Non-Atlas Photographic Work in the Sky Atlas Laboratory

Claus Madsen, ESO

As is well known to the readers of the MESSENGER, the ESO Sky Atlas Laboratory was established to set up and undertake the production of the ESO/SRC Sky surveys. To fulfil its duties, a number of dark rooms were set up and, after some years of hard work, techniques were developed which permit limited mass-production without sacrificing the quality which has become the hallmark of this project.

Apart from its major task, a number of other jobs are executed in the Sky Atlas Laboratory, ranging from the production of publicity photos to special black-and-white work directly related to astronomy. Furthermore, the installation of colour-printing facilities was envisaged by the planners of the new ESO headquarters in Garching. The colour laboratory is about to commence operations (pending final installation).

One major problem in reproducing spectroscopic plates is caused by the enormous density range of the original plates. Whereas this has been solved in a satisfactory way in connection with the copying of the Atlas, the same solution cannot be applied when prints have to be made, due to the fact that photographic paper is unable to cover the density range of the original (or copy) plate. The b/w work therefore includes the application of special contrast manipulation techniques, such as masking, which have proved to be very efficient in bringing out very fine details, especially in heavily exposed parts of the

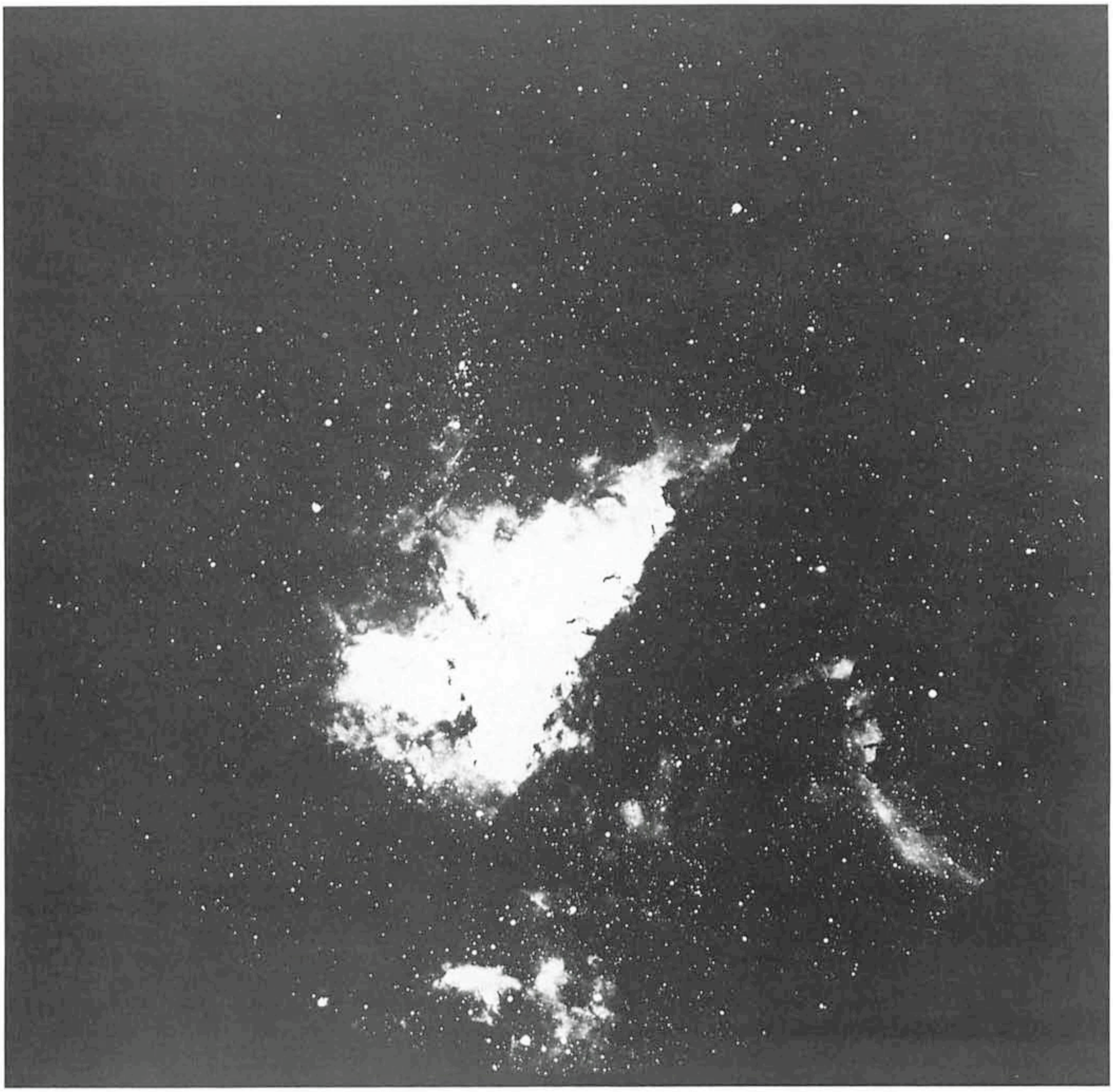

Fig. 1: *This photograph of Eta Carinae was obtained by ESO astronomer Massimo Tarenghi with the 3.6 m telescope. The density range of the plate is $\Delta D = 2.68$ which by far exceeds the dynamic range of the printing paper.*

