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NOVA CI AQUILAE IN DECLINE

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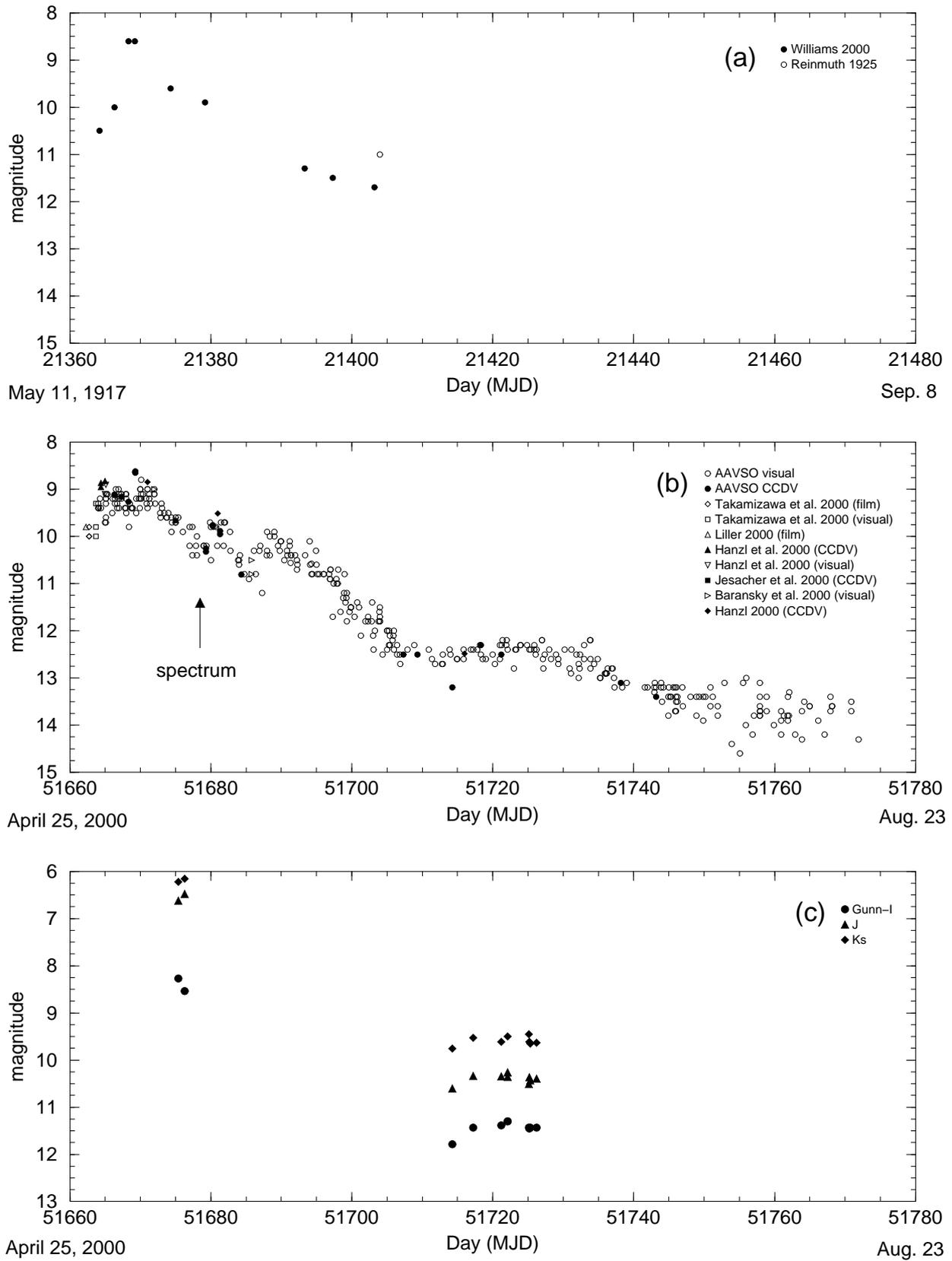
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The first known outburst of CI Aquilae was discovered on Heidelberg plates recorded in June 1917 (Reinmuth 1925) and classified as a possible nova by Dürbeck (1987). The measured maximum of the outburst was  $m_{pg} \approx 11^m$  and thus rather low, but obviously the real maximum has been missed. Williams (2000) found, that this nova outburst had been recorded before on Harvard College Observatory patrol plates from 1917; he measured a maximum of  $8^m.6$ .

