In[ ]:=
```
uc = 2.99792458 * 10^(10);
uG = 6.67428 * 10^(-8);
uMs = 1.9884 * 10^(33);
utime = uG * uMs / uc^3 * 1000;
ulenght = (uG * uMs / uc^2) / 100 000;
urho = (uc^6) / (uG^3 * uMs^2);
uP = (uc^8) / (uG^3 * uMs^2);
rnse = 10^(18) * 1.7827 / 1.3234;
rnsp = 10^(39) * 1.6022 / 1.3234;
urho / rnse;
uP / rnsp;
auc = 2.99792458 * 10^(10);
auG = 6.67428 * 10^(-8);
auMs = 1.9884 * 10^(33);
aurho = (auc^6) / (auG^3 * auMs^2);
normalnuc = 2.705 * 10^(14);
uSIrho = 100^3 / 1000;
uSIp = 100 / 1000;
umrechrho = (uc^6) / (uG^3 * uMs^2);
umrechp = (uc^8) / (uG^3 * uMs^2);
mfmp = 10^6 / 1.3234 * 0.458476;
mfmrho = 10^6 / 1.3234 * 0.458476 / 930;
```

In[ ]:=
```
datapath = "/home/hanauske/Master/Kurz/Mathematica/";
datapathout = "/home/hanauske/Master/Kurz/Mathematica/pizzaout/";
(*EoS1=ReadList[StringJoin[datapath,"DD2Twinstarpaper/eos_hsdd2_beta_t0.1.tab"],
    Table[Real,{i,1,18}]];*)
EoS1 = ReadList[StringJoin[datapath, "EOSKurz/myeos1.dat"], Table[Real, {i, 1, 5}]];
EOS1n =
  Table[{EoS1[[i]][[1]], EoS1[[i]][[4]], EoS1[[i]][[1]] * EoS1[[i]][[3]]}, {i, Dimensions[EoS1][[1]]}];
EOS1na = Table[{EoS1[[i]][[1]], EoS1[[i]][[4]], EoS1[[i]][[1]] * EoS1[[i]][[3]], EoS1[[i]][[6]]},
    {i, Dimensions[EoS1][[1]]}];
pH = Interpolation[Table[{EOS1n[[i, 3]], EOS1n[[i, 2]]}, {i, Dimensions[EOS1n][[1]]}]];
eH = Interpolation[Table[{EOS1n[[i, 2]], EOS1n[[i, 3]]}, {i, Dimensions[EOS1n][[1]]}]];
EoS1
```

Part: Part 6 of $\{4.1256\times10^{-7}, 7.54624\times10^{-11}, 4.12435\times10^{-7}, 0.285019, 0.\}$ does not exist.

Part: Part 6 of $\{0., 5.79721\times10^{-7}, 1.28028\times10^{-10}, 5.79505\times10^{-7}, 0.349366\}$ does not exist.

Part: Part 6 of $\{0., 0., 7.74386\times10^{-7}, 1.99835\times10^{-10}, 7.74045\times10^{-7}\}$ does not exist.

General: Further output of Part::partw will be suppressed during this calculation.

Interpolation: The point 0.` in dimension 1 is duplicated.

Interpolation: Data point {EndOfFile, 99.5251} contains abscissa EndOfFile, which is not a real number.

Out[ ]=
```
{{4.1256 × 10^-7, 7.54624 × 10^-11, 4.12435 × 10^-7, 0.285019, 0.},
 {0., 5.79721 × 10^-7, 1.28028 × 10^-10, 5.79505 × 10^-7, 0.349366},
 {0., 0., 7.74386 × 10^-7, 1.99835 × 10^-10, 7.74045 × 10^-7}, ··· 7919 ···,
 {1.5491, 0.317528, 0.00500309, 0.00138728, 0.00375132},
 {313.415, 1.54914, 0.317551, EndOfFile, EndOfFile}}
```

