**Characterizing AGN Continua in the Far-Ultraviolet**

Matthew L. Stevans, Jr.¹, J. Michael Shull¹, Charles M. Danforth¹

¹CASA, University of Colorado at Boulder

---

**Introduction**

Spectral observations of active galactic nuclei (AGNs) in the far-ultraviolet (FUV) and the extreme-ultraviolet (EUV) have three general components:

1. Continuum: Low order approximation power-law.
2. Broad emission features: Logarithmic, asymmetric.
3. Absorption features: Gaussian-like.

---

**Methods**

We took a test sample of 3 AGN that have been observed by COS and FUSE. Two targets also have IUE data. Here is our process for fitting continua:

1. Multiplicatively scaled fluxes.
2. Stitched newly scaled spectra.
3. Corrected for galactic extinction and transformed to rest frame.
4. Selected possible regions of line-free continuum.
5. Least-squares fitted selected continuum regions.

We sought to select the lowest points of potential continuum regions.

The model we used to fit the continuum:

\[ F_\nu = C \lambda^{-\alpha} \]

Where \( \alpha \) is the power-law index, \( C \) is a constant, and \( F_\nu \) is the specific flux per unit wavelength interval. \( F_\nu \propto \nu^{-\alpha} \)

---

**Results**

---

**Motivations**

Quantifying the FUV and EUV continua of AGNs aids in understanding the nature of the other components; specifically:

- understanding emission line formation.
- characterizing the UV bump in AGN spectral energy distributions.
- determining the composition and density of the intergalactic medium (IGM).

---

**Discussion**

- We were able to find line-free continua and detected power-law breaks around 1200 Angstroms confirming that our method works.
- Comparing results to Telfer et al. 2002 who got \( \alpha \) EUV: 1.76(12) and \( \alpha \) FUV: 0.69(06); Scott et al. 2004 who got \( \alpha \) EUV: 0.56(33); our Seyfert 1.5’s seem to support Telfer et al. 2002.
- By increasing our sample size we look to shed light on the Telfer et al. 2002, Scott et al. 2004 \( \alpha \) EUV discrepancy.
- We will introduce targets with greater z so we can study the EUV with data from COS.

---

**References**


---

**Table 1: Fitted Power-Law Indices**

<table>
<thead>
<tr>
<th>Target Name</th>
<th>AGN Type</th>
<th>Z</th>
<th>( \alpha ) EUV</th>
<th>( \alpha ) FUV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mrk 817</td>
<td>Seyfert</td>
<td>0.031</td>
<td>1.63(10)</td>
<td>.70(10)</td>
</tr>
<tr>
<td>Mrk 290</td>
<td>Seyfert</td>
<td>0.030</td>
<td>1.55(10)</td>
<td>.74(10)</td>
</tr>
<tr>
<td>he0226-4110</td>
<td>QSO</td>
<td>0.509</td>
<td>.56(33)</td>
<td>.43(10)</td>
</tr>
</tbody>
</table>

---

Figure 1: Mrk 817 rest frame spectrum covering 900-3250 Angstroms. Data from Far-Ultraviolet Spectroscopic Explore (FUSE) – black, left; Cosmic Origins Spectrograph (COS) – blue, center; International Ultraviolet Explorer (IUE) – black, right. Feature identification from Telfer et al. 2002. Green line is EUV continuum fit and purple line is FUV continuum fit. Both axes have log scaling. Earth symbols label gaps caused by air glow removal.

Figure 2: Mrk 817 picture from the Hubble Space Telescope.

Figure 3: This unification model unifies Seyfert galaxies and quasars (QSO) and labels the regions of the AGN where common spectral features are produced. It attributes spectral differences to the orientation of a gas torus (orange donut) encircling the black hole, relative to the observer.

Figure 4: Mrk 290 rest frame EUV-FUV spectrum. Fuse data – black, left; COS data – blue, center; IUE data – black, right.

Figure 5: He0226-4110 rest frame EUV spectrum. Fuse data – black; COS data – blue.