Spectoplot

This document is written to aid the analysis of the Cowan code output (.spec). Specifically when using the code for multiple even and odd parities. When using Cowan it is best to keep all the odd and all the even parities together i.e. all odd followed by all even or vice versa. There are a few reasons for this one is for CI, the other which is more important for spectoplot is that there will be a single header at the top of the .spec file which can be imported into Matlab very easily. Matlab imports the .spec file as a structure containing the "data" and the "textdata".

```
Tempdata=importdata('SnX.spec');
%This imports the SnX file as a 1x1 structure in matlab
% data: [number of transitions x 7]
% textdata:[1 + number of transitions + configurations(
    odd or even, which ever has the most) x 11 ]

%To convolve all the transitions in the file with a
    Gaussian with a standard deviation of 0.02 nm,
spectoplot(Tempdata.data)
```

This results in the following figure 1.

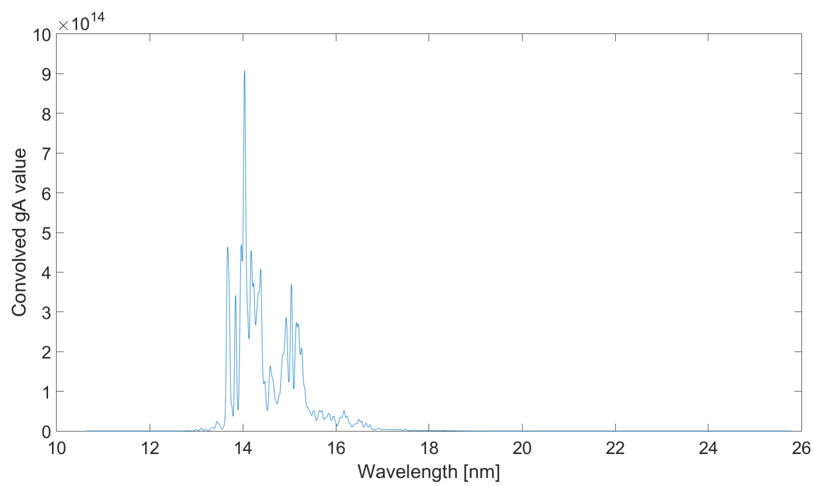

Figure 1: SnX example part 1

```
%To change the standard deviation
spectoplot(Tempdata.data,0.2)
%the second entry is your standard deviation... as long
    as your not cherry picking!
```