plates (e.g. nebulae). Due to the very limited density range of the paper, it is virtually impossible to retain such details by normal printing (Fig. 1). The introduction of a low-contrast photographic mask in the printing phase, however, ensures a much better reproduction (Fig. 2). It goes without saying that using such a mask requires a great deal of accurate work on the part of the photographer in order to obtain a sharp picture, since it must be kept in perfect registration with the original or the printing paper during the process.

Other tasks include contrast enhancement, e.g. to show the extension of very faint galaxies (Fig. 3), the production of pictures with diagrammatic overlays, etc.

A lot of interest focuses on the colour laboratory currently being set up. The lab itself centres around an Italian-made Durst Repro-Laborator 1800 enlarger, fitted with a colour head featuring dichroic filters with a range of 195 CC values (used to influence the colour balance of the prints).

There is a German-made Autopan 60–40 C processing machine intended for the Ciba P–3 colour process. Control is achieved by means of Macbeth transmission and reflection densitometers.

Unlike the more common colour processes (based on the chromogenic development), the Ciba one is based on the bleaching of excess colour dyes in the emulsion in order to produce a picture of proper density and colour balance. The presence of the colour dyes in the emulsion during the exposure very drastically reduces the scattering of light in and between the emulsion layers, permitting a sharpness hitherto unknown with common colour materials. Furthermore, the stability of the colour dyes has been proved to exceed by far that of the dyes formed in chromogenic development. The process stability is generally regarded as good, ensuring a homogenous quality even when the output is relatively small as it may be at certain times of the year. Finally, the self-masking

