SPECTRUM FLATTENING TUTORIAL

Once you have used Spect3D Visualizer to view the spectral output from your Spect3D simulation and save the output spectrum to a file, you will want to import the synthesized spectrum into Origin for the purposes of comparison with Jim Bailey's measured spectrum.

1. Open a new Origin workspace, and make sure the default blank worksheet is the active window.

2. Click on **File** in the menu bar, and then on **Import** from the drop-down menu. In the Import sub-menu, click on **Simple Single ASCII…**

3. Before navigating to the file you want to import, click on **Options** at the bottom of the file window.

4. In the dialog box that opens, click on the drop-down menu that reads **Read as Missing Data** and select **Start New Worksheet/Column**. (NOTE: If you only saved the spectral data from one time step to your data file, this step probably isn't necessary, but it does come in handy if you do decide to save the spectra from several time steps to a single data file and then want separate that data by time step into different worksheets in Origin.) Click **Update Options**.

5. Now in the file window, navigate to the directory containing your data file, and double-click the filename in the file window to import the data into Origin.

6. If you updated the import options so that a new worksheet/column is written when a non-numeric character is encountered in the import data file, you should now have two worksheets open. One worksheet will contain no data and the other will have data. You can close the worksheet with no data by clicking on the close box on the title bar and then selecting **Delete** in the prompt window.

7. Now, in the remaining worksheet containing your spectral data, select both columns by clicking and dragging across the column headers. With the two columns selected, click on **Plot** on the menu bar, and then select **Line** from the drop-down menu. This will generate a plot of your spectral data.

8. At this point, I would usually print the plot and use a pencil and ruler to fit a line to the spectrum. If you wanted, you could probably do the same procedure on the computer using the line tool on the toolbar on the left of the Origin workspace window. I preferred the pencil and paper approach because I thought I could be more accurate that way, but really doing it all on the computer probably could be just as accurate if you took your time. Anyway, the point of all of this is to fit a line to the *relevant* parts of the spectrum so that you can *subtract out* the

continuum. The relevant features of the spectrum occur in the wavelength range of ~10 angstroms to ~14 angstroms, so be sure to fit a line that best matches that portion of the spectrum. To do this, I usually picked two points in the range of 10.8 angstroms to 11.5 angstroms since there were more lines in that range of the spectrum and I thought it was important to have a good fit over that region. I calculated the slope using these two points ($m = \Delta y/\Delta x$) and then used this slope and one of the points to write an equation for the line fitting the spectrum in the form $(y - y1) = m(x - x1)$. The final equation, as expected, was of the form $y = m*x + b$.

9. Select the worksheet containing your spectrum data, and right click in the white space next to your last column. Select **Add New Column**. Click on the light gray header of the column to select the entire column, and then right click on the selected area and choose **Set Column Values**. This will bring up a formula entry dialog box with an area where you can input the equation of the line you came up with in the last step. The syntax of your formula should be Col(line) = m*Col(X) + b, where Col(X) is the column containing the wavelength x values for your spectrum. Once finished, click **Ok.** Now you should have a column of values describing your fit line. At this point, I would usually plot my fit line with the spectrum to make sure I had a good fit. Obviously, if the fit was not good, I would go back and adjust the line parameters until I achieved a satisfactory fit.

10. The last step is to divide the spectrum data values by the fit line data values. To do this, again create a new column in your spectrum worksheet, and use the **Set Column Values** feature to enter the formula Col(flat) = Col(spect)/Col(line) where Col(spect) is the column containing your spectrum y values. Again, I would usually plot Col(flat) to make sure the flattened spectrum looked OK. Once you are satisfied with your flattened spectrum, you can plot it against the spectral data provided by Jim Bailey to gauge the fidelity of your modeling procedure.