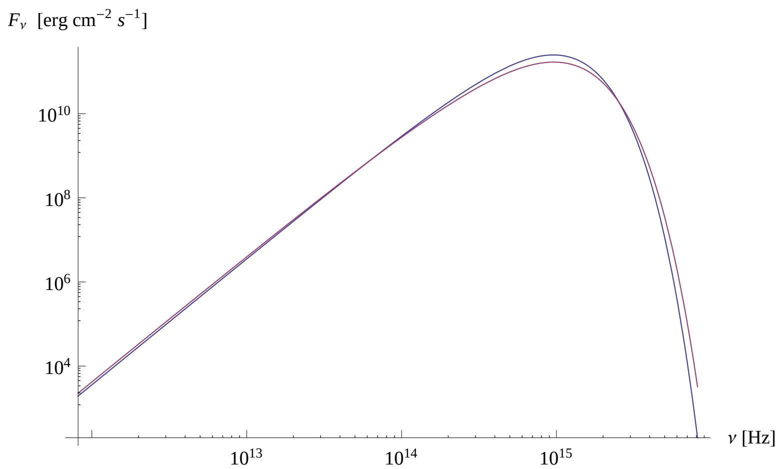
$\{1.06271\times10^{18}, 1.61077\times10^{18}, 2.05442\times10^{18}, 2.44148\times10^{18}, 2.79125\times10^{18}, 3.11392\times10^{18}, 3.41567\times10^{18}, 3.70059\times10^{18}, 3.97157\times10^{18}, 4.23074\times10^{18}, 4.47974\times10^{18}, 4.71982\times10^{18}, 4.95202\times10^{18}, 5.17718\times10^{18}, 5.396\times10^{18}, 5.60904\times10^{18}, 5.81683\times10^{18}, 6.01978\times10^{18}, 6.21826\times10^{18}, 6.41261\times10^{18}\}$

{



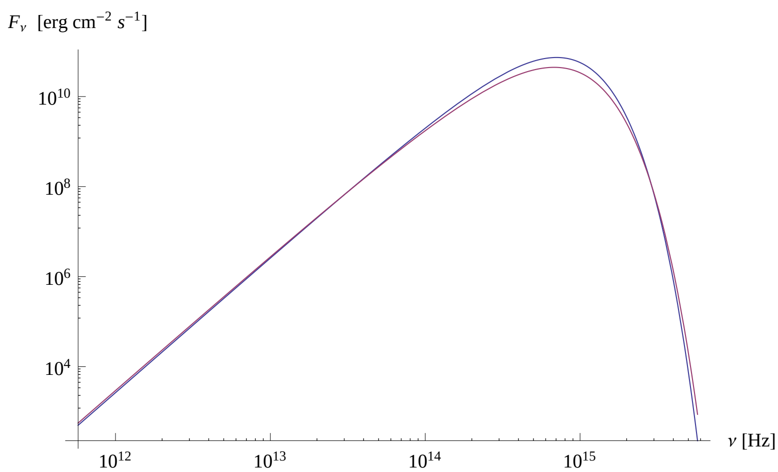
10^{10}
10^{8}
10^{6}
10^{4}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,



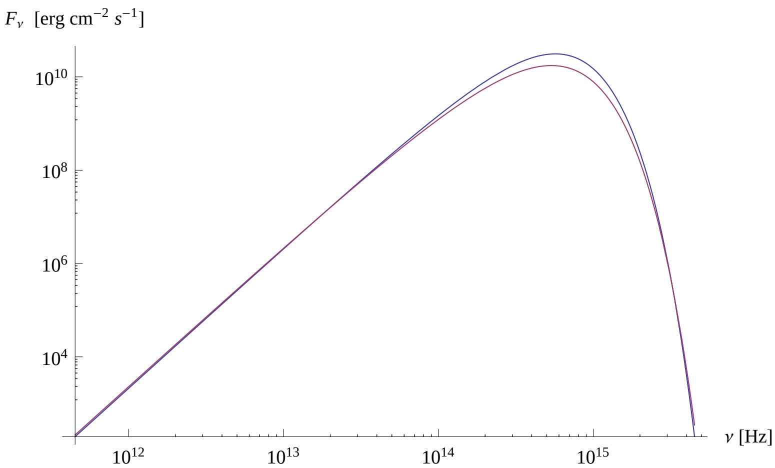
F_ν [erg cm^{-2} s^{-1}]
10^{10}
10^{8}
10^{6}
10^{4}
10^{13}
10^{14}
10^{15}
ν [Hz]