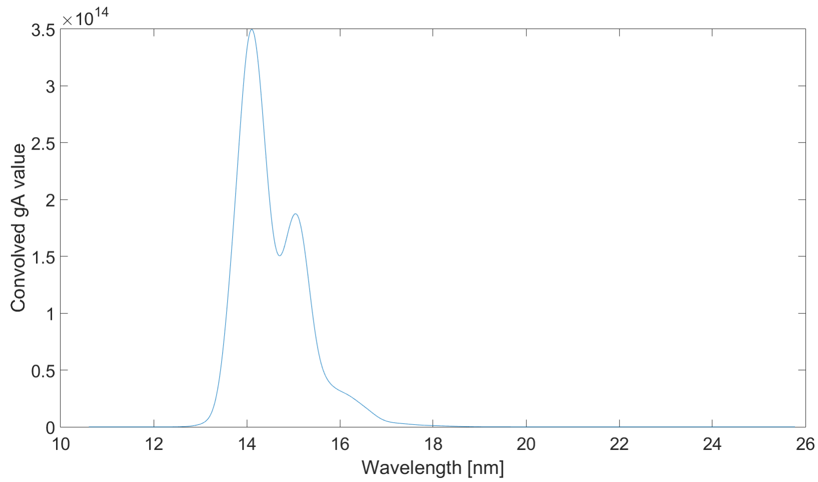

Figure 2: SnX example part 2

The next example is how to use spectoplot to cherry pick even and odd configurations for analysis.

```
close all; clear all; clc;
Ion=importdata('85_00_Sn_XIV_correct_correcter.spec');
data_Ion=Ion.data; text_Ion=Ion.textdata;
config=length(text_Ion)-length(data_Ion);
%Number of configurations within the .spec file
for i=1:length(data_Ion(:,1))
      I=i+config;
      textdata1(i)=str2num(cell2mat(text_Ion(I,4)));
      textdata2(i)=str2num(cell2mat(text_Ion(I,9)));
end
% allows the extraction of the configuration number in the text data file to use with the data gA and wavelength (this is needed due to the splitting in importing in matlab)
subplot(2,2,1)
spectoplot(data_Ion,textdata1,0,textdata2,0,200);
title('all-all')
subplot(2,2,2)
spectoplot(data_Ion,textdata1,0,textdata2,1,200);
title('all-first')
subplot(2,2,3)
spectoplot(data_Ion,textdata1,1,textdata2,0,200);
title('first-all')
```

```
subplot(2,2,4)
spectoplot(data_Ion,textdata1,2,textdata2,2,200);
title('second-second')
```

