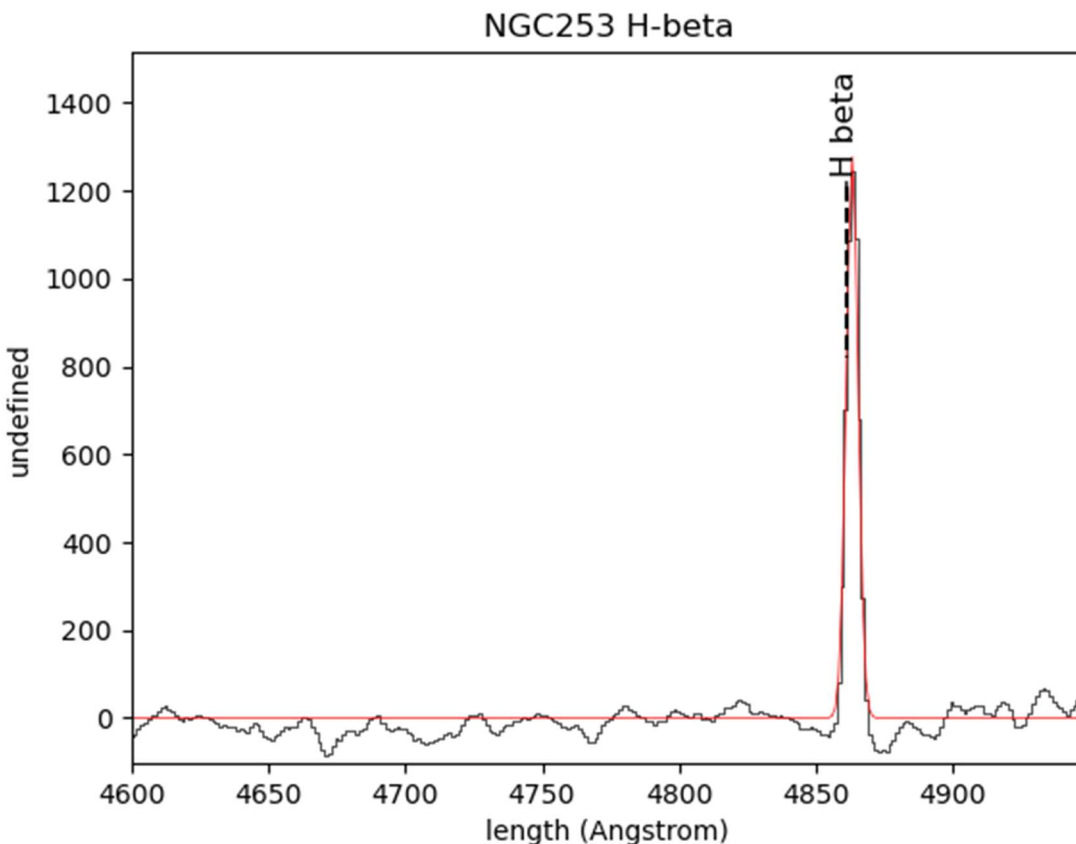**PySpecKit:**

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1. PySpecKit is written in python and aims to provide spectroscopic analysis tools for many different astronomical instruments. It was created due to the lack of spectroscopic analysis tools that worked on a general wavelength.
2. I chose this package because, while not entirely the same, my dad does mass spectrometry at work, and I've been curious to understand what precisely he does. While I'm aware this does not map completely to my interest, I hope to at least understand a little more.
3. PySpecKit started development in 2009, starting as a script in agpy. By 2011 it had migrated into a package of its own, and moved onto Github in 2012. Astropysics, developed in 2012, solves many of the same problems as PySpecKit. I am using version 1.0.4.dev.
4. The last version to release was in late 2023. However, the latest update to the Github was six months ago. It appears the package is still being maintained by the original authors, Adam Ginsberg and Jordan Mirocha. There are no clear instructions on how to contribute to this project. However, they do provide contact information and a forum to post issues or cases.
5. The installation was easy. From the website's recommendation, I was able to install using the pip install command.
6. It installs using the standard pip/conda install.
7. Source code is provided on the PySpecKit website: https://pyspeckit.readthedocs.io/en/latest/_modules/pyspeckit/spectrum/models/model.html#AstropyModel
8. Yes, some packages do use PySpecKit. For example, Spectuner, a package which aims to identify spectral lines without manual intervention, cites PySpecKit. Furthermore, bayes_spec is another package which offers more analysis tools through numerical techniques.
9. PySpecKit appears to be used in python script and Jupyterlab. Most code examples are made using python script.

10. Examples are provided in the Jupyterlab notebook. Below is a short example of plotting and creating a Gaussian fit for a spectrum from a .tab file.

```python
ha_data = np.loadtxt('ngc253_ha.tab')
ha = pyspeckit.Spectrum(data = ha_data[:,1]-300,
                        xarr = ha_data[:,0]*u.AA)
ha.plotter()
ha.specfit(fittype = 'gaussian')
#an example of a plot with annotations.
ha.plotter.savefig('ha_with_fit')
```

11. Pyspeckit comes with a built in Spectrum.plotter() function which can be used to plot spectrums, display multiple spectrums over one another, and to plot a fit over the spectrum.

12. The following figure shows an example spectrum (black), with a Gaussian fit overlayed (red). It also shows a label on the h-beta line using the line_id feature of Pyspeckit.

13. Pyspeckit is pure python.
14. Pyspeckit takes several types of datasets as inputs, such as FITS files, numpy arrays, and txt files. Data can also be generated using tools such as numpy. However, this will occasionally generate warnings as the generated data doesn't have correct headers.
15. The output of Pyspeckit is images. Using the Spectrum.plotter.savefig() command, .png files can be generated of the plots described above.
16. There are no provided tests.
17. Due to the nature of Pyspeckit, the result of the fitting can be visually inspected to be correct.
18. Some of the requirements are listed on the Installation and Requirements page, such as that PySpecKit uses numpy and matplotlib primarily. Scipy, astropy, atpy and hdf5 are optional packages. However, I have found that Pyspeckit also uses several other packages not listed on the page for some of the modules. For instance, it requires spectral_cube for any use of the cubes class. Furthermore, lineid_plots is needed to use some properties of the plotter (but has not been updated for 7 years, so some functionality is lost.) This information is given under the module description and command description respectively.
19. Pyspeckit has a website with API documentation for the modules. It also has a basic plotting guide and some example codes. I was also able to find an overview paper written by the authors.
20. Preferred citation:
    a. https://ui.adsabs.harvard.edu/abs/2022AJ....163..291G
21. References:
    a. Astropysics: https://ascl.net/1207.007
    b. Spectuner: https://ascl.net/2412.013
    c. bayes_spec: https://ui.adsabs.harvard.edu/abs/2024JOSS....9.7201W/abstract
    d. spectral_cube: https://ascl.net/1609.017
    e. lineid_plot: https://github.com/phn/lineid_plot/tree/master/lineid_plot
22. There are 62 papers citing PySpecKit from their ADS page.
    a. https://ui.adsabs.harvard.edu/abs/2022AJ....163..291G/citations
23. No, I did not need to learn new Python methods to use this package. This class was enough. I did run into some errors, but this does not seem to be the fault of the package.
24. I did not have prior experience with this package and I worked individually. However I would like to mention that the spectral_cube package caused errors for me, so I was unable to use the .fits file in my project.