,



F_ν [erg cm^{-2} s^{-1}]
10^{10}
10^{8}
10^{6}
10^{4}
10^{12}
10^{13}
10^{14}
10^{15}
ν [Hz]

,




```
Σtmp = Σ
Σ = Σ[[6 ;;]];
Ωtmp = Ω
Ω = Ω[[6 ;;]];
νtmp = ν
ν = ν[[6 ;;]];
Tpblack = (9/8 ν Σ Ω^2/σ)^(1/4) ;
κS = 1.83 × 10^9 Ω (Tp1)^(-9/4);
ϵS = κS/(κS + κes);
Ξ = (0.873 ϵS^(-1/6))/(1 - 0.127 ϵS^(5/6)) 1/(1 + (ϵS^-1 - 1)^(2/3));

r1 = Table[FindRoot[9/8 ν [[i]] Σ[[i]] Ω[[i]]^2 == Ξ[[i]] σ Tp1^4,
    {Tp1, (9/8 ν[[i]] Σ[[i]] Ω[[i]]^2/σ)^0.25 }], {i, 1, Length[Σ]}];
Tp = Tp1 /. r1
κS = Table[1.83 × 10^9 Ω[[i]] Tp[[i]]^(-9/4), {i, 1, Σ // Length}];
(*κS=1.83 10^9 Ω (Tp)^(-9/4)*)
ϵS = κS/(κS + κes);
```

$$x = \left(1 + \frac{1}{\epsilon s}\right)^{-1};$$

$$\xi = h \frac{\nu 1}{kb\,Tp};$$

$$f = \xi^{-3}\left(1 - e^{-\xi}\right);$$

$$K\nu = -\frac{1}{3} + \frac{2^{1/3}}{3\left(-2 + 27\,f\,x^2 + \sqrt{-4 + \left(-2 + 27\,f\,x^2\right)^2}\right)^{1/3}} + \frac{\left(-2 + 27\,f\,x^2 + \sqrt{-4 + \left(-2 + 27\,f\,x^2\right)^2}\right)^{1/3}}{3 \times 2^{1/3}};$$

$$\epsilon\nu = \left(1 + \frac{1}{K\nu}\right)^{-1};$$

(*Peak freqency*)

$$\nu max = 2.82\,kb\,\frac{Tp}{h};$$

(*Peak freqency. Note this is approximate,
as it it is technically only applicable in for a blackbody. *)

$$\nu max = 2.82\,kb\,\frac{Tp}{h};$$

$$B1 = \frac{\left(2\,h\,\nu 1^3 / c^2\right)}{E^{(h\,\nu 1)/(kb\,Tpblack)} - 1};$$

$$B2 = \frac{\left(2\,h\,\nu 1^3 / c^2\right)}{E^{(h\,\nu 1)/(kb\,Tp)} - 1};.$$

$$\text{Table}\left[\text{LogLogPlot}\left[\left\{B1[[i]],\ 2\,\frac{\epsilon\nu[[i]]^{1/2}}{1 + \epsilon\nu[[i]]^{1/2}}\,B2[[i]]\ //\ Re\right\},\right.\right.$$
$$\{\nu 1,\ 0.001\,\nu max[[i]],\ 10\,\nu max[[i]]\},\ ImageSize \to Medium,$$
$$\left.\left. AxesLabel \to \left\{\text{"}\nu\ [Hz]\text{"},\ \text{"}F_\nu\ \ [erg\ cm^{-2}\ s^{-1}]\text{"}\right\}\right],\ \{i, 1, \Sigma\ //\ Length\}\right]$$

```
ν = νtmp;
Ω = Ωtmp;
Σ = Σtmp;
```