On April 28, 2000 Takamizawa et al. (2000) discovered a probable nova in Aquila with  $m_V \approx 10^m$  which seems to be identical with the 1917 nova. It reached its peak in the beginning of May at about  $8^m.7$ , which is  $7^m.5$  above the quiescent phase (Szkody 1994). If no outbursts were missed between 1917 and 2000, CI Aql has the longest period (83 years) of all recurrent novae so far known.

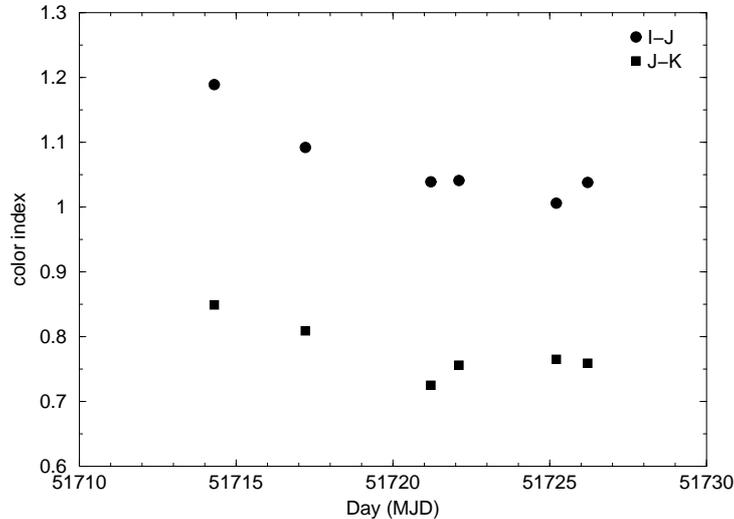
We obtained near infrared photometries of this object using the DENIS instrument (Epchtein et al. 1997) at the ESO 1-m telescope in La Silla in the period from May 10 (about 12 days after outburst) to July 1, 2000. The images were taken simultaneously in all three bands Gunn-*I* ( $0.82 \mu\text{m}$ ), *J* ( $1.25 \mu\text{m}$ ) and *K<sub>s</sub>* ( $2.15 \mu\text{m}$ ). The exposure time of each image was 9 seconds in *I* and 11 seconds in *J* and *K*. Each band was observed with five to seven images while moving the source around in the field of view. This was used to eliminate errors due to local flatfield effects, and to be able to obtain the sky background using the iso-airmass median sky filtering. Thus, the intrinsic noise within one set could be reduced to  $0^m.01$ . The fluxes of the nova and two nearby comparison stars were measured using the SExtractor software (Bertin & Arnouts 1996). The magnitudes of the nova were calculated relative to the two comparison stars, which were then calibrated using the DENIS online zero points. The difference of the measured magnitudes of the two comparison stars indicate the overall quality of the measurements. The errors are  $0^m.013$  in *I*,  $0^m.031$  in *J* and  $0^m.023$  in *K*.

Fig. 1 shows the light curve of CI Aql (a) in 1917 as measured from photographic plates, (b) in 2000 from visual data and (c) in 2000 from our NIR data, all in the same scale. In each of the three cases the abscissa covers a range of 120 days. The light curve (b) contains mostly data contributed to the AAVSO database by amateur astronomers (Mattei 2000). The filled symbols are photometries obtained using CCDs, the open symbols are visual estimates and can therefore contain significant errors. Especially after the end of July (MJD 51750), when the magnitude of the nova has fallen below  $13^m$ , there is a pretty large straggling of the data. The light curve shows a rather slow decline compared to



**Figure 1.** The light curve of CI Aql (a) in 1917, (b) 2000 in the visual, (c) 2000 in near-infrared

other recurrent novae ( $t_2 \approx 25$  days). The NIR decline is of about the same order as the visual decline. On June 27 (MJD 51722) we took three sets of images in intervals of about 20 minutes, and we could not find any short-term variation with this period.



**Figure 2.** The color indices  $I - J$  and  $J - K$  of CI Aql between June 14 and July 4, 2000

While the nova gets bluer in  $I - J$  (Fig. 2), the reddening in  $J - K$  around June 25, 2000 (MJD 51720) may indicate the start of a dust formation episode.  $J - K$  was about  $0^m36$  on May 11/12. The decrease in  $I - J$  is consistent with a recovery from the  $0^m7$  dip in the visual (Fig. 1b) between MJD 51700 and 51720 caused by the formation of a dust shell. The increase of  $J - K$  may be a sign of the onset of the formation of very hot dust particles causing the next dip in the visual light curve starting at MJD 51730. Using typical dust formation radii of  $10^{11}$  m (Kimeswenger & Koller 2000), this gives an estimate for the velocity of the dust drift of a few hundreds of km/s.