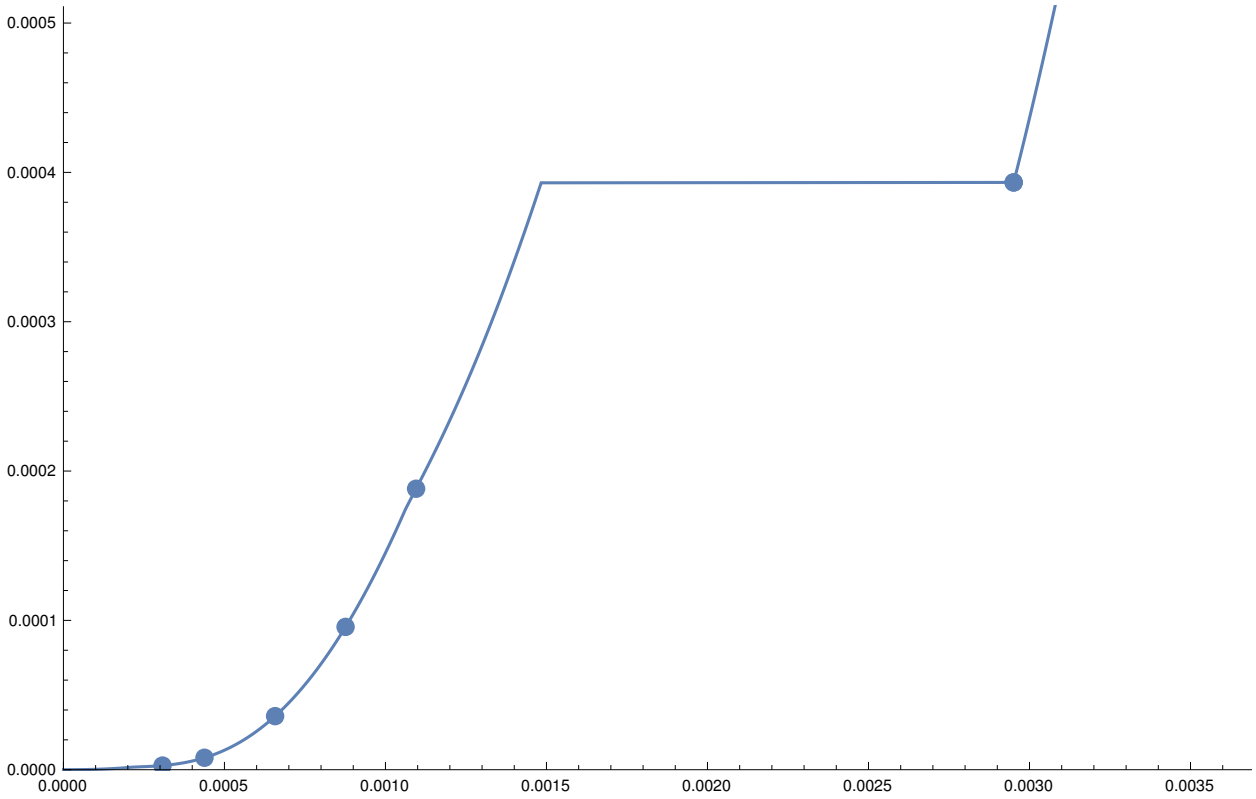
large output | show less | show more | show all | set size limit...

In[ ]:=
```
(*DD2fromTwinstarpaper, Einheiten: 1:rho:1/fm^3 , 4:pressure:MeV/fm^3 *)
rho0Cactus = 0.0004379896294784459;
Cacrho1 = 0.7 * rho0Cactus;
Cacrho2 = 1 * rho0Cactus;
Cacrho3 = 1.5 * rho0Cactus;
Cacrho4 = 2 * rho0Cactus;
Cacrho5 = 2.5 * rho0Cactus;
Cacrho6 = 4 * rho0Cactus;
Cacrho7 = 6 * rho0Cactus;
(*SimName="DD2Twinstarpaper/eos_hsdd2_beta_t0.1.tab";*)
SimName = "EOSKurz/myeos1.dat";
str = OpenRead[StringJoin["/home/hanauske/Master/Kurz/Mathematica/", SimName]];
(*Skip[str,String,5];*)
```

