RCW 86 as the remnant of a calcium-rich core-collapse supernova explosion

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The pyriform appearance of the supernova remnant (SNR) RCW 86 (Fig. 1) can be explained as the result of a supernova (SN) explosion near the edge of a bubble blown by the wind of a moving massive star. This interpretation implies that the SN exploded near the centre of the arc-like optical nebula in the south-west of RCW 6. Using Chandra data we discovered two sources in the expected position of the SN progenitor (Fig. 1), one of which, [GV2003] S, turns out to be a foreground late-type active star, while the second one, [GV2003] N, was interpreted as a candidate neutron star [1]. Using the 7-channel imager GROND we detected a G-type star at the position of [GV2003] N. Follow-up VLT/FORS2 spectroscopy of this star revealed clear radial velocity variations, indicative of a close, eccentric binary, and showed that the star is strongly polluted with calcium and other elements [2]. Our findings mean that [GV2003] N is a post-SN binary system, which lost most of its initial mass due to common-envelope evolution shortly before core collapse, and that the SN explosion that formed RCW 86 might belong to the class of Ca-rich SNe – faint and fast transients, whose origin is strongly debated. The short orbital period of [GV2003] N indicates that this binary system will evolve into a low-mass X-ray binary (LMXB) within its nuclear time scale ($\sim 10^{10}$ yr), providing the first definite example of a pre-LMXB located within a SNR.

References


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