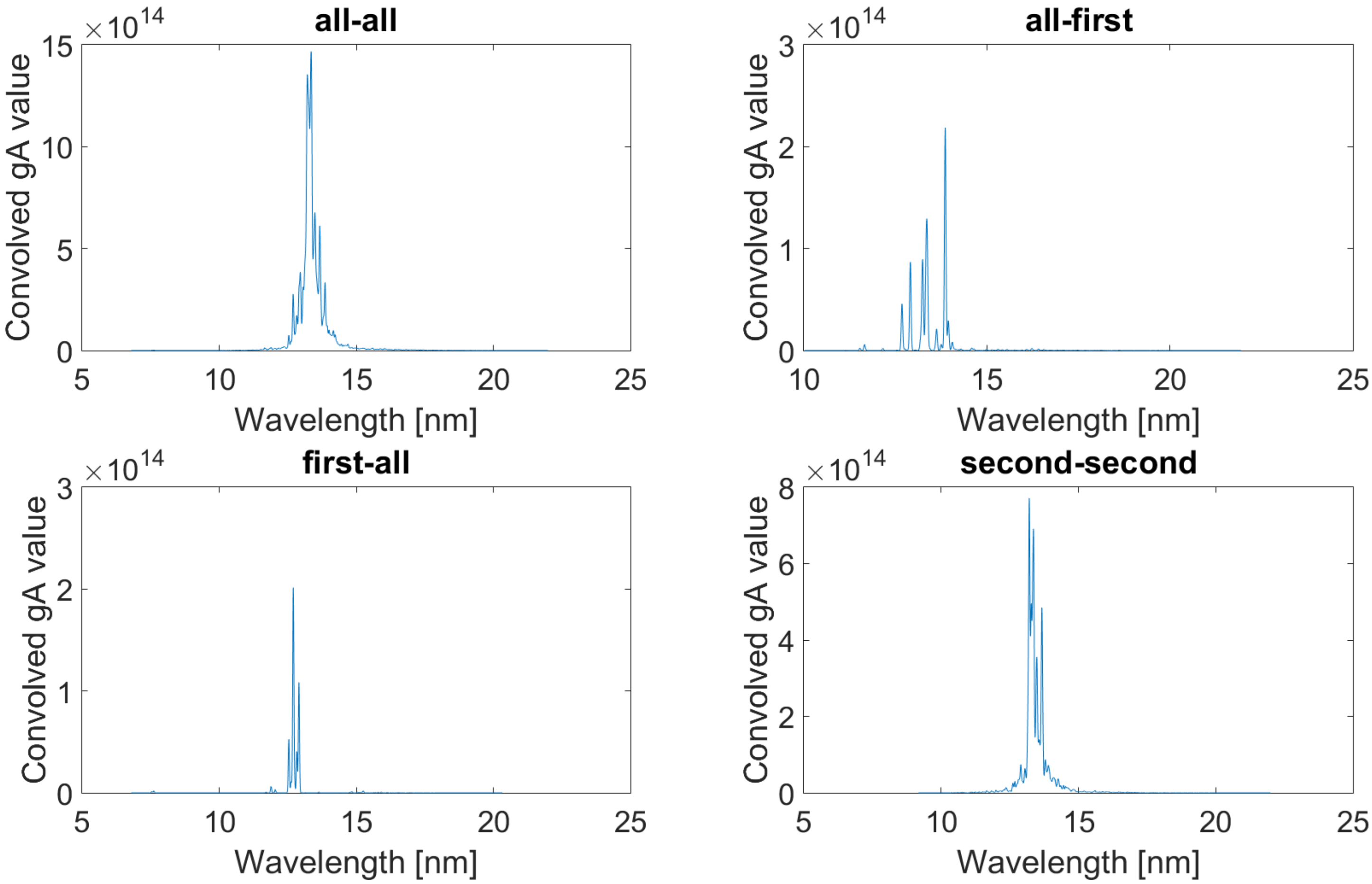

Figure 3: Sn XIV using spectoplot

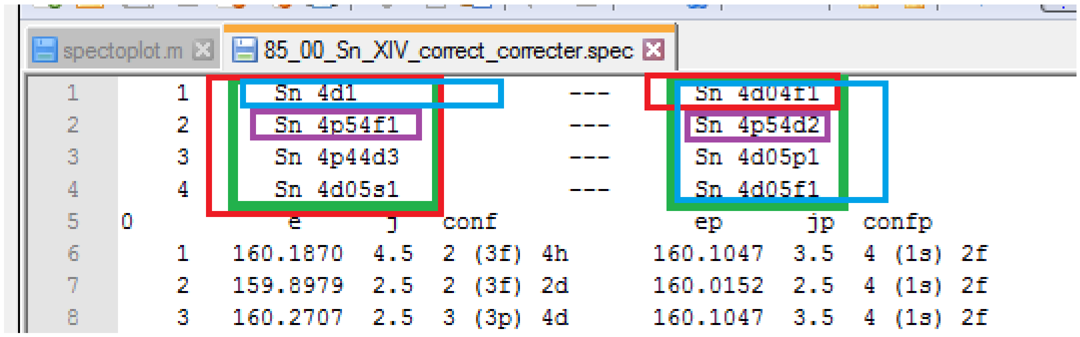

Figure 4: In the previous figure, green is the top left, red is top right, blue is bottom left and purple is bottom right

If the data is needed after picking the transitions using spectoplot like above, this can be done as below.

```
newdata=spectoplot(data_Ion,textdata1,2,textdata2,2,200);
```

This returns an n*4 array, with n being the number of transitions. The columns go as follows, first is wavelength in Angstroms, second is gA, third is gf and fourth is the transition energy.

spectoplot can be used in a few different ways.
1 input, data convolves with a 0.02 nm standard deviation Gaussian.
2 inputs convolves data with a user defined standard deviation Gaussian.
3 inputs, data and textdata followed by configuration number (0 for all).
5 inputs, data both text data and configuration numbers.
6 inputs, 5 inputs + upper wavelength limit in angstroms.
7 inputs, 6 inputs + colour.
8 inputs, 7 inputs + lower wavelength limit in angstroms.
9 inputs, 8 inputs + variable standard deviation in nanometres.

