1. Background

Lyman alpha (121.5 nm) and Lyman beta (102.6 nm) are emitted spectral lines of hydrogen and lie in the vacuum UV.

There is a “fog” of hydrogen gas around Mars that is illuminated by the Sun at Lyman alpha and Lyman beta.

To know how much hydrogen is in this fog, we need to know how bright the Sun is at these wavelengths.

Mars hydrogen can only “see” light at the center of the line of Lyman alpha and Lyman beta.

The Mars Atmospheric and Volatile Evolution mission (MAVEN) Extreme Ultraviolet Monitor (EUVM) instrument measures the total brightness.

Full-disk solar data is taken by the SUMER instrument on SOHO (NOT pointed directly at the Sun).

2. Goal

Can we infer Lyman beta line center brightness using measured band-integrated (total) Lyman alpha brightness values at Mars?

3. Methods

- Get SUMER data from Virtual Solar Observatory
- Extract wavelengths shift
- Plot wavelengths vs mean spectrum
- Scatter plot of SUMER vs LISIRD
- Calibrate relative to LISIRD and TIMED/SEE
- Average data along the slit
- Align graphs on center wavelength
- Integrate over all aligned graphs

4. Lyman alpha (121.5 nm)

SUMER + LISIRD / TIMED/SEE enables us to connect line center brightness to total brightness.

- LISIRD gives band-integrated Lyman alpha brightness.
- SUMER gives us the shape of the Lyman alpha spectral line with an unknown calibration.
- LISIRD/SUMER is the ratio needed to calibrate the SUMER spectrum and get correct total brightness.
- Once calibrated, SUMER gives us the line center Lyman alpha brightness.

We can apply 1-4 to Lyman beta.

5. Lyman beta (102.6 nm)

6. Future Work

We want to recreate Fig. 7 and Fig. 8 from Lemaire+2015 (DOI: 10.1051/0004-6361/201526059) using the three subplots above.

We will plot the SUMER band-integrated Lyman alpha brightness vs SUMER Lyman beta line center brightness.

Do a regression analysis (y=mx+b) where x is the Lyman alpha EUVM measurement, and y is the Lyman beta line center brightness.

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