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A Detailed Comparison of HST FOS and IUE UV Spectra of Selected Seyfert Nuclei

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1. Introduction

Significant improvements in our understanding of the physical conditions in active galaxies requires the development of sophisticated models that can predict in detail the emission from the nucleus. Accurate measurements of both the UV continua and the many weak diagnostic UV lines provide critical calibrations for such models.

Rigorous comparisons of the *HST* FOS and *IUE* UV flux calibrations have so far been performed using spectrophotometric standard star spectra. These calibration observations have precision acquisition sequences and the spectra have very high S/N. Such data are not representative of typical FOS observations of an AGN, which often cannot be acquired with the same precision as standard stars, especially for pre-COSTAR data. Furthermore, the UV flux from a typical AGN is several magnitudes fainter than from a spectrophotometric standard star, and is more representative of typical non-stellar fluxes. Flux-dependent effects (in either FOS or *IUE*) may need to be considered at these lower flux levels.

The ability to establish accurately the level of the continuum is influenced significantly by the presence of numerous weak lines in low S/N or low spectral resolution spectra. Comparison of high S/N, high-resolution FOS spectra with lower S/N, lower-resolution *IUE* spectra enable a determination of the magnitude of the error that can be introduced when measuring both the continuum flux and emission-line flux.

2. Data Reduction

These analyses use all non-proprietary archival UV FOS spectrophotometric observations of the nuclei of NGC 3783, NGC 5548, and MKN 509 for which near-simultaneous (within 24 hours) *IUE* observations are available.

The FOS spectra are recalibrated using the latest 'average inverse sensitivity' method calibration. A brief description of this technique and how it revises the FOS flux calibration is provided by Pesto et al. (this conference).

The *IUE* spectra are recalibrated using the latest NEWSIPS processing.

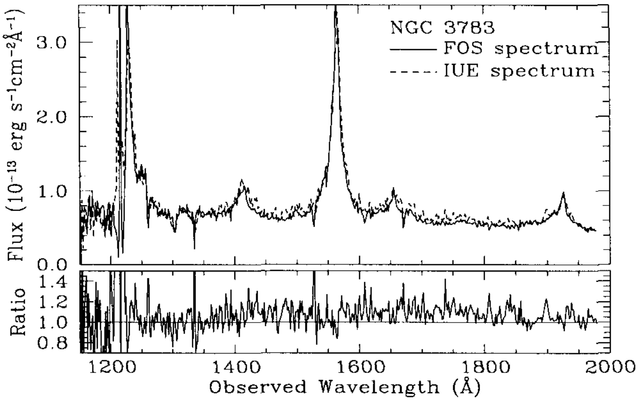

Figure 1.

3. Comparison of HST FOS and IUE Spectra

3.1. Photometric Comparison:

Figure 1 compares the FOS and *IUE* spectra. In the Figure, the recalibrated FOS data have been convolved with a Gaussian kernel to the same resolution as the *IUE* data, and have been resampled on to the *IUE* wavelength grid. The data demonstrate that, at least for this limited set of observations, the absolute photometric calibrations of the FOS and *IUE* agree within 8%. No attempt is made to correct the FOS observations for target acquisition inaccuracies. But a careful analysis of the aperture throughputs for miscentered targets shows that there is $< 2\%$ loss in flux for the associated miscentering from binary acquisitions performed. We assume that the nuclear flux is emitted by a source that is small compared with both the FOS and *IUE* apertures. Although *HST* WFPC images confirm that all of these targets have compact, unresolved nuclei, the presence of faint extended UV continuum emission cannot be ruled out.

3.2. Wavelength Comparison:

In each FOS spectrum, wavelength zero-point shifts of 0.2–2.0 Å are required to align the interstellar absorption lines to their rest wavelength. The *IUE* spectra did not require any zero-point shifts. The wavelength calibrations of the FOS and *IUE* were then compared by cross-correlating subsections of the spectra. Cross-correlation of the shifted spectra reveals no presence of second-order effects, just a zero-point shift of $\sim$1 Å.

3.3. Emission-Line Measurements:

The emission lines in both the FOS and *IUE* spectra are fitted using multiple Gaussian fits. Comparison of line-intensity measurements shows that strong lines agree within 10%. Due to the lower resolution, spectral fitting tends to over estimate the continuum level in the *IUE* data and thus the weak-line intensities differ by $> 15\%$.

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