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# NEAR-IR PHOTOMETRY AND OPTICAL SPECTROSCOPY OF THE HERBIG Ae STAR AB AURIGAE

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AB Aur (HD 31293; A0Ve+sh) is often considered prototypical of the class of Herbig Ae stars, optically visible pre-main sequence stars of intermediate mass surrounded by circumstellar disks of dust and gas. Its photometric and spectral properties are well studied over a wide wavelength range (e.g. Böhm & Catala 1993; Grady et al. 1999; van den Ancker et al. 1999; Catala et al. 1999). Although photographic measurements in the beginning of this century (Gaposchkin 1952 and references therein) showed the star to be strongly variable, it has remained nearly constant (Herbst et al. 1994; van den Ancker et al. 1998) until a fading of $\approx 1$ magnitude in brightness from Nov. 30 to Dec. 1, 1997, reported by amateur observers (Kawabata et al. 1998 and references therein). Such an event had not been observed since the start of photoelectric measurements of AB Aur, more than 30 years ago. Although puzzling, this report did not trigger immediate response from the astronomical community since such irregular photometric behaviour is known to occur in other Herbig Ae stars and is attributed in these systems to variable extinction towards the central star by dust clouds moving in and out of our line of sight. However, a recent IAU circular (Ashok et al. 1999) reports that in January 1999, the near-infrared brightness of AB Aur, due to thermal emission from dust in the circumstellar disk, has decreased by more than a magnitude, and the Pa$\beta$ and Br$\gamma$ lines, known to be prominent from literature (Harvey 1984; Evans et al. 1987; Nisini et al. 1995; Rodgers & Wooden 1998), are no longer present in emission. These observations suggest that the optical event at the end of 1997 might be related to an EXOR event (after the prototype EX Lup; Herbig 1977; Herbst et al. 1994), in which a considerable part of the inner circumstellar disk, seen nearly edge-on, was accreted, as opposed to an UXOR event (after UX Ori; Bibo & Thé 1990; Grinin et al. 1998), in which matter moves in and out of our line of sight, but in which the total amount of dust does not change.

To further investigate the changes in the AB Aur system, we have obtained new near-IR photometry of AB Aur using the 1.5-m Carlos Sanchez Telescope (CST) at the Izaña observatory on Tenerife on April 24, 1999 (JD 2451292.862). The data were taken through a $20''$ diaphragm and reduced in a standard fashion. The resulting magnitudes ($J = 6.25 \pm 0.06$, $H = 5.36 \pm 0.05$, $K = 4.51 \pm 0.05$) are about a magnitude brighter than the ones reported by Ashok et al. (1999) and are only marginally fainter than older

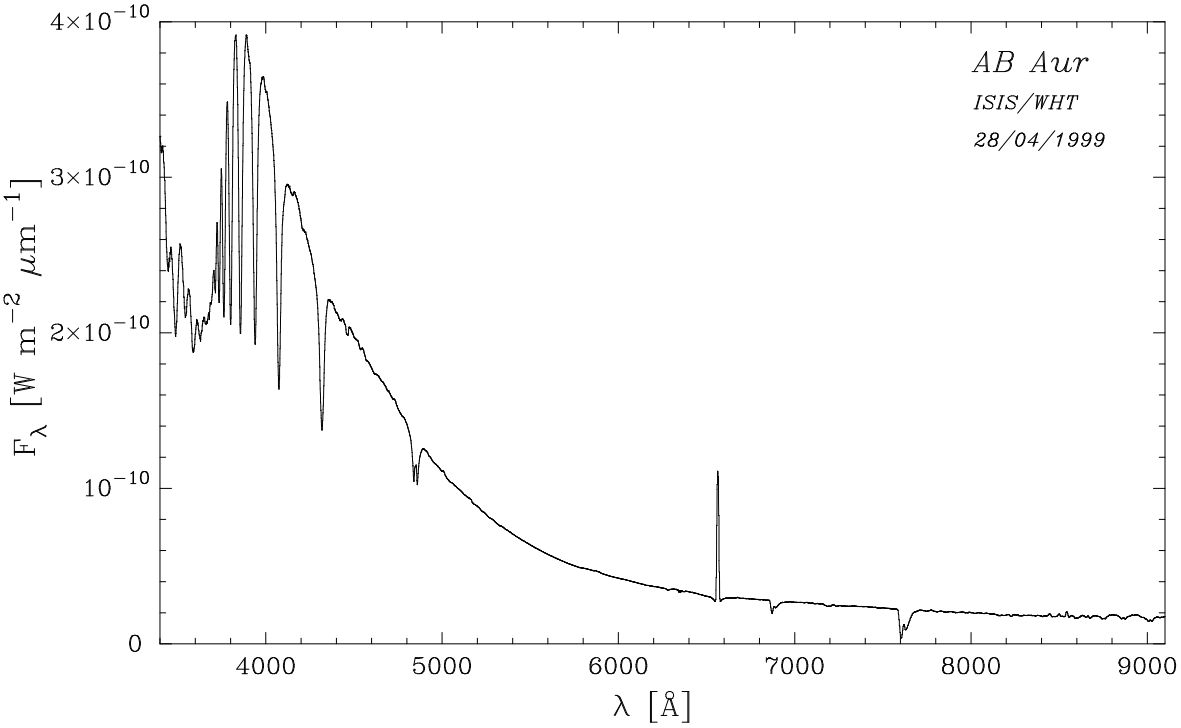


**Figure 1.** Merged optical spectra of AB Aur taken on April 28, 1999 with ISIS at WHT.

literature values (Strom et al. 1972; Cohen & Schwartz 1976; Lorenzetti et al. 1983; Berrilli et al. 1987). On April 28, 1999, optical spectra of AB Aur in the 3000–8200 Å (at JD 2451297.359; 1.9 Å pixel$^{-1}$) and 6100–9100 Å (at JD 2451297.362; 2.7 Å pixel$^{-1}$) wavelength ranges were obtained in service mode with the ISIS spectrograph on the 4.2-m William Herschel Telescope (WHT) at La Palma. The spectra were reduced with the usual steps of bias subtraction, flatfielding, background subtraction and spectral extraction, and wavelength and flux calibration. Since the night in which the spectra were taken was not of photometric quality, the absolute fluxes of the spectra were scaled to photometric literature values, and they were merged into one single spectrum (Fig. 1). A plot in which the continuum has been normalized to 1 and in which some of the features are identified is shown in Fig. 2.