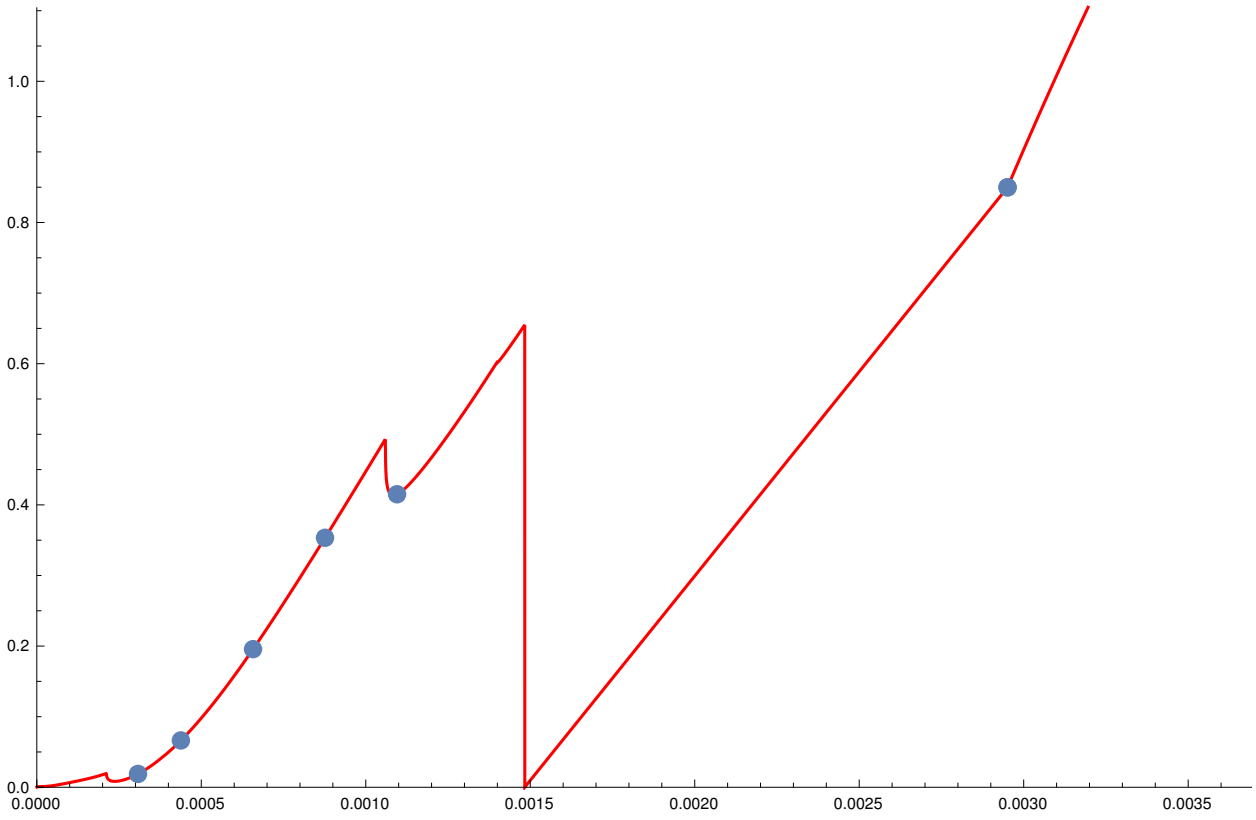
```
EOSTable = ReadList[str, Table[Real, {i, 1, 6}]];
NP = Dimensions[EOSTable][[1]]
datapure = Table[{EOSTable[[n, 1]], EOSTable[[n, 4]]}, {n, 1, NP - 1}];
data = Table[{EOSTable[[n, 1]] / mfmrho, EOSTable[[n, 4]] / mfmp}, {n, 1, NP - 1}];
data = Table[{EOSTable[[n, 3]], EOSTable[[n, 2]]}, {n, 1, NP - 1}];
ddata = Table[
   {data[[n, 1]], ((data[[n + 1, 2]] - data[[n, 2]]) / (data[[n + 1, 1]] - data[[n, 1]]))}, {n, 1, NP - 2}];
data;
n = 1;
While[data[[n, 1]] <= Cacrho1, l = 1; n++];
Cacrho1 = {data[[n, 1]], data[[n, 2]], ddata[[n, 2]], datapure[[n, 2]]};
While[data[[n, 1]] <= Cacrho2, l = 1; n++];
Cacrho2 = {data[[n, 1]], data[[n, 2]], ddata[[n, 2]], datapure[[n, 2]]};
While[data[[n, 1]] <= Cacrho3, l = 1; n++];
Cacrho3 = {data[[n, 1]], data[[n, 2]], ddata[[n, 2]], datapure[[n, 2]]};
While[data[[n, 1]] <= Cacrho4, l = 1; n++];
Cacrho4 = {data[[n, 1]], data[[n, 2]], ddata[[n, 2]], datapure[[n, 2]]};
While[data[[n, 1]] <= Cacrho5, l = 1; n++];
Cacrho5 = {data[[n, 1]], data[[n, 2]], ddata[[n, 2]], datapure[[n, 2]]};
While[data[[n, 1]] <= Cacrho6, l = 1; n++];
Cacrho6 = {data[[n, 1]], data[[n, 2]], ddata[[n, 2]], datapure[[n, 2]]};
While[data[[n, 1]] <= Cacrho7, l = 1; n++];
Cacrho7 = {data[[n, 1]], data[[n, 2]], ddata[[n, 2]], datapure[[n, 2]]};
PRange = {{0, 1.3 * Cacrho7[[1]]}, {0, 1.3 * Cacrho7[[2]]}};
dPRange = {{0, 1.3 * Cacrho7[[1]]}, {0, 1.3 * Cacrho7[[3]]}};
purePRange = {{0, 1.3 * Cacrho7[[1]] * (umrechrho * uSIrho)}, {0, 1.3 * Cacrho7[[4]]}};
PA = ListLinePlot[data, PlotRange → PRange];
PPA = ListPlot[{{Cacrho1[[1]], Cacrho1[[2]]},
     {Cacrho2[[1]], Cacrho2[[2]]}, {Cacrho3[[1]], Cacrho3[[2]]}, {Cacrho4[[1]], Cacrho4[[2]]},
     {Cacrho5[[1]], Cacrho5[[2]]}, {Cacrho6[[1]], Cacrho6[[2]]}, {Cacrho7[[1]], Cacrho7[[2]]}},
    PlotMarkers → {Automatic, Medium}, PlotRange → PRange];
dPA = ListLinePlot[ddata, PlotRange → dPRange, PlotStyle → Red];
dPPA = ListPlot[{{Cacrho1[[1]], Cacrho1[[3]]},
     {Cacrho2[[1]], Cacrho2[[3]]}, {Cacrho3[[1]], Cacrho3[[3]]}, {Cacrho4[[1]], Cacrho4[[3]]},
     {Cacrho5[[1]], Cacrho5[[3]]}, {Cacrho6[[1]], Cacrho6[[3]]}, {Cacrho7[[1]], Cacrho7[[3]]}},
    PlotMarkers → {Automatic, Medium}, PlotRange → PRange];
Show[PA, PPA]
Show[dPA, dPPA]
```

