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 $\sim$0.06 magnitudes) in the broadband flux. Our studies suggest that the ionizing flux ($\lambda$ $\sim$100-400Å) varies with greater amplitude and possibly in a non-synchronous manner with the observed continuum flux ($\lambda$ $\sim$2000Å).

## ABSTRACT OF THE DISSERTATION

### Time Variability of Broad Absorption-Line QSOs

by

Thomas A. Barlow

Doctor of Philosophy in Physics

University of California, San Diego, 1993

Professor E. Margaret Burbidge, Chair

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 simpliest 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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## FIELDS OF STUDY

Major Fields: Physics and Astrophysics

Studies in Electromagnetism and Statistical Mechanics:
Professor Donald R. Fredkin

Studies in Classical Mechanics:
Professor Thomas M. O'Neil

Studies in Quantum Mechanics:
Professor Julius Kuti

Studies in Mathematical Methods:
Professor Frank B. Thiess

Studies in General Relativity:
Professor Ping Yip

Studies in Astrophysics:
Professor Robert J. Gould

## VITA
## Thomas A. Barlow

PERSONAL:

| | |
|---|---|
| Date of Birth: | 2 April, 1963 |
| Place of Birth: | Mountain View, California |
| Citizenship: | USA |

DEGREES:

| | |
|---|---|
| 1993 | Ph.D. in Physics, University of California, San Diego.<br>Dissertation: "Time Variability of Broad Absorption-Line QSOs."<br>Advisor: Professor E. Margaret Burbidge |
| 1990 | C. Phil. in Physics, University of California, San Diego. |
| 1985 | B.S. in Physics, University of California, San Diego |

RESEARCH POSITIONS:

| | |
|---|---|
| 1986 – 1993 | Research Assistant, University of California, San Diego |

TEACHING POSITIONS:

| | |
|---|---|
| 1985 – 1986 | Teaching Assistant, University of California, San Diego |

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software.

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To my parents.

The dissertation of Thomas A. Barlow is approved, and it is acceptable in quality and form for publication on microfilm:

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Chair

University of California, San Diego

1993

UNIVERSITY OF CALIFORNIA, SAN DIEGO

# Time Variability of Broad Absorption-Line QSOs

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Physics

by

Thomas A. Barlow

Committee in charge:

Professor E. Margaret Burbidge, Chair
Professor William A. Coles
Doctor Vesa T. Junkkarinen
Professor Kurt Marti
Professor Harding E. Smith
Professor Arthur M. Wolfe

1993