In our new AB Aur spectral data, emission components are clearly present in H I (H$\beta$, H$\alpha$ and the Paschen lines up to P12), He I, Na I, O I and the red Ca II triplet. Except for the chromospheric He I emission at 5875 and 6678 Å, which appears somewhat stronger, the relative strength of all spectral features are within errors equal to those given in the spectral atlas of AB Aur by Böhm & Catala (1993). Strong variability of the He I emission strength was already noted by those, as well as by other authors (Catala et al. 1993, 1997, 1999). Our He I line strengths are within the range of values found in literature.

The new near-IR photometry and optical spectroscopy of AB Aur presented here shows that if the reported infrared variability is real, the system has returned to its normal, inactive, state within 100 days of the measurements taken by Ashok et al. (1999). If the previous active phase was due to an EXOR-like enhanced accretion episode, the mechanisms responsible for keeping the circumstellar disk stable must therefore have replenished the inner disk material with material from the outer disk within this period.

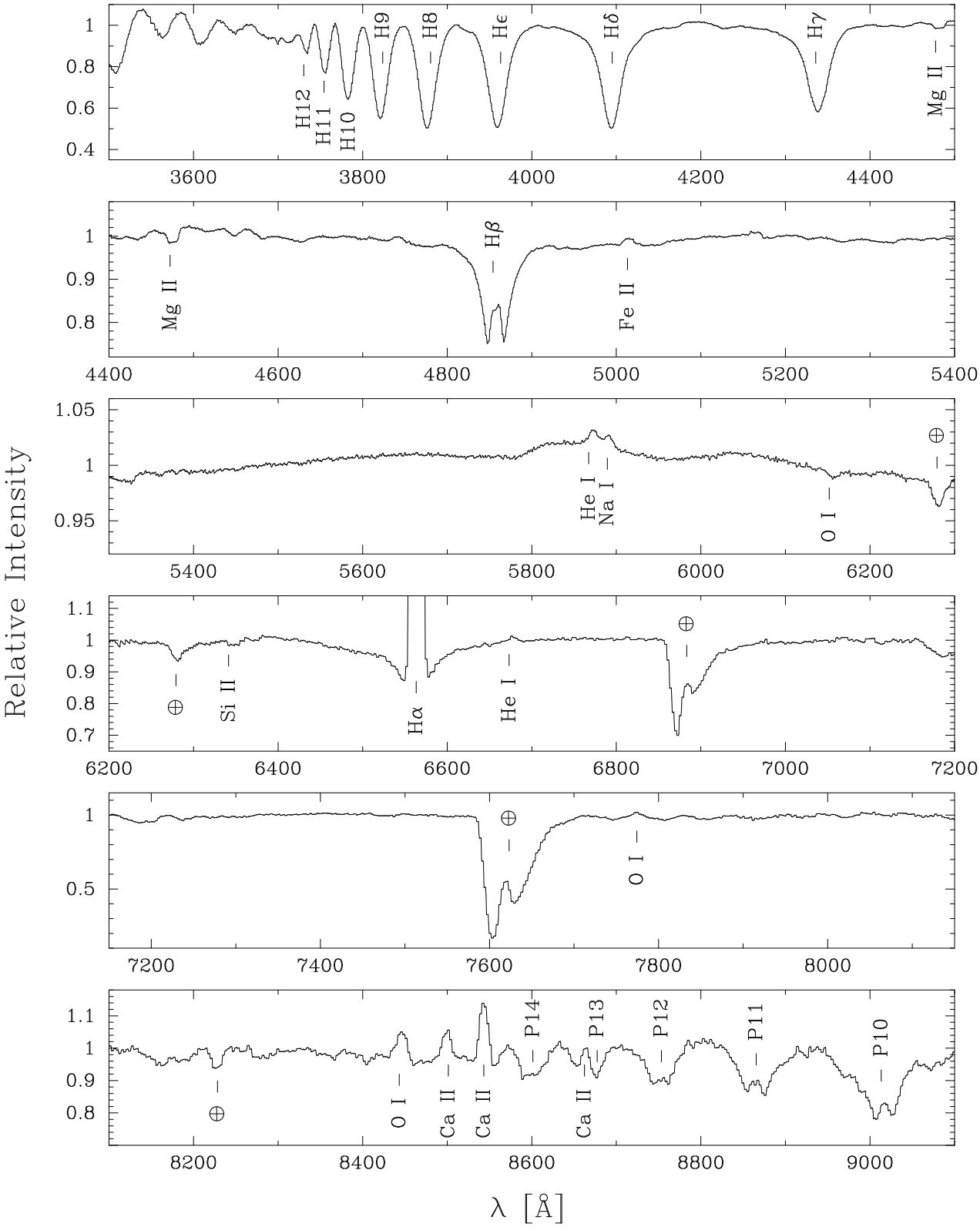


**Figure 2.** Normalized optical spectra of AB Aur with the most prominent features identified.

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