{139 475., 92 019.2, 72 147.9, 60 710., 53 102.4, 47 599.9, 43 394.8, 40 053.7, 37 320.8, 35 034.5,
33 087.3, 31 404.2, 29 931.6, 28 629.9, 27 468.9, 26 425.6, 25 481.6, 24 622.5, 23 836.6, 23 114.2}

$\{7.15588 \times 10^{-6}, 2.52999 \times 10^{-6}, 1.37715 \times 10^{-6}, 8.94485 \times 10^{-7}, 6.40041 \times 10^{-7},$
$4.86896 \times 10^{-7}, 3.86381 \times 10^{-7}, 3.16248 \times 10^{-7}, 2.65033 \times 10^{-7}, 2.26289 \times 10^{-7},$
$1.96143 \times 10^{-7}, 1.72144 \times 10^{-7}, 1.52668 \times 10^{-7}, 1.36606 \times 10^{-7}, 1.23176 \times 10^{-7},$
$1.11811 \times 10^{-7}, 1.02091 \times 10^{-7}, 9.37031 \times 10^{-8}, 8.64037 \times 10^{-8}, 8.00052 \times 10^{-8}\}$

$\{1.06271 \times 10^{18}, 1.61077 \times 10^{18}, 2.05442 \times 10^{18}, 2.44148 \times 10^{18}, 2.79125 \times 10^{18},$
$3.11392 \times 10^{18}, 3.41567 \times 10^{18}, 3.70059 \times 10^{18}, 3.97157 \times 10^{18}, 4.23074 \times 10^{18},$
$4.47974 \times 10^{18}, 4.71982 \times 10^{18}, 4.95202 \times 10^{18}, 5.17718 \times 10^{18}, 5.396 \times 10^{18},$
$5.60904 \times 10^{18}, 5.81683 \times 10^{18}, 6.01978 \times 10^{18}, 6.21826 \times 10^{18}, 6.41261 \times 10^{18}\}$