Out[ ]= 6603

Out[ ]=



Out[ ]=



In[ ]:=
```
setrho1 = Cacrho1[[1]] * (umrechrho * uSIrho);
setrho2 = Cacrho2[[1]] * (umrechrho * uSIrho);
```

```
setrho3 = Cacrho3[[1]] * (umrechrho * uSIrho);
setrho4 = Cacrho4[[1]] * (umrechrho * uSIrho);
setrho5 = Cacrho5[[1]] * (umrechrho * uSIrho);
setrho6 = Cacrho6[[1]] * (umrechrho * uSIrho);
setrho7 = Cacrho7[[1]] * (umrechrho * uSIrho);
data0 = {{}};
n = 1;
While[data[[n, 1]] <= Cacrho1[[1]], data0 = Join[data0, {{data[[n, 1]], data[[n, 2]]}}];
  n++];
data0 = Drop[data0, 1];
data0;
n = n - 1;
data1 = {{}};
While[data[[n, 1]] <= Cacrho2[[1]], data1 = Join[data1, {{data[[n, 1]], data[[n, 2]]}}];
  n++];
data1 = Drop[data1, 1];
data1;
n = n - 1;
data2 = {{}};
While[data[[n, 1]] <= Cacrho3[[1]], data2 = Join[data2, {{data[[n, 1]], data[[n, 2]]}}];
  n++];
data2 = Drop[data2, 1];
data2;
n = n - 1;
data3 = {{}};
While[data[[n, 1]] <= Cacrho4[[1]], data3 = Join[data3, {{data[[n, 1]], data[[n, 2]]}}];
  n++];
data3 = Drop[data3, 1];
data3;
n = n - 1;
data4 = {{}};
While[data[[n, 1]] <= Cacrho5[[1]], data4 = Join[data4, {{data[[n, 1]], data[[n, 2]]}}];
  n++];
data4 = Drop[data4, 1];
data4;
n = n - 1;
data5 = {{}};
While[data[[n, 1]] <= Cacrho6[[1]], data5 = Join[data5, {{data[[n, 1]], data[[n, 2]]}}];
  n++];
data5 = Drop[data5, 1];
data5;
n = n - 1;
data6 = {{}};
```

```
While[data[[n, 1]] <= Cacrho7[[1]], data6 = Join[data6, {{data[[n, 1]], data[[n, 2]]}}];
  n++];
data6 = Drop[data6, 1];
data6;
n = n - 1;
data7 = {{}};
While[n <= NP - 1, data7 = Join[data7, {{data[[n, 1]], data[[n, 2]]}}]; n++];
data7 = Drop[data7, 1];
data7;
```

