IUE ABSORPTION STUDIES OF BROAD- AND NARROW-LINE GAS IN SEYFERT GALAXIES

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The interstellar medium of a galaxy containing an active nucleus may be profoundly affected by the high energy (X-ray, EUV) continuum flux emanating from the central source. The energetic source may photoionize the interstellar medium out to several kiloparsecs, thereby creating a global H II region. With the International Ultraviolet Explorer (IUE) satellite we have attempted to observe in several Seyfert galaxies (NGC 3516, NGC 4151, NGC 1068, 3C 120) the narrow absorption lines expected from such global H II regions. Instead, in two of the galaxies (NGC 3516, NGC 4151) we found broad, variable absorption lines at C IV λ1550, N V λ1240, and Si IV λ1400 (Fig. 1), as well as weaker absorption features at O I λ1302 and C II λ1335. These features swamp any possible global H II region absorption.

Such broad absorption features have previously been observed in IUE data, but their origin is still not well understood. In this study we concentrate on the C IV λ1550 line in NGC 3516, an SB0 Seyfert I galaxy. The nineteen IUE short wavelength archive images of this object that are available at the University of Colorado Regional Data Analysis Facility (RDAF) constitute our data base. The broad C IV absorption component, which is superimposed on a broad emission feature, is blueshifted with respect to the narrow emission lines and the peaks of the broad emission lines. Both the broad emission-line region and the continuum emitting region must be at least partially covered by the absorbing region (Fig. 2). The absorption component appears to vary on time scales of less than ten days, and its equivalent width may be anti-correlated with the continuum flux at 1450 Å. Recombination-time arguments limit the density in the absorbing gas to greater than 10^5 cm^{-3}; C IV should be found at such high densities only within 10 pc of the central source. The blueshift of the absorption component suggests that the absorbing material is flowing outward from the galactic nucleus. Standard broad-line cloud models fail to account for the C IV absorption feature. The absorption may arise either in optically thin clouds in the broad-line region or in dense narrow-line clouds. We discuss the significance of UV resonance-line absorption in light of the partial X-ray absorption seen in this galaxy, and we present simple reverberation models for the absorbing region which give an anti-correlation of absorption with continuum flux. The absorption may also be related to optical spectroscopic evidence for outflows in NGC 3516.

Figure 1

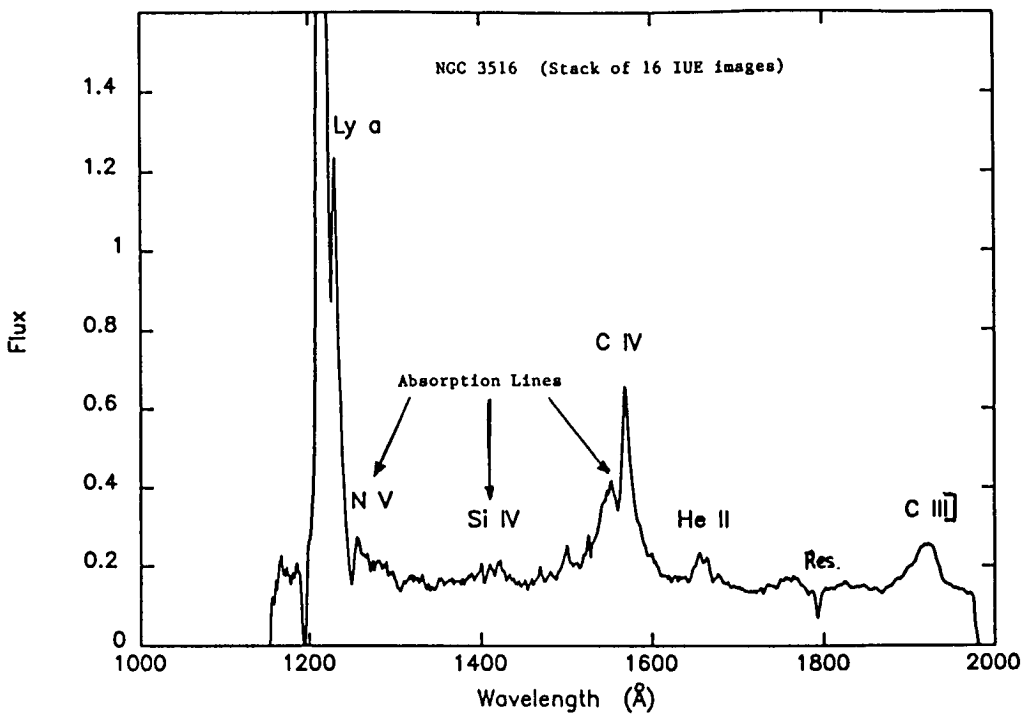

Figure 2