FindRoot::lstol :
The line search decreased the step size to within tolerance specified by AccuracyGoal and PrecisionGoal but was unable to find a sufficient decrease in the merit function. You may need more than MachinePrecision digits of working precision to meet these tolerances. >>

```
FindRoot::lstol :
 The line search decreased the step size to within tolerance specified by AccuracyGoal
     and PrecisionGoal but was unable to find a sufficient decrease
     in the merit function. You may need more than MachinePrecision
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FindRoot::lstol :
 The line search decreased the step size to within tolerance specified by AccuracyGoal
     and PrecisionGoal but was unable to find a sufficient decrease
     in the merit function. You may need more than MachinePrecision
     digits of working precision to meet these tolerances. >>

General::stop :
 Further output of FindRoot::lstol will be suppressed during this calculation. >>

{39 920.4, 35 383.6, 31 872.6, 29 066., 26 765.5, 24 841.7, 23 206.4,
 21 797.3, 20 569., 19 487.9, 18 528., 17 669.5, 16 896.5, 16 196.5, 15 559.2}
```
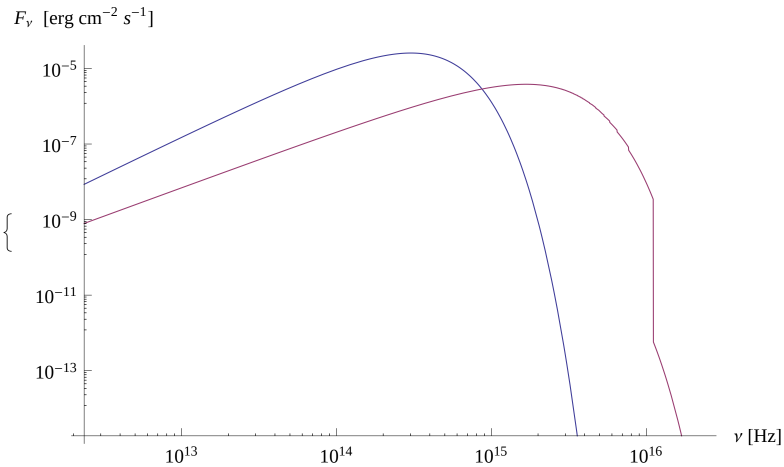
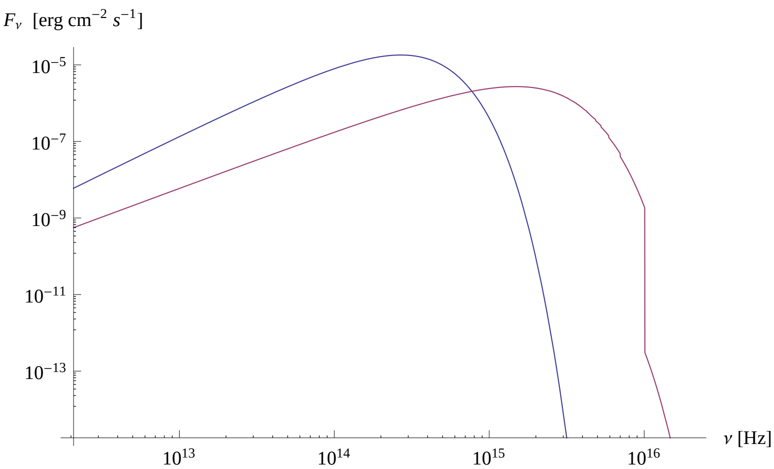
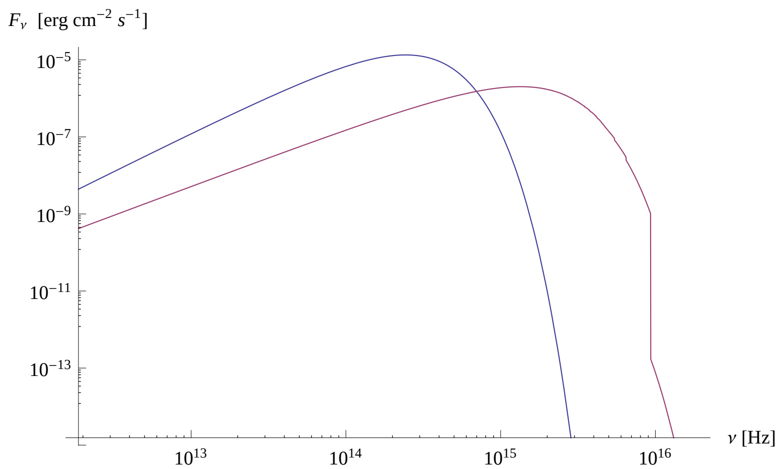
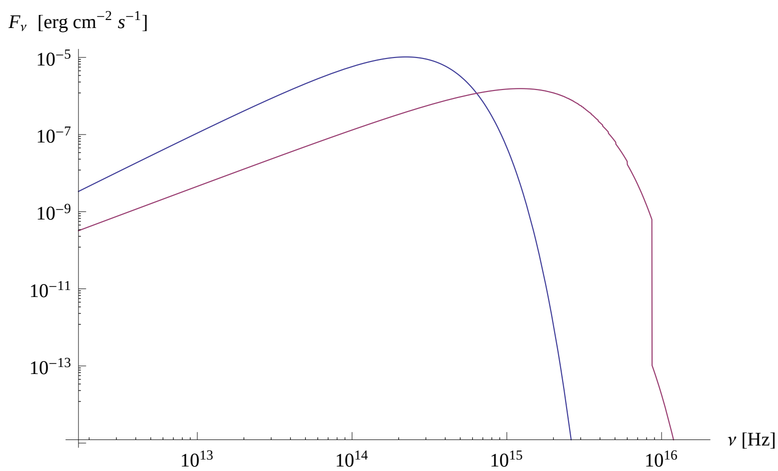

Null.{ 
F_ν [erg cm^{-2} s^{-1}]
10^{-5}
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]
,