In[ ]:=
```
Fitf = FindFit[data0, K * rho^G, {K, G}, rho];
K0 = Fitf[[1, 2]];
polyrmd =
  Fitf[[1, 2]]^(1 / (1 - Fitf[[2, 2]])) * 0.001^((Fitf[[2, 2]] - 1) / (1 - Fitf[[2, 2]])) * umrechrho;
Ga0 = {0, Fitf[[2, 2]]};
Fitf1 = FindFit[data1, K0 * Cacrho1[[1]]^Ga0[[2]] / (Cacrho1[[1]]^G) * rho^G, {G}, rho];
Ga1 = {setrho1, Fitf1[[1, 2]]};
K1 = K0 * Cacrho1[[1]]^Ga0[[2]] / (Cacrho1[[1]]^Ga1[[2]]);
Fitf2 = FindFit[data2, K1 * Cacrho2[[1]]^Ga1[[2]] / (Cacrho2[[1]]^G) * rho^G, {G}, rho];
Ga2 = {setrho2, Fitf2[[1, 2]]};
K2 = K1 * Cacrho2[[1]]^Ga1[[2]] / (Cacrho2[[1]]^Ga2[[2]]);
Fitf3 = FindFit[data3, K2 * Cacrho3[[1]]^Ga2[[2]] / (Cacrho3[[1]]^G) * rho^G, {G}, rho];
Ga3 = {setrho3, Fitf3[[1, 2]]};
K3 = K2 * Cacrho3[[1]]^Ga2[[2]] / (Cacrho3[[1]]^Ga3[[2]]);
Fitf4 = FindFit[data4, K3 * Cacrho4[[1]]^Ga3[[2]] / (Cacrho4[[1]]^G) * rho^G, {G}, rho];
Ga4 = {setrho4, Fitf4[[1, 2]]};
K4 = K3 * Cacrho4[[1]]^Ga3[[2]] / (Cacrho4[[1]]^Ga4[[2]]);
Fitf5 = FindFit[data5, K4 * Cacrho5[[1]]^Ga4[[2]] / (Cacrho5[[1]]^G) * rho^G, {G}, rho];
Ga5 = {setrho5, Fitf5[[1, 2]]};
K5 = K4 * Cacrho5[[1]]^Ga4[[2]] / (Cacrho5[[1]]^Ga5[[2]]);
Fitf6 = FindFit[data6, K5 * Cacrho6[[1]]^Ga5[[2]] / (Cacrho6[[1]]^G) * rho^G, {G}, rho];
Ga6 = {setrho6, Fitf6[[1, 2]]};
K6 = K5 * Cacrho6[[1]]^Ga5[[2]] / (Cacrho6[[1]]^Ga6[[2]]);
Fitf7 = FindFit[data7, K6 * Cacrho7[[1]]^Ga6[[2]] / (Cacrho7[[1]]^G) * rho^G, {G}, rho];
Ga7 = {setrho7, Fitf7[[1, 2]]};
K7 = K6 * Cacrho7[[1]]^Ga6[[2]] / (Cacrho7[[1]]^Ga7[[2]]);
Print["poly_rmd=", NumberForm[polyrmd, 15], "\n",
 NumberForm[Ga0[[1]], 15], "   ", NumberForm[Ga0[[2]], 15], "\n",
 NumberForm[Ga1[[1]], 15], "   ", NumberForm[Ga1[[2]], 15], "\n",
 NumberForm[Ga2[[1]], 15], "   ", NumberForm[Ga2[[2]], 15], "\n",
 NumberForm[Ga3[[1]], 15], "   ", NumberForm[Ga3[[2]], 15], "\n",
 NumberForm[Ga4[[1]], 15], "   ", NumberForm[Ga4[[2]], 15], "\n",
 NumberForm[Ga5[[1]], 15], "   ", NumberForm[Ga5[[2]], 15], "\n",
```

```
 NumberForm[Ga6[[1]], 15], "   ", NumberForm[Ga6[[2]], 15], "\n",
 NumberForm[Ga7[[1]], 15], "   ", NumberForm[Ga7[[2]], 15], "\n"]
(*##########################*)
