

uranian-satellite-spec-kelley

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1 Triplespec Spectra of Uranian Satellites Collection

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```
In [1]: %matplotlib inline
        from glob import glob
        import numpy as np
        import matplotlib.pyplot as plt
        from pds4_tools import pds4_read
```

1.1 Check spectral dispersion

1.1.1 Inspect first file to determine format

```
In [2]: files = sorted(glob('uransatspec/data/processed_sats/*.xml'))
        data = pds4_read(files[0])
        data.info()
```

```
Processing label: uransatspec/data/processed_sats/ariel_85_proc.xml
Now processing a Header structure: HEADER_0
Now processing a Array_3D_Spectrum structure: local_array
0  Header          'HEADER_0'      FITS 3.0
1  Array_3D_Spectrum 'local_array'  3 axes, 5 x 3 x 2048
```

1.1.2 Check wavelengths and spectral dispersion for each order

```
In [3]: spec = data['local_array'].data
        disp = np.zeros(5)
        print('order, min, max, mean dispersion')
        for order in range(5):
            disp[order] = np.nanmean(np.diff(spec[order][0]))
            print(order, np.nanmin(spec[order][0]), np.nanmax(spec[order][0]), disp[order], sep=' ')
```

```

order, min, max, mean dispersion
0, 1.88241, 2.47135, 0.000287711533019
1, 1.41419, 1.85614, 0.000215904976358
2, 1.13255, 1.48668, 0.000172999294591
3, 0.944439, 1.24041, 0.000144586898386
4, 0.90993, 1.0646, 0.000124033016618

```

1.1.3 Verify that all files have similar dispersion

```

In [4]: for file in files:
        spec = pds4_read(file, quiet=True)['local_array'].data
        assert np.allclose(dis, [np.nanmean(np.diff(spec[order][0])) for order in range(5)])
        print(file, 'passed')

```

```

uransatspec/data/processed_sats/ariel_85_proc.xml passed
uransatspec/data/processed_sats/ariel_86_proc.xml passed
uransatspec/data/processed_sats/ariel_87_proc.xml passed
uransatspec/data/processed_sats/ariel_88_proc.xml passed
uransatspec/data/processed_sats/oberon73proc.xml passed
uransatspec/data/processed_sats/oberon74_proc.xml passed
uransatspec/data/processed_sats/oberon75proc.xml passed
uransatspec/data/processed_sats/oberon76_proc.xml passed

```

1.2 Inspect spectra of Oberon

```

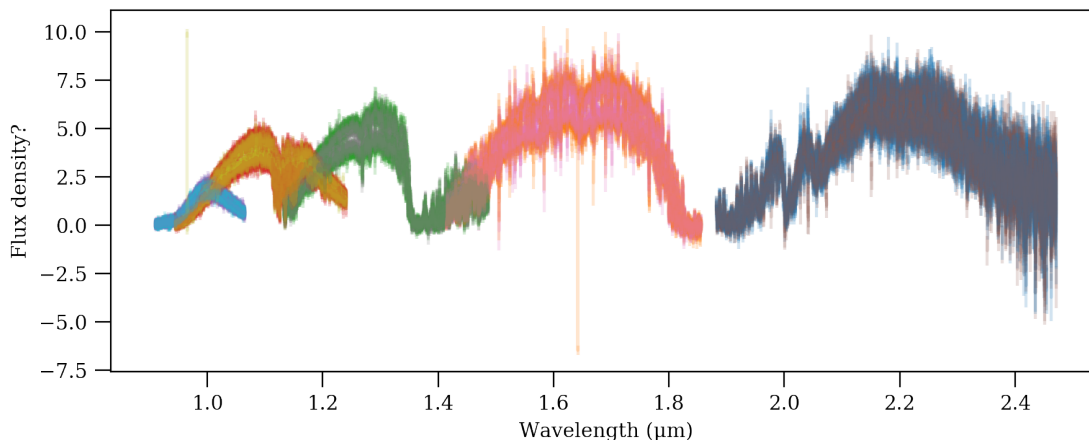
In [5]: oberon = sorted(glob('uransatspec/data/processed_sats/oberon*.xml'))
        plt.figure(1, (8, 3), dpi=200).clear()
        for i, file in enumerate(files):
            spec = pds4_read(file, quiet=True)['local_array'].data
            for order in range(5):
                plt.errorbar(*spec[order], alpha=0.2)
        plt.setp(plt.gca(), xlabel='Wavelength (m)', ylabel='Flux density?')

```

```

Out[5]: [Text(0,0.5,'Flux density?'), Text(0.5,0,'Wavelength (m)')]

```



1.2.1 Spectrum of Ariel (Cartwright et al.)

Figure 4 of Cartwright et al. (2015, Icarus 257, 428, DOI: 10.1016/j.icarus.2015.05.020).
<https://doi.org/10.1016/j.icarus.2015.05.020>

1.3 Lien summary

1. Consider Surface for the Science_Facets.
2. collection.xml: : Why use Multiple Satellites? Why not list the two satellites?
3. Raw and calibration images: Labeling with the spectral data dictionary, but the data are images of the focal plane. Is this the right approach? The Bin_Description class does not make sense in this context.
4. Overview says "Following telluric correction, the five spectral orders are merged to generate the complete reduced spectrum," but the processed data are not telluric corrected or merged. Either the overview must be corrected, or the final spectra provided.
5. Units of the flux and error axes are not specified. (Where should that be?)

** Full lien list submitted separately. **

1.4 PDS4 stuff

1. This data set uses PDS4_SP_1800. This is not on the PDS4 Released Schemas page.
2. OK to use Array_3D_Spectrum for spectral_dispersion \mathbb{C} (wave, fluxd, err) \mathbb{C} order? What would we do in a 4D case?
3. What specifies the units of the dispersion values? It may be implied that all spectral units should be the same, but shouldn't this be explicit in the data dictionary?