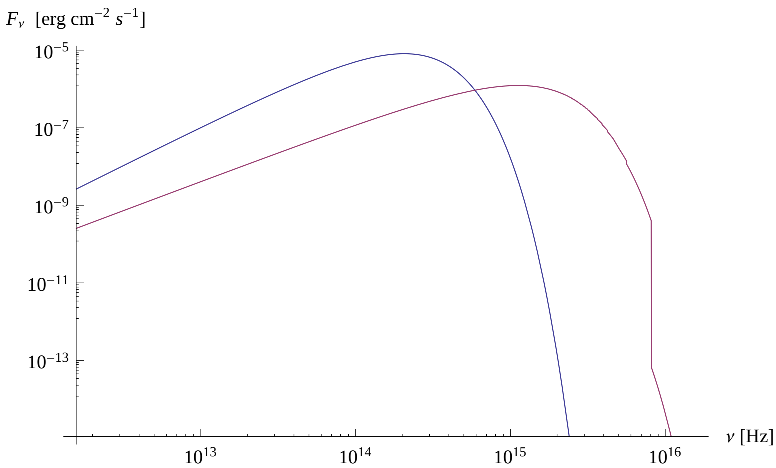

F_ν [erg cm^{-2} s^{-1}]
10^{-5}
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]
,


F_ν [erg cm^{-2} s^{-1}]
10^{-5}
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,

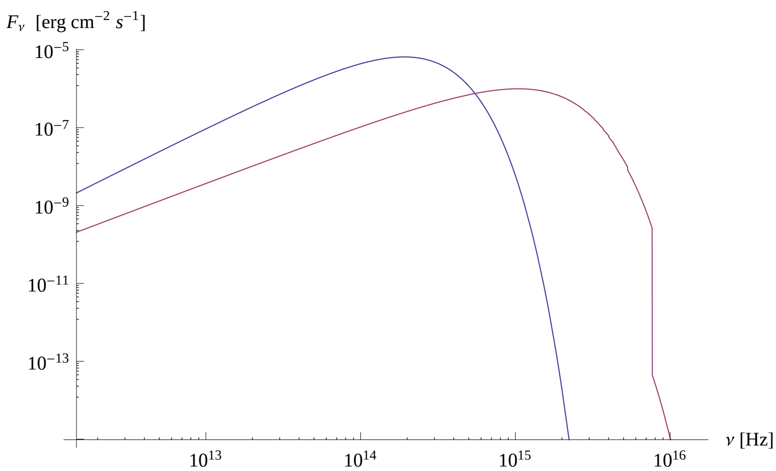

F_ν [erg cm^{-2} s^{-1}]
10^{-5}
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,



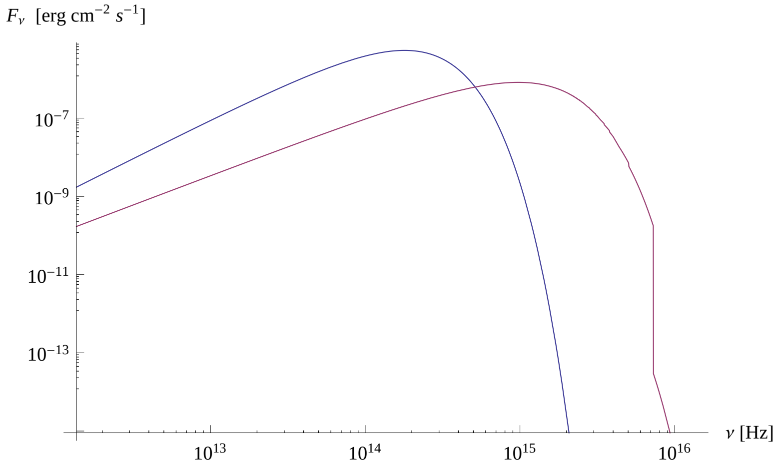
F_ν [erg cm^{-2} s^{-1}]
10^{-5}
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,

