SN 1987 A (continued)

The far southern declination of Supernova 1987 A (–69°.5) means that it is "circumpolar" – always above the horizon – at all of the major astronomical observatories in the southern hemisphere. Observations have therefore continued every night since the discovery in February.

Since the last reports about SN 1987 A in this journal (**49,** pages 25 and 32–34), the comprehensive Proceedings of the ESO Workshop on SN 1987 A have been published, giving an in-depth account of the first four months of intensive observations. Details about this king-size book and how to obtain a copy are given in the box.

Two contributions from ESO are included in this issue of the Messenger. The first concern observations of the infrared spectrum with the 3.6-m telescope and IRSPEC. These data are unique and it has therefore been decided to print the preliminary list of observed lines in its entity. Another contribution provides information about recent speckle observations.

Hard X-rays from SN 1987 A were detected already in August, but this was only announced in late September, because of problems in separating the SN signal from that of the nearby X-ray source, LMC X-1. X-rays in the 20–130 keV energy region were observed with HEXE, a German-built instrument on the Kvant module of the Soviet Mir station. The SN was also detected at energies up to 350 keV by the Soviet "Pulsar X-1" instrument, and also with the Japanese Ginga satellite. The observed spectrum was very hard; this explains why no radiation was registered by earlier experiments in the low-energy range. For instance, a rocket was launched on November 14 from Woomera, Australia, with a detector in the soft X-ray range from 0.75–2 keV, but no signal was detected.

It is not yet clear whether the observed hard X-rays originate in the expanding shell, as diffused emission from decaying Cobalt-56 atoms, or whether the source is a neutron star (pulsar) at the centre. Continued observations may be able to tell which of these two hypotheses is correct, since the flux from a neutron star is thought to remain largely constant, whereas radiation from Cobalt will slowly decrease.

The visual brightness continues to decrease slowly in an exponential way, and accurate measurements indicate that the corresponding "decay-time" lies between 106 and 115 days. This is very near the 111-day mean life of Cobalt-56 and is indicative of this radioactive element being the main source of energy during the present phase. It was thought in late October that a more linear decline in brightness might have begun, but this was soon refuted by continued, accurate photometry in South Africa and in Chile.

The magnitude in late November was about 6.0. This means that it is now becoming too faint to be seen with the unaided eye.

The Editor (November 30, 1987)

The Proceedings of the ESO Workshop on

SN 1987 A

which took place at Garching from 6 to 8 July 1987, have been published. The price for this 688-page volume, edited by I. J. Danziger, is DM 50.– and has to be prepaid.

Payments have to be made to the ESO bank account 2102002 with Commerzbank München or by cheque, addressed to the attention of:

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A 1–5 μm Infrared Spectrum of SN 1987 A

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An infrared spectrum of SN 1987 A covering the atmospheric windows between 1 μm and 5 μm was obtained at R = 1,500 with the IRSPEC spectrometer on the ESO 3.6-m telescope during the period 5–8 October 1987. Unfortunately, the observations had to be spread over several nights due to the presence of cirrus clouds which made it necessary to observe and calibrate separately at each of the ≃ 50 grating positions used. Nevertheless the result is instructive in demonstrating that, with the advent of array detectors, infrared observations do not necessarily have to stop as soon as the clouds appear!

The complete spectrum is reproduced in Figure 1 and, as three enlarged sections, in Figure 2 where the fainter lines are more visible and the main features are also identified. A strikingly large number of emission lines are now present and Table 1 represents our first attempt at identification. Many of these features have not previously been reported in astronomical spectra, several remain unidentified and some of the suggested identifications (mainly amongst the neutral atoms) must be considered uncertain. All the lines are broad, with typical FWHM ≃ 3,000 km s^{-1}. Their profiles range from highly symmetrical to pronounced P Cygni but, in all cases, the emission peaks are redshifted by 400–1,500 km s^{-1} compared with the ≃ 270 km s^{-1} expected for the LMC. Actual values for the "cleanest" and most securely identified lines are given in Table 1. Neither the "excess" redshifts nor their large spread can be attributed to wavelength measurement errors because the positions of H and CO lines in the observed comparison stars confirm the accuracy of the IRSPEC calibration (with a neon spectral line lamp) to better than one pixel (typically < 200 km s^{-1}). Within the observed velocity spread however there do not appear to be systematic differences between species or amongst lines with different optical depths. It should also be noted that visible spectra reveal the Hα emission to be redshifted by