Integrate 2-photon Lineshape over Doppler Distribution

$$\text{transProb}[\omega 1\_, \omega 2\_, v\_] = \sum_{fDPrime=fMinFin}^{fMaxFin} \sum_{f=fMinGnd}^{fMaxGnd} \left(\left(\frac{(\gamma Fin + \gamma T)^2}{4} \Big/ \left(\left(2\pi \nu GndToFin[f, fDPrime] - \omega 1 \left(1 + \frac{v}{c}\right) - \omega 2 \left(1 - \frac{v}{c}\right) \right)^2 + \frac{(\gamma Fin + \gamma T)^2}{4} \right) \right) \right.$$

$$\left. \frac{1}{2f+1} \sum_{m=-f}^{f} \sum_{mDPrime=-fDPrime}^{fDPrime} \text{Abs}\left[\sum_{fPrime=fMinInt}^{fMaxInt} \sum_{mPrime=-fPrime}^{fPrime} \left(\frac{\gamma Int + \gamma T}{2} \Big/ \left(\frac{i\,(\gamma Int + \gamma T)}{2} + \left(\omega 1 \left(1 + \frac{v}{c}\right) - 2\pi \nu GndToInt[f, fPrime] \right) \right) \right. \right. \right.$$

$$\left. \left. \left. dGndToInt_{f,fPrime,m,mPrime}\, dIntToFin_{fPrime,fDPrime,mPrime,mDPrime} \right) \right]^2 \right);$$

$$\text{fnToIntegrate}[fR\_, v\_] = \sum_{n1=1}^{Length[n1List]} \sum_{n2=1}^{Length[n2List]} \text{dopplerDist}[v]$$

$$\text{transProb}[\omega L[n1List[[n1]], fR], \omega L[n2List[[n2]], fR], v];$$

```
vIntSpec[fRep_?NumericQ] := NIntegrate[fnToIntegrate[fRep, v], {v, -60 000, 60 000},
   MinRecursion → 3, MaxRecursion → 10, AccuracyGoal → 4, PrecisionGoal → 2];
```

Calculation

```
δf = 1;
fr = fRepMin;
fRepList = {};
(*Form the fRepList*)
While [fr < fRepMax,
 {fRepList = Append[fRepList, fr];
  fr += δf;}]

(*Export["C:\\RbDFCS\\Rb87_5D52.txt",totalSpec,"Table"];*)
tt = AbsoluteTime[];
 (*distribute NIntegrate among CPU cores*)
specList = ParallelTry[vIntSpec, fRepList, Length[fRepList]];
ttt = AbsoluteTime[] - tt;
Print["Execution time = ", ttt]
fRepList = fRepList - Min[fRepList];
totalSpec = Table[{fRepList[[t]], Chop[specList[[t]]]}, {t, 1, Length[specList]}];
ListPlot[totalSpec, PlotRange → All, Joined → True ]
```

```
Execution time = 188.4960083
```