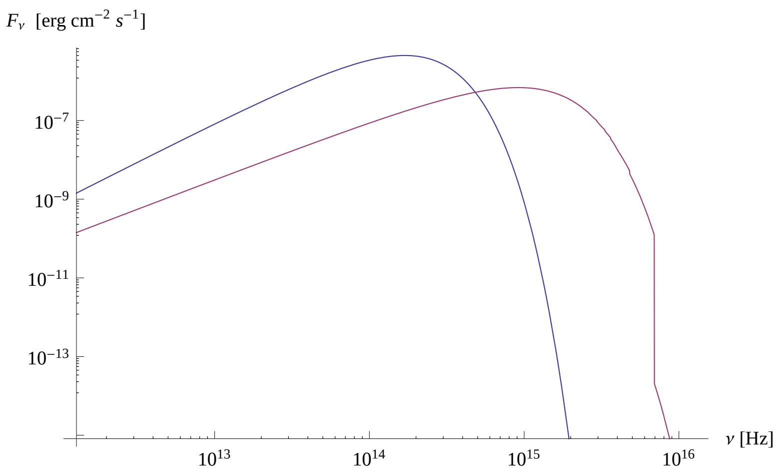


F_ν [erg cm^{-2} s^{-1}]
10^{-5}
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

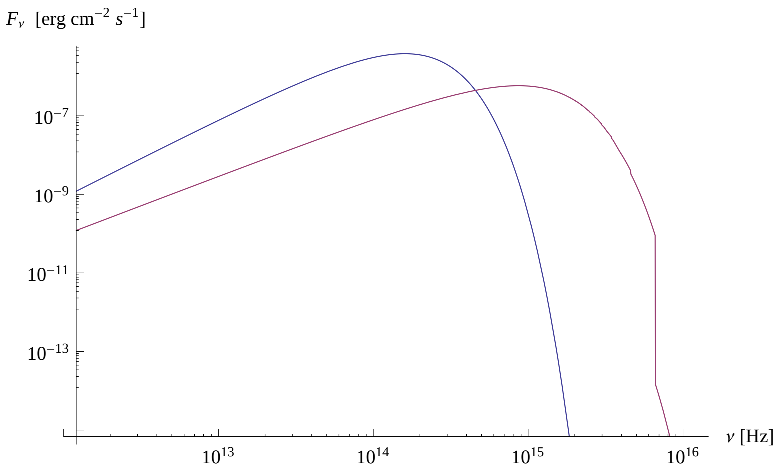
,


F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,

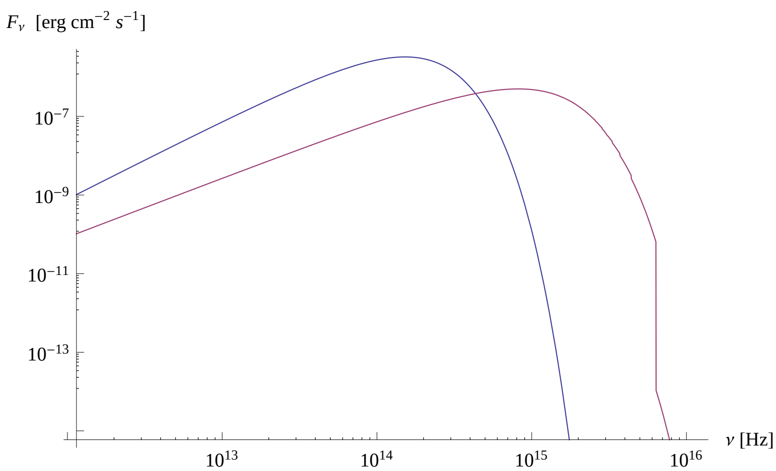

F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,