polyrmd = polyrmd^(-Ga0[[2]] + 1) / (0.001^(Ga0[[2]] - 1)) / (urho^(-Ga0[[2]] + 1));
Ga0 = {0, Ga0[[2]]};
Ga1 = {Ga1[[1]] / (urho * 1000), Ga1[[2]]};
Ga2 = {Ga2[[1]] / (urho * 1000), Ga2[[2]]};
Ga3 = {Ga3[[1]] / (urho * 1000), Ga3[[2]]};
Ga4 = {Ga4[[1]] / (urho * 1000), Ga4[[2]]};
Ga5 = {Ga5[[1]] / (urho * 1000), Ga5[[2]]};
Ga6 = {Ga6[[1]] / (urho * 1000), Ga6[[2]]};
Ga7 = {Ga7[[1]] / (urho * 1000), Ga7[[2]]};
K1 = polyrmd * Ga1[[1]]^Ga0[[2]] / (Ga1[[1]]^Ga1[[2]]);
K2 = K1 * Ga2[[1]]^Ga1[[2]] / (Ga2[[1]]^Ga2[[2]]);
K3 = K2 * Ga3[[1]]^Ga2[[2]] / (Ga3[[1]]^Ga3[[2]]);
K4 = K3 * Ga4[[1]]^Ga3[[2]] / (Ga4[[1]]^Ga4[[2]]);
K5 = K4 * Ga5[[1]]^Ga4[[2]] / (Ga5[[1]]^Ga5[[2]]);
K6 = K5 * Ga6[[1]]^Ga5[[2]] / (Ga6[[1]]^Ga6[[2]]);
K7 = K6 * Ga7[[1]]^Ga6[[2]] / (Ga7[[1]]^Ga7[[2]]);
e0 = (polyrmd * Ga1[[1]]^Ga0[[2]]) / (Ga0[[2]] - 1) + Ga1[[1]];
a1 = e0 / Ga1[[1]] - 1 - K1 * Ga1[[1]]^(Ga1[[2]] - 1) / (Ga1[[2]] - 1);
e1 = (1 + a1) * Ga2[[1]] + K1 * Ga2[[1]]^Ga1[[2]] / (Ga1[[2]] - 1);
a2 = e1 / Ga2[[1]] - 1 - K2 * Ga2[[1]]^(Ga2[[2]] - 1) / (Ga2[[2]] - 1);
e2 = (1 + a2) * Ga3[[1]] + K2 * Ga3[[1]]^Ga2[[2]] / (Ga2[[2]] - 1);
a3 = e2 / Ga3[[1]] - 1 - K3 * Ga3[[1]]^(Ga3[[2]] - 1) / (Ga3[[2]] - 1);
e3 = (1 + a3) * Ga4[[1]] + K3 * Ga4[[1]]^Ga3[[2]] / (Ga3[[2]] - 1);
a4 = e3 / Ga4[[1]] - 1 - K4 * Ga4[[1]]^(Ga4[[2]] - 1) / (Ga4[[2]] - 1);
e4 = (1 + a4) * Ga5[[1]] + K4 * Ga5[[1]]^Ga4[[2]] / (Ga4[[2]] - 1);
a5 = e4 / Ga5[[1]] - 1 - K5 * Ga5[[1]]^(Ga5[[2]] - 1) / (Ga5[[2]] - 1);
e5 = (1 + a5) * Ga6[[1]] + K5 * Ga6[[1]]^Ga5[[2]] / (Ga5[[2]] - 1);
a6 = e5 / Ga6[[1]] - 1 - K6 * Ga6[[1]]^(Ga6[[2]] - 1) / (Ga6[[2]] - 1);
e6 = (1 + a6) * Ga7[[1]] + K6 * Ga7[[1]]^Ga6[[2]] / (Ga6[[2]] - 1);
a7 = e6 / Ga7[[1]] - 1 - K7 * Ga7[[1]]^(Ga7[[2]] - 1) / (Ga7[[2]] - 1);
Prho = Piecewise[{{polyrmd * rho^Ga0[[2]], rho < Ga1[[1]]}, {K1 * rho^Ga1[[2]], rho < Ga2[[1]]},
     {K2 * rho^Ga2[[2]], rho < Ga3[[1]]}, {K3 * rho^Ga3[[2]], rho < Ga4[[1]]},
     {K4 * rho^Ga4[[2]], rho < Ga5[[1]]}, {K5 * rho^Ga5[[2]], rho < Ga6[[1]]},
     {K6 * rho^Ga6[[2]], rho < Ga7[[1]]}, {K7 * rho^Ga7[[2]], rho < 10 * Ga7[[1]]}}];
PB = Plot[Prho, {rho, 0, 1.3 * Ga7[[1]]}, PlotStyle → Red];
Show[PB, PA, PPA]
```