For a stick plot version

```
spectolineplot(data_Ion);
```

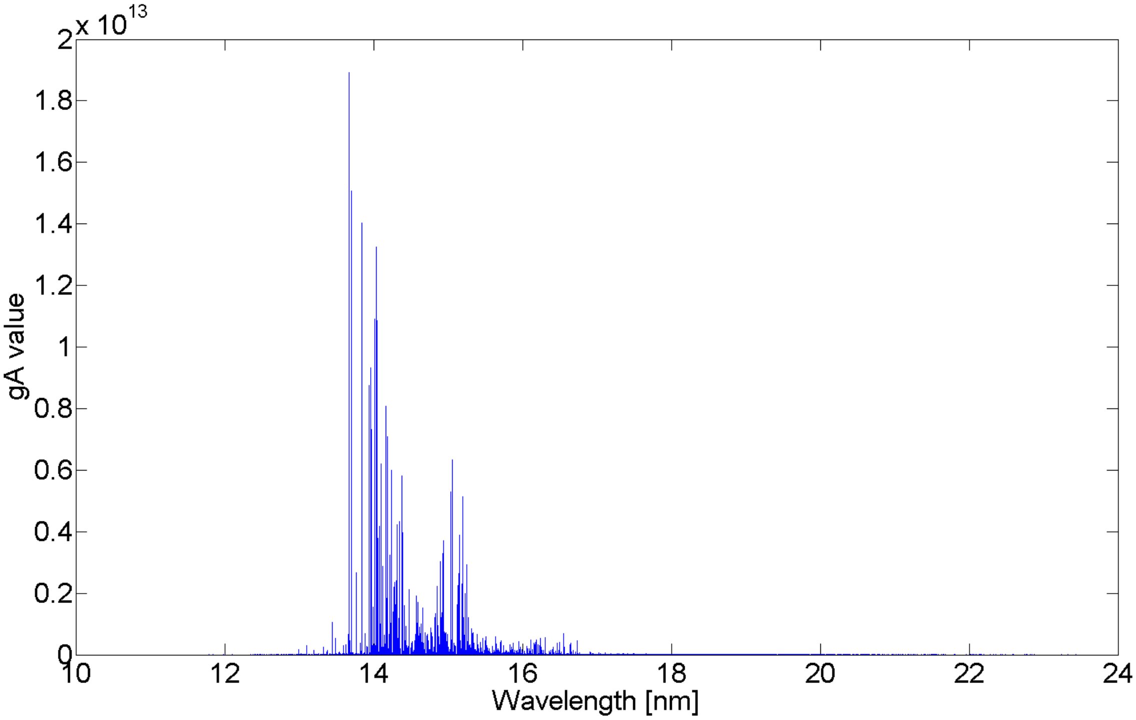

Figure 5: Spectolinplot example

The final version of spectoplot is spectoplotyy[1]. Spectoplotyy takes in 10 varibles, data, textdata1, configuration number 1, textdata2, configuration number 2, upper wavelength limit, colour (doesn't work), lower wavelength limit, Wavelength experimental data, Intensity experimental data.

The actual use case of this code is shown below with a few of the output figures. The code was used in conjunction with the CR model by Colombant and Tonon. The CR model function has three inputs, atomic number, temperature and illuminating wavelength. The output has two columns spectroscopic notation of the ion stage followed by the percentage of that ion stage.

```
close all; clear all; clc;
A=31; wave=1064;

GaVII=importdata('GaVII.spec');%Importing
data_GaVII=GaVII.data;
GaVIII=importdata('GaVIII.spec');
data_GaVIII=GaVIII.data;
GaIX=importdata('GaIX.spec');
data_GaIX=GaIX.data;
GaX=importdata('GaX.spec');
data_GaX=GaX.data;
GaXI=importdata('GaXI.spec');
data_GaXI=GaXI.data;
GaXII=importdata('GaXII.spec');
data_GaXII=GaXII.data;
GaXIII=importdata('GaXIII.spec');
data_GaXIII=GaXIII.data;
%length of mega data
lengthData=length(data_GaVII)+length(data_GaVIII)+length(data_GaIX)+...
    length(data_GaX)+length(data_GaXI)+length(data_GaVII);
DATA=zeros(lengthData,7);
%%%%DUMMY text data...
textdata1=zeros(lengthData,11);textdata2=textdata1;

for temperature=30:10:30
    Ga=CRratio(A,temperature,wave);
    I=0;
    %mega data stitching and scalling
    for i=1:length(data_GaVII(:,1))
        I=I+1;
        DATA(I,6)=data_GaVII(i,6).*Ga(7,2);%gA
        DATA(I,2)=data_GaVII(i,2);%wavelength
    end
```

[1]There was intention of making spectolineplotyy, however it was never finished

```
    for i=1:length(data_GaVIII(:,1))
        I=I+1;
        DATA(I,6)=data_GaVIII(i,6).*Ga(8,2);%gA
        DATA(I,2)=data_GaVIII(i,2);%wavelength
    end
    for i=1:length(data_GaIX(:,1))
        I=I+1;
        DATA(I,6)=data_GaIX(i,6).*Ga(9,2);%gA
        DATA(I,2)=data_GaIX(i,2);%wavelength
    end
    for i=1:length(data_GaX(:,1))
        I=I+1;
        DATA(I,6)=data_GaX(i,6).*Ga(10,2);%gA
        DATA(I,2)=data_GaX(i,2);%wavelength
    end
    for i=1:length(data_GaXI(:,1))
        I=I+1;
        DATA(I,6)=data_GaXI(i,6).*Ga(11,2);%gA
        DATA(I,2)=data_GaXI(i,2);%wavelength
    end
    for i=1:length(data_GaXII(:,1))
        I=I+1;
        DATA(I,6)=data_GaXII(i,6).*Ga(12,2);%gA
        DATA(I,2)=data_GaXII(i,2);%wavelength
    end
    for i=1:length(data_GaXIII(:,1))
        I=I+1;
        DATA(I,6)=data_GaXIII(i,6).*Ga(13,2);%gA
        DATA(I,2)=data_GaXIII(i,2);%wavelength
    end
    a=importdata('GaExperiment.txt');%fine
    X1(:,1)=a(:,1); Y1(:,1)=a(:,2);
    figure(temperature)
    spectoplotyy(DATA,textdata1,0,textdata2,0,180,0,0,X1,
        Y1);
end
```