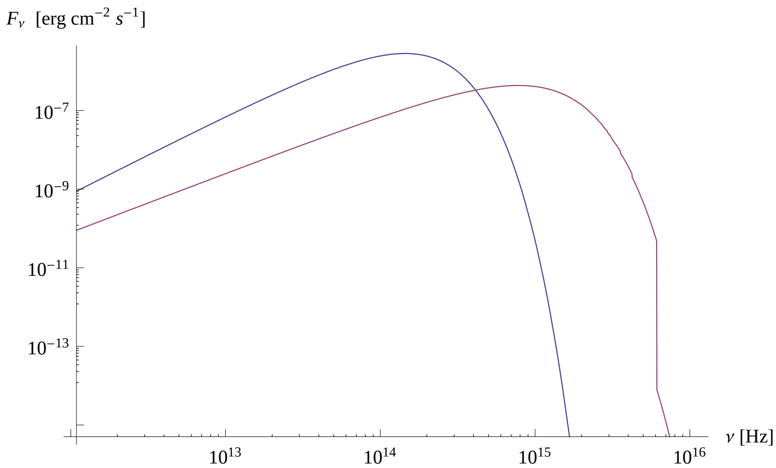
F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,



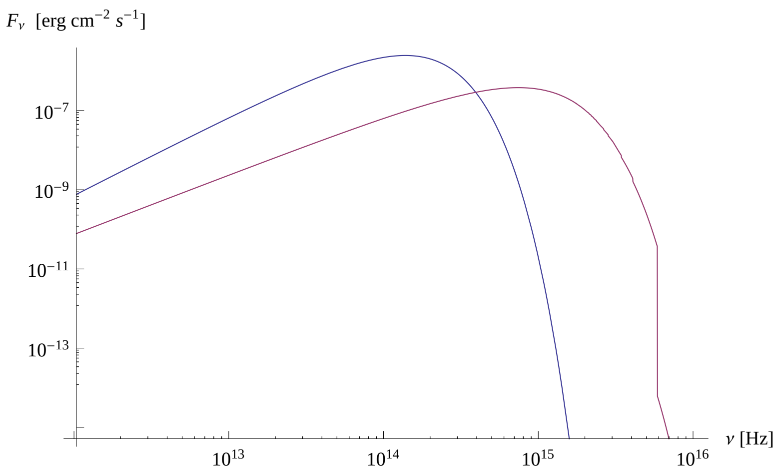
F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,



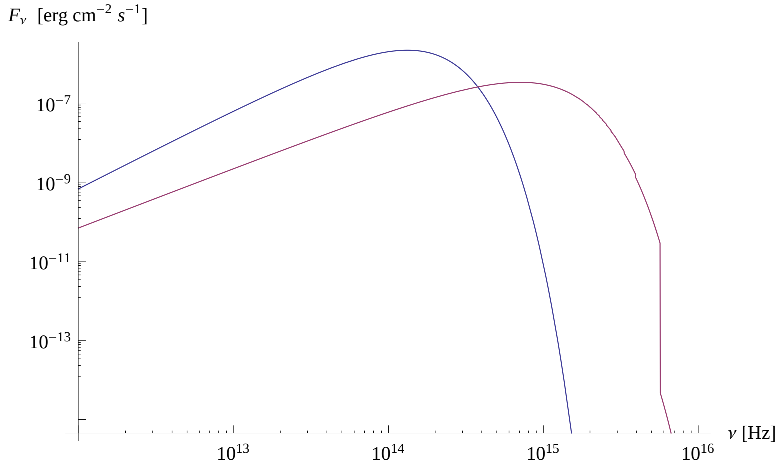
F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,