Furthermore, we obtained a composite spectrum of CI Aql with the Innsbruck 60-cm telescope on May 14, 2000 (MJD 51679), about two weeks after the outburst of the nova (marked with an arrow in Fig. 1b). We took two or three spectra of every region with an exposure time of 1800 seconds each. The spectrograph was used with a grating of 240 lines/mm, giving a resolution of about  $2.4 \text{ \AA}/\text{pixel}$  on the CCD. Different spectra of the same region show no differences, which indicates that the error is smaller than 10% of the continuum. Therefore, the various features at the emission lines are real and not caused by noise. The spectrum, shown in Fig. 3, shows a flat continuum from 4000 to 9000  $\text{\AA}$  and strong emission lines (1.5 to 9 times the continuum). The FWHM range from 3400 km/s (in case of  $H_\alpha$ ) up to 7400 km/s (in case of [NII]). The emission line profiles vary significantly between the different species: the lines with higher velocities are asymmetrical and show multiple peaks, the lines with lower velocities exhibit a single asymmetric peak.

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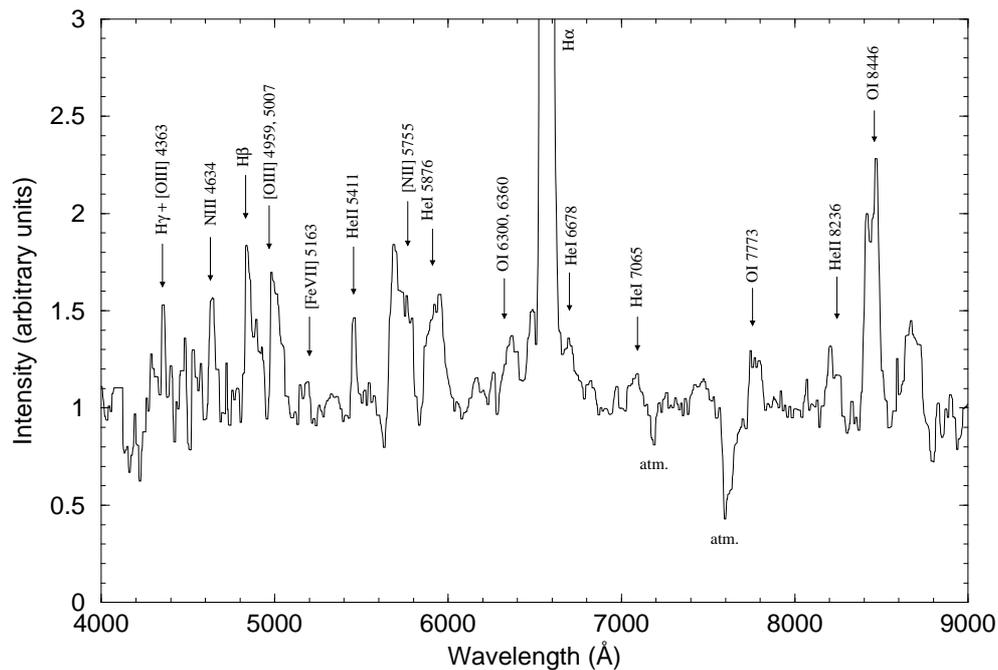


Figure 3. Composite spectrum of CI Aql taken on May 14, 2000

References:

- Baransky, A., Pearce, A., Yoshida, S., 2000, *IAUC*, **7436**, 4  
 Bertin, E., Arnouts, S., 1996, *A&AS*, **117**, 393  
 Dürbeck, H.W., 1987, *Space Sci. Rev.*, **45**, 1  
 Epchtein, N., De Batz, B., Capoani, L., et al., 1997, *The ESO Messenger*, **87**, 27  
 Hanžl, D., 2000, *IAUC*, **7444**, 3  
 Hanžl, D., Reszelski, M., Hornoch, K., Lehký, M., 2000, *IAUC*, **7411**, 3  
 Jesacher, M.O., Kautsch, S.J., Kimeswenger, S., et al., 2000, *IAUC*, **7426**, 3  
 Kimeswenger, S., Koller, J., 2000, *Ap&SS*, in press  
 Liller, W., 2000, *IAUC*, **7411**, 2  
 Mattei, J.A., 2000, Observations from the AAVSO International Database, private communication  
 Reinmuth, K., 1925, *AN*, **225**, 385  
 Szkody, P., 1994, *AJ*, **108**, 639  
 Takamizawa, K., Kato, T., Yamamoto, M., et al., 2000, *IAUC*, **7409**, 1  
 Williams, D.B., 2000, *IBVS*, No. 4904