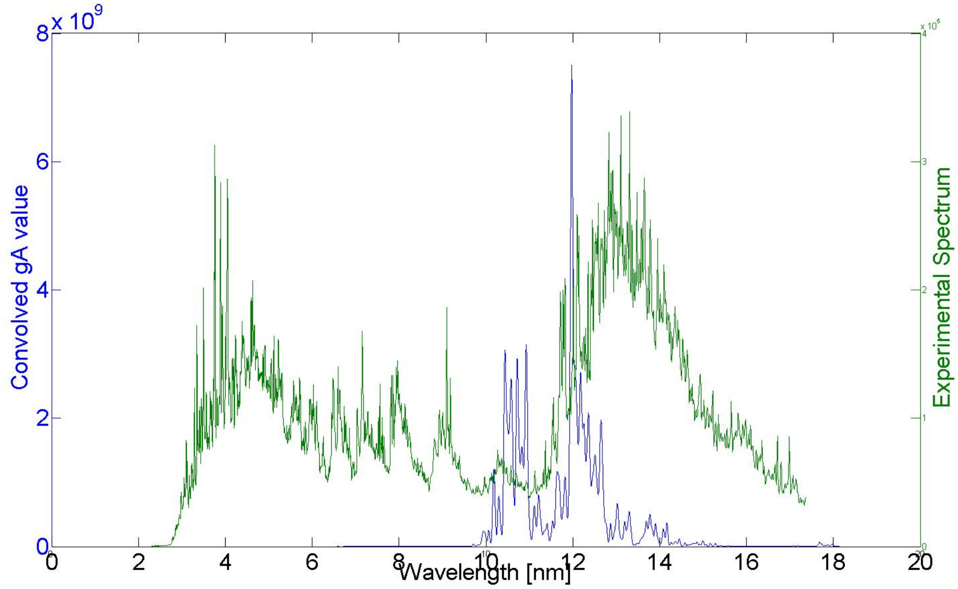

Figure 6: spectoplotyy example 10 eV

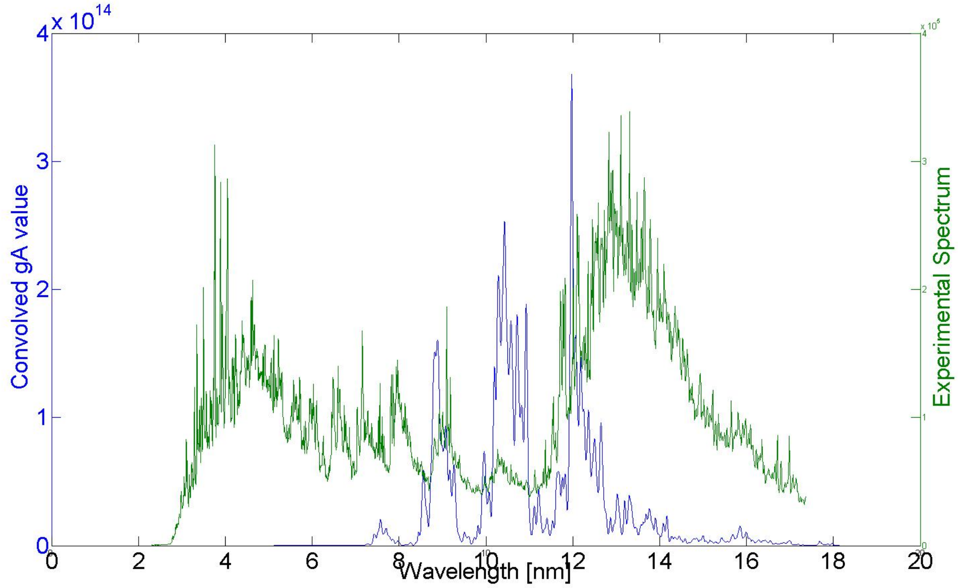

Figure 7: spectoplotyy example 20 eV

