The Gaseous Environment of the Supernova 1987 A in the Large Magellanic Cloud

A visual inspection of a deep photograph of the region centred on 30 Doradus obtained in the light of the gaseous emission of ionized hydrogen (e.g. the Hα pictures by Elliott et al. 1977, *Astron. Astrophys.* **55,** 187 and the multicolour photograph published in the *Messenger* No. 48) clearly suggests that the supernova occurred within the boundaries of that supergiant HII region. This is hardly surprising: the 30 Dor complex is the largest concentration of young, massive stars in the Local Group of galaxies and as massive stars are the progenitors of type II supernovae there was a high chance to observe the first close-by supernova in modern times in that region.

The supernova is located at about 21 arcminutes from the centre of 30 Doradus; the gaseous emission, although not as strong as in the centre of the nebula, is still quite prominent. There is no published study in the literature of the distribution of ionized gas in the direction of the SN. It will be difficult for some time yet to obtain a deep exposure of that area without saturating the detector with the light of the supernova. We circumvented this problem by using a reflecting spot inserted at the position of the supernova in the focal plane of EFOSC, the ESO Faint Object Spectrograph and Camera. A short description of this simple coronograph is given by Dekker and D'Odorico in this issue of the *Messenger.* Figure 1 shows an example of these masked images. Pictures were obtained in the light of Hα [NII], [SII], [OIII] and the continuum. They provide an insight into the complex structure and into the ionization of the gas and will serve as a reference to study the modifications to the ionization to be induced in the coming years by the SN flash and the interaction with the ejecta.

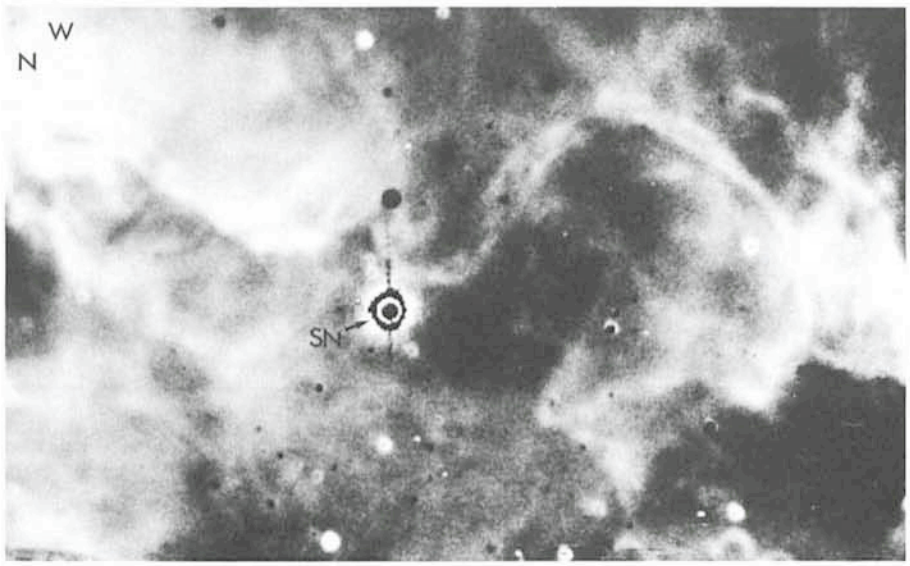

Figure 1: *The field of SN 1987A in the light of the O^{++} gaseous emission. The highly ionized gas appears white and diffuse and most of the stars appear as white dots in this picture which was obtained by subtracting from a CCD frame obtained through an interference filter centred at the 5007 Å emission line one other frame centred on the adjacent continuum. The observations are from the ESO focal reducer EFOSC at the 3.6-m telescope. About 99 % of the light of the supernova (still brighter than V = 4.5 at that time) was blocked by a reflecting spot deposited on a glass plate mounted in one position of the aperture wheel of the instrument. Residual scattered light is still visible around the SN image. The exposure time of a single CCD frame was 5 minutes.*

The precursor star appears to have been located at the edges of a bright ridge of emission on one side and of a bubble on the other. The latter could be the result of a previous SN explosion or the effect of mass loss winds from massive young stars. It appears too extended to be attributed to the mass loss in the SN precursor alone. This type of structure is quite common in 30 Dor, where such energetic phenomena are relatively frequent. Their physical association with the supernova has to be proved by a detailed kinematical study, a chance projection being also a possibility.

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Updating and New Functions of EFOSC

This last August three new features have been tested in EFOSC and are now fully implemented in the instrument. This brief report is intended to make users promptly aware of the new possibilities.

A New Field Lens to Reduce the Scattered Light

The most serious shortcoming of EFOSC in the first two years of operation was possibly the so-called sky concentration, a diffuse spot of light 5–20 % above the background in the centre of the image which is caused by light – from the sky background and stars – reflected by the CCD back into the camera and returned by some optical surfaces, the main contribution coming from the field lens.

Careful flat-fielding could take care of this effect, which however remained the main limitation to the photometric accuracy of the instrument. Following a new design by Bernard Delabre, a new field lens has been manufactured and has been successfully integrated in the camera. The first tests show that the sky concentration is now reduced to 1–5 % depending on the CCD and the filter used. The scale of the instrument is now very slightly modified (0.674 arcsec/30 μm pixel). As of the end of August, the new lens is routinely used in the instrument.

A Coronographic Option in the Direct Imaging Mode

A simple coronograph provides now a new observing mode option in EFOSC. It consists of a coated glass plate on which 6 reflecting spots have been deposited. The current diameters are 1.5, 2, 3, 4, 6 and 8 arcseconds. The plate is