

provides the opportunity for detailed study of the ionization properties, column density, and elemental abundance of the gas in an isolated region of space in the environment of moderate and high-redshift QSOs.

In our studies, we have found cases of BAL variability that appear to be correlated with a change in continuum flux. However, we have also discovered a few cases where the BALs varied, but no change was detected (to a limit of ~ 0.06 magnitudes) in the broadband flux. Our studies suggest that the ionizing flux ($\lambda \sim 100\text{-}400\text{\AA}$) varies with greater amplitude and possibly in a non-synchronous manner with the observed continuum flux ($\lambda \sim 2000\text{\AA}$).

ABSTRACT OF THE DISSERTATION

Time Variability of Broad Absorption-Line QSOs

by

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Doctor of Philosophy in Physics

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In this thesis, we present the results of a three year project to monitor broad absorption-line QSOs (BALQSOs) with both broadband imaging (for continuum flux changes) and spectrophotometry (for broad absorption-line variations). Of the 54 BALQSOs monitored with broadband imaging, $\sim 33\%$ showed significant time variability with deviations of 0.1 to 0.3 magnitudes. Spectroscopic monitoring of 23 BALQSOs resulted in the detection of broad absorption-line (BAL) time variations in 15 BALQSOs. Six of these cases are small (marginal) variations, and four show large BAL changes.

All of the BAL time variations appear to be changes in the residual intensity, or normalized flux, within the line, rather than variations in the velocity structure of the outflowing BAL gas. Our primary hypothesis is that a variable photoionizing continuum causes a change in the ionization levels, and thus a redistribution of the fractional abundances of the ions, resulting in the strengthening or weakening of the absorption lines.

The BAL changes will appear *nearly* simultaneous with the continuum variations if the BAL variation mechanism travels in step with the continuum photons, and the mechanism induces rapid changes in the ionization of the gas. Thus, unlike studies of broad emission-line variability in active galactic nuclei, BAL variability does not (for the simplest models) yield direct information about the size of the region. Time-variability studies have suggested that the velocity of the BAL gas increases (or decreases) monotonically with distance from the continuum source. With this assumption, BAL time variability

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To my parents.

The dissertation of Thomas A. Barlow is approved, and it is
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Chair

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UNIVERSITY OF CALIFORNIA, SAN DIEGO

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