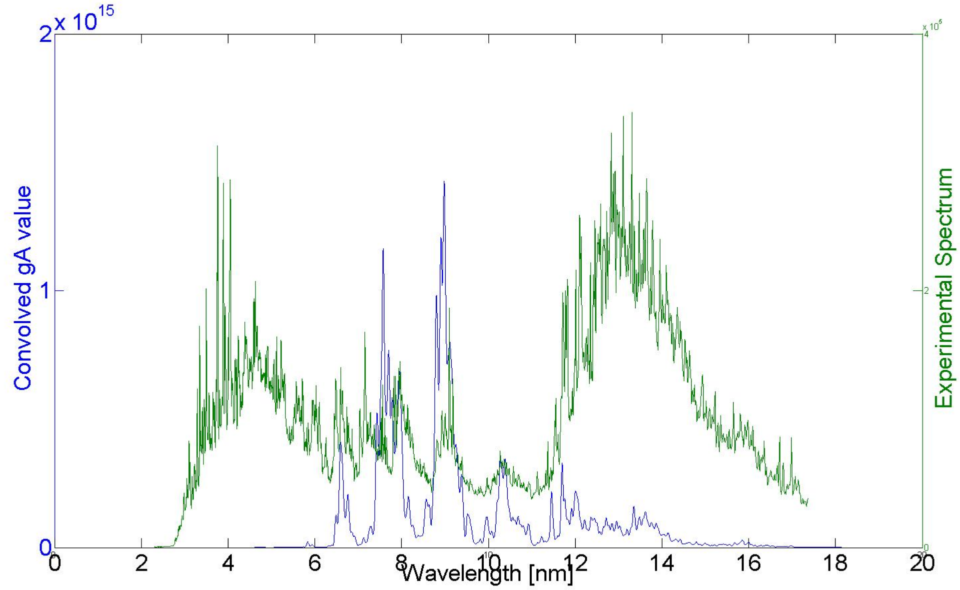

Figure 8: spectoplotyy example 30 eV

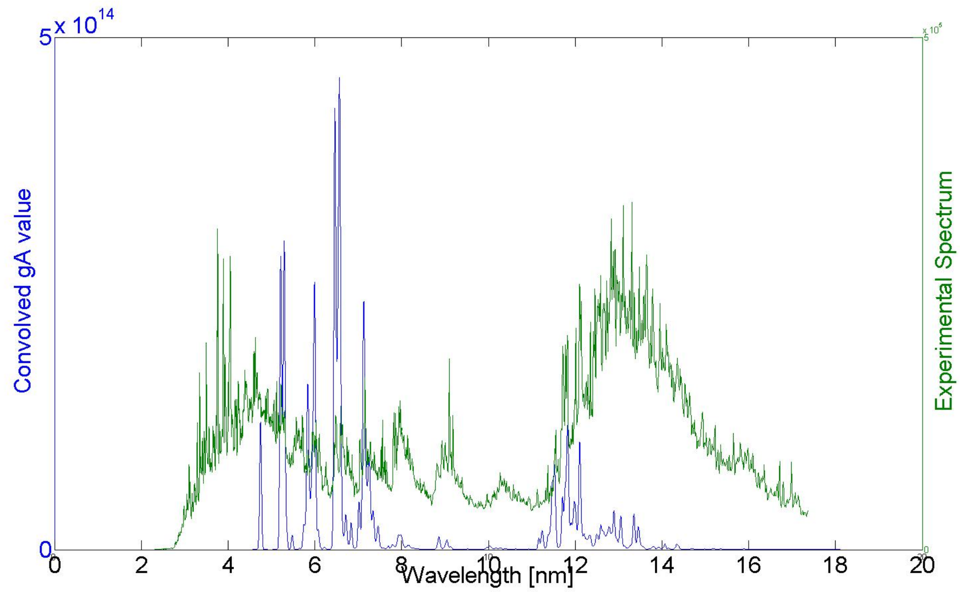

Figure 9: spectoplotyy example 70 eV