poly_rmd=$5.7817269450468 \times 10^{18}$

0 2.32099340435551

$1.92115278693784 \times 10^{17}$ 2.92580123560412

$2.72621723559 \times 10^{17}$ 3.40131182933083

$4.08847202980738 \times 10^{17}$ 3.51496833267321

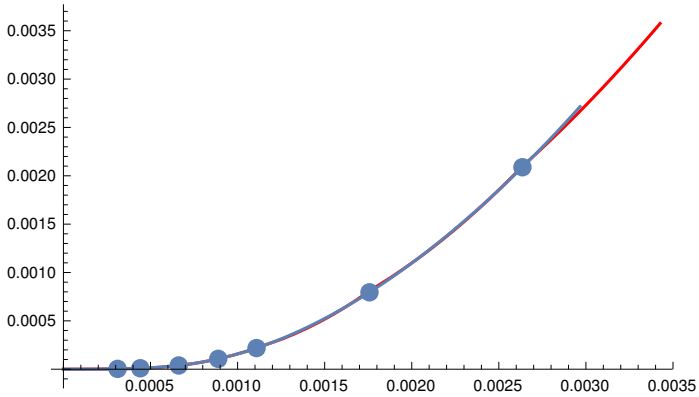
$5.48985349670787 \times 10^{17}$ 3.20748965080253

$6.84794693717803 \times 10^{17}$ 2.83729357418746

$1.08532747875338 \times 10^{18}$ 2.34924219002929

$1.62764968869902 \times 10^{18}$ 2.03097219335027

Out[ ]=



In[ ]:=
```
Prho /. rho → 0.001
data[[10]]
datadiff = Table[{data[[n, 1]],
    Sqrt[(data[[n, 2]] - (Prho /. rho → data[[n, 1]]))^2] / data[[n, 2]]}, {n, 1, NP - 1}];
datadiffR = Table[Sqrt[(data[[n, 2]] - (Prho /. rho → data[[n, 1]]))^2] / data[[n, 2]],
   {n, 1, NP - 1}];
PRangediff = {{0, 1.7 * Cacrho7[[1]]}, {-0.01, 2 * 10^(-1)}};
Max[datadiffR]
Min[datadiffR]
PPAdiffR = ListPlot[{{Cacrho1[[1]], 0}, {Cacrho2[[1]], 0}, {Cacrho3[[1]], 0},
    {Cacrho4[[1]], 0}, {Cacrho5[[1]], 0}, {Cacrho6[[1]], 0}, {Cacrho7[[1]], 0}},
   PlotMarkers → {Automatic, Medium}, PlotRange → PRange];
PdiffR = ListLinePlot[datadiff, PlotRange → PRangediff];
Show[PdiffR, PPAdiffR]
```

Out[ ]= 0.000157427

Out[ ]= $\{3.16853 \times 10^{-12}, 2.05251 \times 10^{-16}\}$

Out[ ]= 1.

Out[ ]= 0.0000570618

Out[ ]=