Revista Mexicana de Astronomía y Astrofísica, **27**, 223-226 (1993)

ABSTRACTS OF CONTRIBUTED PAPERS/RESUMENES DE CONTRIBUCIONES

A NEW INTERPRETATION OF BROAD EMISSION LINE WIDTHS IN HIGH LUMINOSITY AGNs

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We present the results of our recent statistical investigations of broad emission line profiles (the λ1400 feature, C IV λ1549, C III] λ1909, and Mg II λ2798) in high quality spectra of intermediate and high redshift QSOs (originally observed by Sargent, Steidel, & Boksenberg for Lyman limit, C IV, and Mg II absorption line studies). Approximately 200 spectra are involved. The most striking trends are found with increasing line width ($\geq 3\sigma$, several $> 8\sigma$): the intensity ratios C III]/C IV, Mg II/C III], and λ1400/C IV increase, the equivalent width of C IV decreases, the C IV profile becomes less-sharply peaked, and the peaks of C III] and C IV become increasingly blueshifted relative to the peak of Mg II. Traditionally, the line width has been interpreted as a measure of the typical velocities reflecting the dynamics of a single zone. We suggest that different line widths may be the simple consequence of having two kinematically distinct zones, with differing emission from each region in different objects. We describe our line profiles with an empirical two Gaussian scheme: a blueshifted ($\sim$ 1000 km s^{-1}) broad (FWHM $\sim$ 7000 km s^{-1}) base and a narrow (FWHM $\sim$ 2000 km s^{-1}) core. Profiles generated in this way can reproduce, in general, the observed trends with line width (line shape, asymmetry, and line shift) although additional assumptions are needed to account for the correlations with the line ratios. We discuss some mechanisms which may give rise to two such quasi-independent components.

NEAR-INFRARED MOLECULAR HYDROGEN EMISSION AS A PROBE OF THE STRUCTURE AND ENERGETICS OF PHOTODISSOCIATION REGIONS

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We have mapped the v=1-0 S(1), v=2-1 S(1), and v=6-4 Q(1) near-infrared emission lines of molecular hydrogen in several extended photodissociation regions, including the Orion A molecular cloud. We

have used a new instrument, the University of Texas Fabry Perot spectrometer, that is capable of observing previously undetected, extended low-surface brightness emission. The Orion A cloud is a known site of both shock and radiative excitation processes. Comparing the strengths of the three observed lines, we can probe the relative contribution of each excitation mechanism throughout the cloud and thereby study the energetics of star formation environments. Also, in Orion A, we see molecular hydrogen that extends > 2.5 parsecs (20 arcminutes) from the OB stars of the Trapezium region, the most likely source of exciting ultraviolet photons. Our maps of parsec-scale molecular hydrogen emission are consistent with recent [CII] 158 micron maps of the photodissociated boundaries of molecular clouds, which suggest that ultraviolet photons can penetrate large distances into the clouds through gaps in a clumpy structure (e.g., Howe et al. 1991, ApJ, 373, 158; Stacey et al. 1993, ApJ, 404, 219). The clumpiness of the material plays a role both in fragmentation to form stars and in allowing ultraviolet radiation to break up the cloud. Observations of ultraviolet-excited molecular hydrogen emission in the near-infrared provide a new tool for studies of the physics of cloud boundaries. Using near-infrared mapping of molecular hydrogen, we can address simultaneously the degree of clumping, the excitation processes, and physical conditions in the cloud.

HELIUM-LIKE IRON LINE TEMPERATURE DIAGNOSTICS IN CLUSTERS OF GALAXIES

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The emission complex around $\sim$ 6.7 keV, arising from He-like Fe lines and their dielectronic satellites, has been observed at low resolution in a number of clusters of galaxies. With sufficient spectral resolution, the ratio, $G = (x + y + z)/w$, of the intercombination (x and y) and forbidden (z) to the resonance (w) lines arising from the $n = 2$ level of the He-like ion, is a sensitive temperature diagnostic. The temperature behavior of this ratio is strongly dependent on the spectral resolution. We introduce an alternative definition for G that includes the contribution of satellite lines and improves the temperature fidelity of this diagnostic; namely, along a line of sight, of projected radius b, through the cluster, $G(b) = W^{xyz}(b)/W^{w}(b)$, where W is an equivalent width, xyz denotes the energy band from 6635 to 6695 eV, and w that from 6695 to 6720 eV. We find that deprojection of the observed values of this ratio can yield accurate temperature profiles for temperatures in the range 10^7 to 10^8 K that do not suffer from the cluster model uncertainties inherent in deconvolution of broad-band X-ray surface brightness profiles.

In summary: (i) G must be defined as ratio of equivalent widths in the $\sim$ 6635 to 6695 eV range to that in the 6695 to 6720 eV range in order to have a useful T_e diagnostic. As originally defined as the ratio of the individual x, y, and z lines to the w line, G is non-monotonic when the higher ($n > 3$) dielectronic satellite lines are properly included. (ii) $G(T_e)$ depends only on a relatively small set of atomic data and not on cluster model parameters (gravitational potential, abundances, etc.) as does the surface brightness method for deriving T_e. (iii) Only relative measurements are needed to define $G(b)$ eliminating the dependence on instrument systematics and the distance scale. (iv) G is a monotonic function of temperature for $T_e \leq 10^8$ K and G can be measured for $T_e \geq 10^7$ K. (v) G provides only T_e; other measurements or model assumptions must be used to obtain the density, abundances, etc. (vi) G requires high spectral resolution as is possible with the XRS detector to be flown on the AXAF-S mission (12 eV spectral, $\sim$ 1 arcmin spatial resolution).

THE LINEAR THEORY OF CONVECTIVE INSTABILITIES IN ACCRETION DISKS.

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Convective instabilities may arise in ionized or neutral accretion disks. In some cases (e.g., low mass protostellar disks) they are likely to be an important mechanism for angular momentum transfer. Unfortunately, there is some uncertainty regarding the *direction* of angular momentum transport in convectively unstable regions. Previous work, based on the