

## RESEARCH NEWS

### Birth of a supernova remnant observed

Astronomers from the Australia Telescope National Facility (ATNF) and the University of Sydney have made the first detection of the emergence of a supernova remnant. The observations, to be published in *Nature*, were made with the Australia Telescope Compact Array and the University's Molonglo Observatory Synthesis Telescope (MOST) in 1990 and 1991.

Supernova remnants are the remains of exploded stars. Very few are visible to optical telescopes; most have been detected as radio sources. We know of about 160 in our own galaxy and a further 60 in other galaxies. Never before, however, have astronomers witnessed one being created.

In this case, the supernova remnant has arisen from Supernova 1987A, an exploding star detected in February 1987. This was the first 'close' supernova since the invention of the optical telescope in the late sixteenth century. As such, it provided a unique opportunity to follow the death throes of a large star, and it has been minutely observed at several wavelengths.

The star was in a nearby galaxy (the Large Magellanic Cloud) that can be seen well only from the southern hemisphere, so the work of the Australian telescopes has been essential. In February 1987 the supernova could just be seen above the horizon at Bangalore. (Lat 13° N).

The initial explosion was accompanied by a burst of radio emission, which died away after only a few weeks. However, a radio source reappeared in July 1990, when it was first detected with the MOST. The Australia Telescope, working at higher frequencies than the MOST, was able to detect the source about a month later.

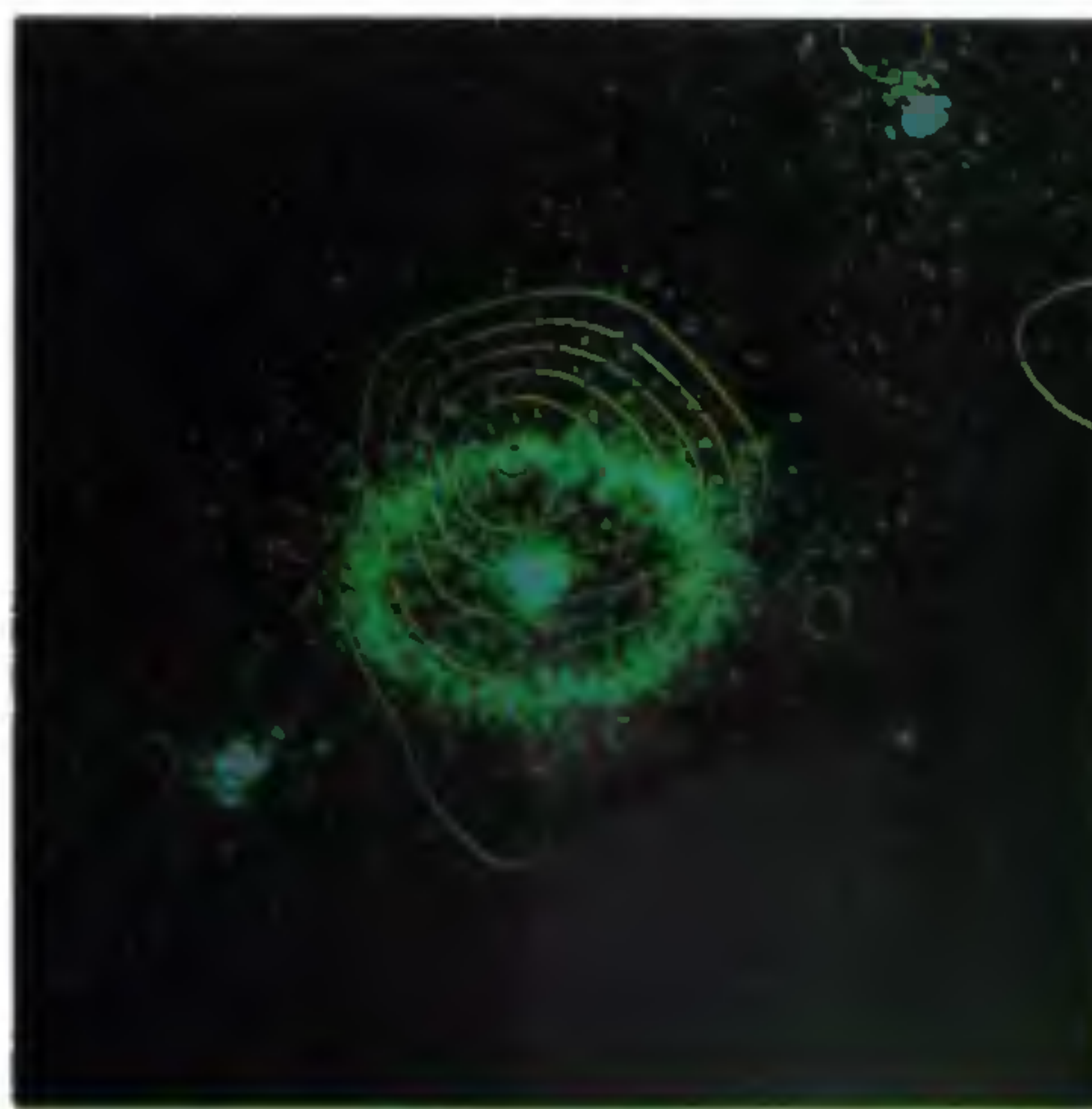
The radio source has been increasing

in strength at all observed radio frequencies between 843 MHz (the MOST's frequency) and 8.6 GHz. In April [1991], the sixth antenna of the AT's Compact Array was brought into operation, giving a full 6 km array. This in turn improved the instrument's resolution to 0.8 arcseconds at 3 cm wavelength, which enabled the AT to make detailed images of the object. These images have been compared with optical pictures of the star's remains made by the Hubble Space Telescope, which show a light ring approximately 1.7 by 1.2 arcseconds in size. The radio emission is extended and centred within 0.5 arcsecond of the optical supernova, and probably lies within this ring.

The radio source might have been a pulsar formed during the explosion of the star. However, observations with the

Parkes Tidbinbilla interferometer showed no evidence of a compact component, which rules out a central pulsar as a major source of emission. Observations with the AT Compact Array showed that the angular extent of the source is greater than 1 arcsecond.

The spectra of the source are consistent with optically thin synchrotron radiation. This, and the size of the source, suggest that relativistic electrons are being accelerated by interaction of the debris of the explosion with clumps of material that lie around the supernova. It appears that we are seeing, for the first time, the emergence of a supernova remnant. Further observations will help to determine the nature of the electron acceleration process and the relationship between the radio waves and optical emission.



The Australia Telescope image of the supernova remnant (shown as contour lines) is superimposed on the image from the Hubble Space Telescope (NASA/ESA).

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