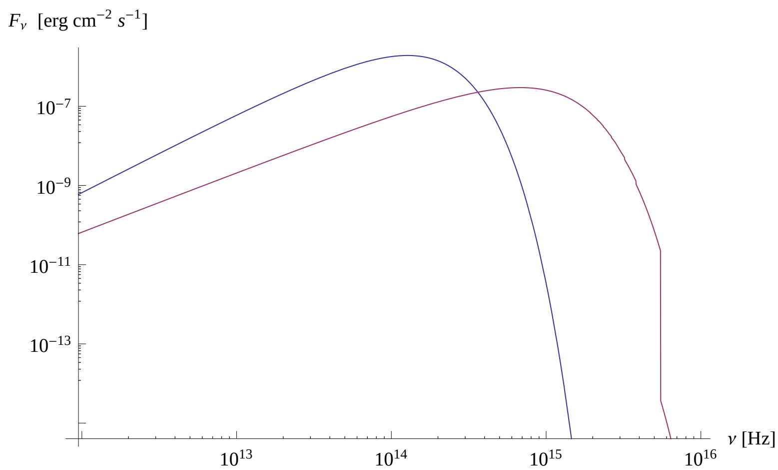


F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

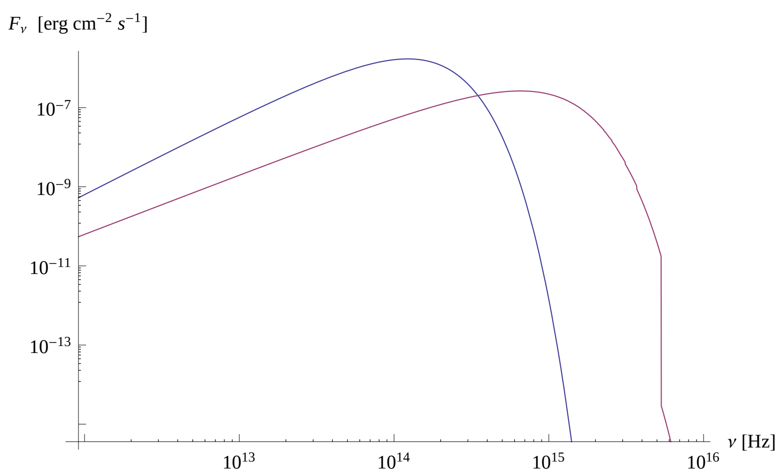
,


F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,


F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

,


F_ν [erg cm^{-2} s^{-1}]
10^{-7}
10^{-9}
10^{-11}
10^{-13}
10^{13}
10^{14}
10^{15}
10^{16}
ν [Hz]

}

$$\texttt{Module}\Big[\{\xi,\ \Xi,\ \epsilon\texttt{s},\ \texttt{K}\nu,\ \texttt{f},\ \epsilon,\ \texttt{p1},\ \texttt{p2}\},$$

$$\texttt{K}\nu = \left(\texttt{y} \ /.\ \left(\texttt{Solve}\left[\texttt{y}^2\ (1+\texttt{y}) == \left(1-\frac{1}{\epsilon\texttt{s}}\right)^{-2} \texttt{f},\ \texttt{y}\right][[1]]\right)\right);$$

$$\epsilon = \left(1+\texttt{K}\nu^{-1}\right)^{-1};$$

$$\texttt{f} = \xi^{-3}\left(1-e^{-\xi}\right);$$

$$\texttt{p1} = \texttt{Plot}\left[\frac{15}{\pi^4}\,\texttt{NIntegrate}\left[2\ \frac{\epsilon^{1/2}}{1+\epsilon^{1/2}}\ \frac{e^{-\xi}}{\texttt{f}},\ \{\xi,\ 0,\ \infty\}\right],\ \{\epsilon\texttt{s},\ 0,\ 1\},\ \texttt{AxesOrigin} \to \{0,\ 0\}\right];$$

$$\texttt{p2} = \texttt{Plot}\left[\frac{0.873\,\epsilon\texttt{s}^{-1/6}}{1-0.127\,\epsilon\texttt{s}^{5/6}}\ \frac{1}{1+\left(\epsilon\texttt{s}^{-1}-1\right)^{2/3}},\ \{\epsilon\texttt{s},\ 0,\ 1\},\ \texttt{PlotStyle} \to \texttt{Directive}[\texttt{Red}]\right];$$

$$\texttt{Show}[\texttt{p1},\ \texttt{p2}]$$

$$\Big]$$

$$(*\Xi=\frac{15}{\pi^4}\int_0^\infty 2\ \frac{\epsilon^{1/2}}{1+\epsilon^{1/2}} e^{-\xi}\frac{d\xi}{\texttt{f}}*)$$

$$(*2\ \frac{\epsilon^{1/2}}{1+\epsilon^{1/2}}\ \frac{e^{-\xi}}{\texttt{f}}\texttt{//Simplify//TraditionalForm}*)$$