SCIENTIFIC NEWS

Recent CFHT Observations of the X-Ray Binary AC211 in M15

Last July, 3 nights of imagery and 3 nights of spectroscopy were devoted to tackling the puzzling low-mass X-ray binary system AC211/X2129+119 in M15. It is still the only X-ray source optically identified in a globular cluster, and a coordinated campaign of CCD photometry carried out last year with the CFHT and the 2-m telescope at Pic-du-Midi led to the determination of the orbital period of the system, 8.5 hours (Ilovaisky et al. 1987: *Astronomy and Astrophysics*, 179. L1).

The present program involves two joint proposals by M. Aurière (Observatoire du Pic du Midi), S.A. Ilovaisky et C. Chevalier (Observatoire de Haute Provence), L. Koch-Miramond (Cen/Saclay) and J.P. Cordoni (Universite de Montpellier). With only two hours lost due to fog on the third imaging night, we enjoyed clear and marvelously stable skies throughout our runs, obtaining large amounts (those double-density chips) of great quality data which we hope will allow us to considerably improve our understanding of this system.

170 UBV frames of the M15 core were obtained in good to excellent seeing during 15 hours of monitoring (the longest exposure time was 5 minutes with the U filter) with the RCA2 CCD at the Cassegrain focus. On 18 July the star exhibited no brightness modulation whatsoever. On 19 July the U brightness decreased by 1 magnitude and later recovered its original level, showing a well-defined light minimum linked to orbital motion and similar to those we had already observed last year. Another shallower minimum was seen on 20 July. This enables us to improve the orbital ephemeris, now based on 3 years of data, and to compute the phases corresponding to our spectroscopic observations made later. The excellent seeing prevailing, particularly at the time of light minimum, was well exploited with the high-resolution chip at the F/8 focus (0".11/pixel) enabling us to accurately map the faint stars near AC211, thus improving our magnitude measurements and errors on the color determinations. We will then have for the first time extensive color data covering a large part of the orbital cycle, so essential in modeling the system.

On 26-28 July, over 30 excellent long-slit spectra of the M15 core were obtained with the Herzberg spectrograph and the RCA4 CCD. The 1" wide slit was oriented with respect to easily visible outlying cluster stars in such a way to put AC211 blindly in the slit, a necessity since at times we could not see the star on the TV monitor used for guiding. The resolution on these spectra is 1.8 Å (FWHM). Exposures times were 30 minutes, quite short for a 16th magnitude star at 42 Å/mm, even with a 3.6-m telescope, but we benefit here from the preflashing effect of the background light from the unresolved cluster core stars.

The spectra show spectacular changes in the strengths and profiles of the HeII 4686 Å emission line and the H and HeI absorption lines. Two representative spectra from the first night are shown in Figure 13 which illustrates these changes (the continuum slope is artificial and will be removed). The bottom spectrum was taken at 10H UT and the top spectrum some three hours later. The sharp Balmer absorption cores come from the contaminating cluster star-light and will have to be subtracted before any detailed modeling of the hydrogen lines can be carried out, but here they serve to illustrate the strongly negative velocity of the absorption profiles of AC211 with respect to the cluster. Measurements of the radial velocities are in progress. When combined with the profile shapes and using the phases determined from our CCD photometry, they should tell us where the absorption lines (and also the emission) are formed in this remarkable system.

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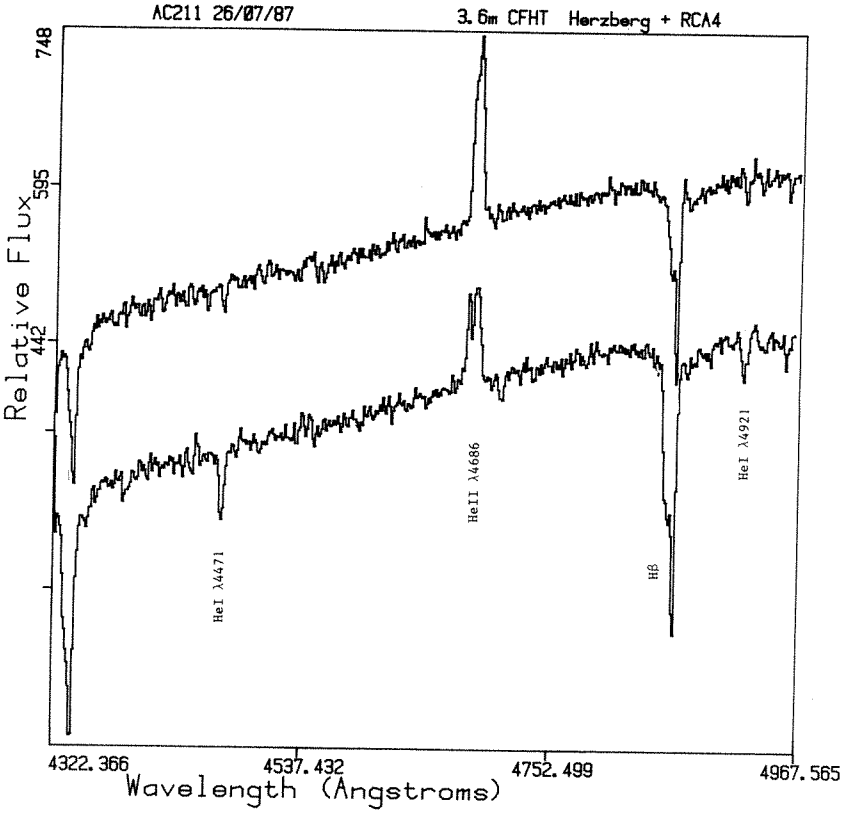

Figure 13.