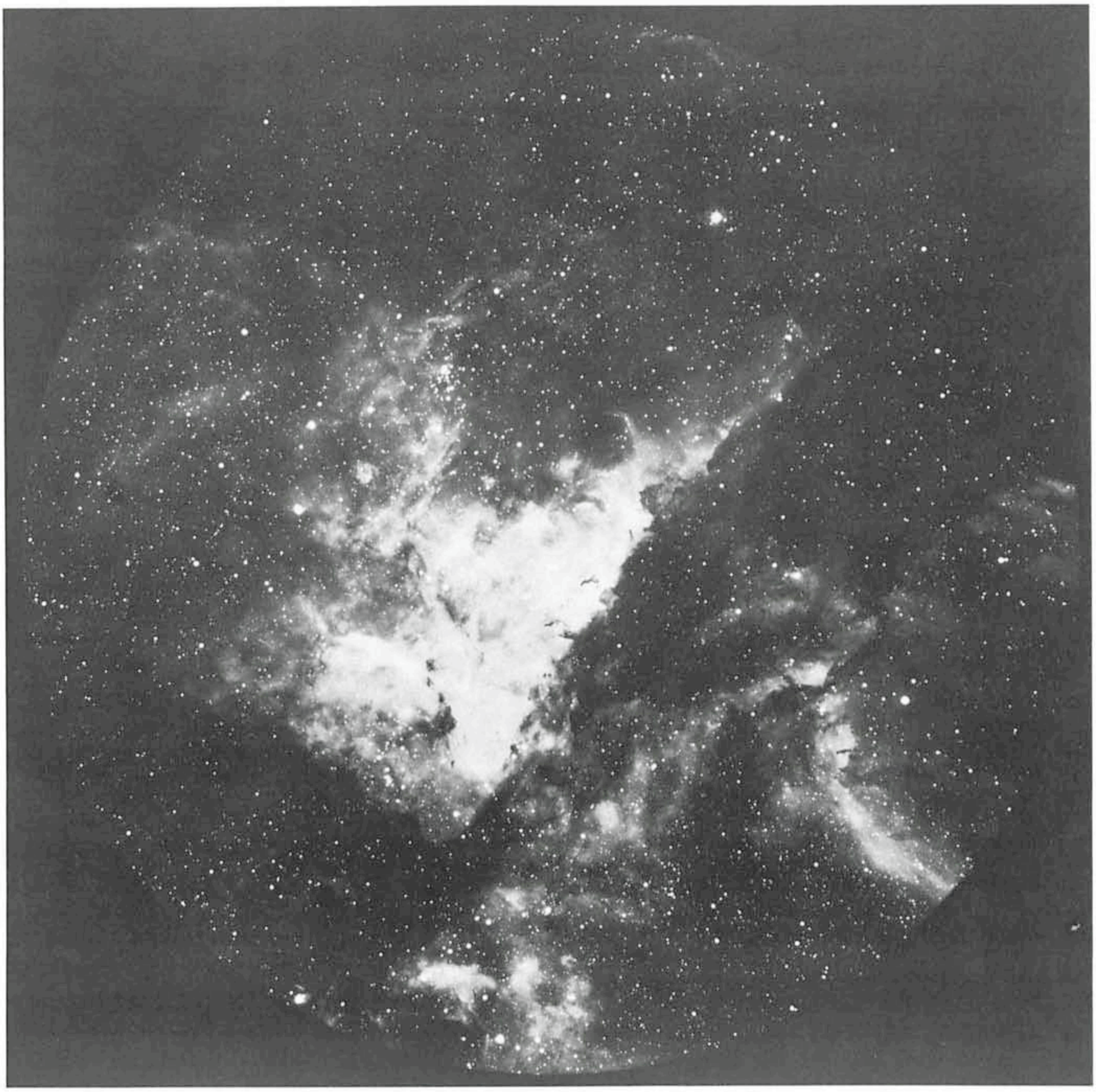

Fig. 2: *A masked print of the same plate shows a vast increase in details.*

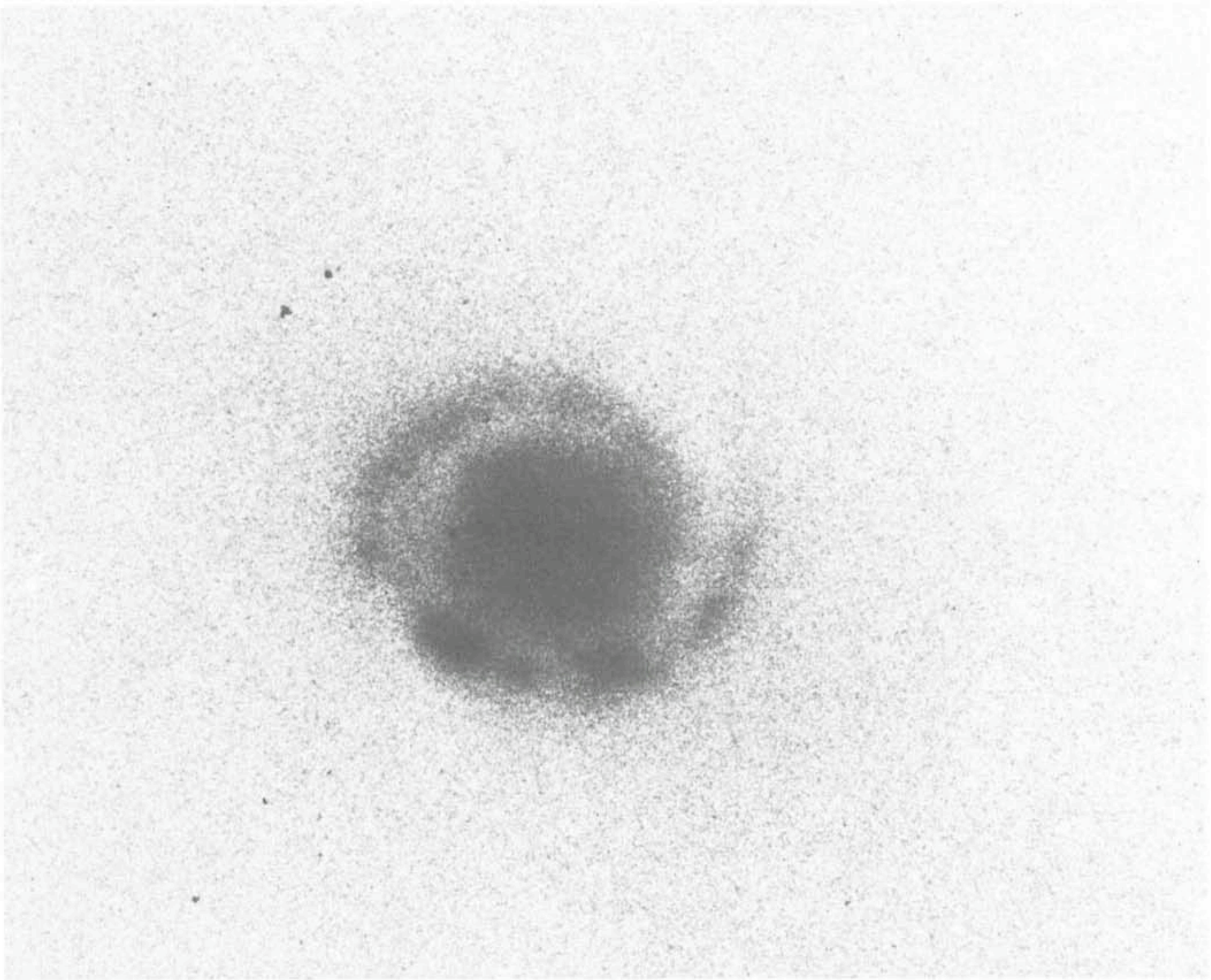

Fig. 3: *Contrast manipulation can be a matter of contrast enhancement, too, like this photograph of NGC 1510, which was originally made on a IIIa-J plate. An intermediate film copy was made featuring a greatly increased contrast.*

P-3 process offers a significant improvement in colour rendition as compared to the Cibachrome-A process which is being used elsewhere.

Trial runs with the machine have already been made and (at the time of writing) we are awaiting the final details of installation.

The colour laboratory will enable us to produce colour prints and large colour transparencies from colour slides (or b/w colour separation film). In order to use the lab properly for reproducing astronomical materials, the original transparencies will have to be of good quality. As is well known, rather poor results are obtained if ordinary colour film is used at the telescope. Two major obstacles are generally held responsible for this fact: the bad performance of the film when it is subjected to excessive exposure times (the Low Intensity Reciprocity Failure) and lack of spectral sensitivity. As far as LIRF is concerned, the techniques normally used to overcome these problems in the black-and-white film cannot be applied because the three main layers of the colour material respond differently to low-intensity exposures (very often resulting in a "crossed-curves" condition), producing a noticeable colour cast which unfortunately cannot be corrected. Attempts to overcome the LIRF problem by means of cooling the emulsion have been quite successful, and fairly good results have been obtained in this way. However, the cooling of large colour films at the telescopes appears to be very difficult from a technical point of view. Consequently much attention has been paid to alternative ways of colour printing. One method, which forms the basis of our project, involves the revival of the old additive printing technique (three-colour printing). It is our intention to make prints by means of superpositioning b/w plates (of the same object, but exposed in different pass bands) and exposing them sequentially onto colour duplicating film or colour printing paper through filters of the three additive primary colours. Apart from bypassing the above-mentioned problems, this method has the obvious advantage that existing plates can also be used. The major difficulties are the alignment of the plates (inaccuracy leads to three different images in the primary colours of each object) and adjusting the contrast in order to ensure a printable density range as well as a proper colour balance. In the coming months, much time will have to be devoted to these problems, but once we have found their solutions, we expect to be able to produce colour prints of interest not only to the public but also, of course, to the astronomical community.