extreme Ap stars it is smaller than −0.05. The value for Z is −0.016 in the case of b Per, it is −0.010 for TU Hor. The other peculiar binaries we mentioned have not yet been measured. So the Z-index for these stars does not indicate a pronounced Ap character. High-resolution spectra taken by Eric Maurice of ESO confirm that no strong peculiarities are present for TU Hor. Yet—since the value of the Z-index for TU Hor is a mean of more than 750 measurements—it possibly indicates a marginal, but genuine, peculiarity.

It can, however, be asked whether such a marginal Ap character can explain the large photometric variations. The mechanism generally admitted for the light variations of Ap stars is the oblique rotator model: the enhanced elements are not distributed homogeneously over the surface of the star, and the observed aspect changes during a rotation period. The light variations are then caused by the combined effects of blocking and backwarming. This mechanism cannot explain the observed behaviour of TU Hor, since the peculiarities, if they exist, are too small. However, several authors have argued that blocking and backwarming is not sufficient to explain the variations of some strongly magnetic stars, but that, in addition, a temperature variation up to some hundredths degrees, associated with the magnetic field, has to be invoked. This temperature variation is similar to that observed for TU Hor.

If the temperature variations observed in the case of TU Hor are due to a magnetic field, why then did this field not cause the strong peculiarities observed for most strongly magnetic stars? I believe that the answer lies in the close binary nature of TU Hor. The synchronous rotation imposed by the close companion has rendered magnetic braking ineffective and so diffusion has not been able to lead to strong peculiarities. Also, the tidal interactions could hinder diffusion.

This would then also explain the conspicuous lack of close binary systems among the known magnetic Ap stars. Several theories have been advanced to explain this discrepancy. It has been argued that magnetic fields cannot develop or would be destroyed in close systems. Another possibility is clearly that magnetic fields can exist in close binaries, but that the high rotation velocities imposed by the orbital motion and the tidal interactions reduce the importance of diffusion. Strong magnetic fields would then manifest themselves through the associated temperature variations, and this is precisely what is observed for TU Hor.

Spectra have been taken at the coudé focus of the ESO 1.52 m telescope in collaboration with Eric Maurice from ESO. These spectra will be useful to better describe the behaviour of this close binary. However, it can be doubted whether the Zeeman splitting caused by the supposed magnetic field will be observed directly. Indeed, the lines are not enhanced as in the magnetic Ap stars, and strong rotational broadening occurs. It can, however, be hoped that indirect evidence for a magnetic field can be found. Since b Per—a similar star—is a known radio source, it would be interesting to search for synchrotron radiation from TU Hor.

Astronomical Colour Printing at ESO

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When the photographic labs in the new Garching Headquarters were planned, the installation of a colour lab was also foreseen. Following the removal from Geneva, a market survey of available colour equipment was carried out, leading to the purchase of a Durst 1800 Laborator enlarger featuring a CLS 2000 colour head and a negative carrier able to accommodate 25 × 25 cm originals, an Autopan 40–60 C processing machine and various equipment for process control.

The equipment was delivered in the course of 1981 and after trial runs, the processing machine was commissioned by the end of that year. The photographic process selected was the Cibachrome P-3 process, which has been described in detail elsewhere (Ilford AG: Cibachrome TB 29EN, TB 30EN [Ilford, Fribourg, 1979, 1980]). Suffice to say that one of the most significant advantages of this process is the very good sharpness achieved, due to highly limited light dispersion in the emulsion layers.

Following a period of producing plain colour prints from colour originals, we turned towards our ultimate goal, that of producing astronomical colour photographs. The motivations for astronomical colour photography are both scientific and aesthetic. A picture of a large area of the sky, of a complex nebula, or of an active galaxy shown in colour, gives immediate information on the distribution of different types of stars, or on different structures within a particular object; it is capable of clearly identifying various emission mechanics (continuum or lines), and of revealing the presence of peculiar objects, such as supernovae remnants. A beautiful object, such as a planetary nebula, becomes a polychromatic painting for an amateur astronomer and a source of important scientific information for a professional astronomer.

The Tri-Colour Method

As described elsewhere, ordinary colour film is not very suitable for astronomical photography. This difficulty has led many astronomers into obtaining their colour photographs from ordinary (b/w) spectroscopic plates. A study of the current methods of producing such composites from B-V-R plates lead us to chose the tri-colour method, the basic principles of which were described by Maxwell as early as 1861 (Malin, D.F., *Vistas in Astronomy,* Vol. 24, part 3, 1980, p. 220), who demonstrated that "white" light is composed of light of the three additive primary colours, blue, green and red. When printing colour pictures, this means that a colour print can be obtained by printing the original sequentially through standard broadband B-G-R filters. The colour balance is controlled by changing the relative amount of B-G-R exposures, whereas the density is determined by the total exposure. In the early days of colour photography the tri-colour method enjoyed much popularity, whereas now, with a few exceptions, it is generally regarded as being outdated. For most professional applications, the far more convenient and faster subtractive colour printing method is used. Contrary to the additive tri-colour method, the subtractive method only requires one exposure through one or two filters of the subtractive primary colours, yellow, magenta, and cyan.

As the tri-colour method requires three exposures (of one original), it goes without saying that it is possible to obtain a colour picture based on *three* (b/w) original films (or plates) which have been made with filters of the appropriate pass bands.

The tri-colour method consequently has proved to be very useful when it comes to working with astronomical plates, particularly when applied to a reversal process such as Cibachrome P-3.

When working with a reversal process, the "original" must be a positive transparency. For this reason, the original B-V-R plates are first printed onto b/w film to obtain three positive images. The intermediate copying stage allows for adjusting the positive films individually with regard to contrast and density. For the time being contact printing is used for this stage, at least when large fields are concerned. The intermediate positive films are superimposed on a light table by means of a 50 × microscope. After alignment of the films, registration holes are punched, and the films are then printed sequentially with B-G-R filters onto Ektachrome 6121 duplicating film. This too is done by contact printing, for which a Standard Klimsch Vakuprint VT 111 contact printer is used with a point light source and a filter turret fitted with Kodak Wratten 99 (B), 98 (G) and 70 (R) filters. Contact printing has of course the advantage of avoiding any loss due to the involvement of optical systems, but also requires the utmost care to ensure good registration during the printing phase.

Once the colour transparency is obtained with a proper colour balance, it is then printed by means of the Durst 1800 colour enlarger onto standard Cibachrome CPS-paper. Final colour corrections can be made with the CLS-2000 colour head, this time, however, according to the subtractive printing method.

Fig. 1: *A 4 × 4 degree picture of the Large Magellanic Cloud obtained with the ESO Schmidt telescope on La Silla. Three b/w plates have been used: IIa-O/GG-385/60 min; 103a-D/GG-495/40 min; 089-04/RG-630/60 min.*
There is a clearly visible difference in colour (or temperature) between the stars in the central part or those in a globular cluster, and the stars in the external regions. The red colour points out the H II regions with their intense H_α emission and complex morphologies.

Fig. 2 *is an enlargement of the Fig. 1 print centered on the 30 Doradus complex. Hot O and B stars of recent formation cause the ionization of the interstellar gas.* ▶