Synchrotron X-Rays in Supernova Remnant RCW 86

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Abstract

Chandra ACIS-S observations of the southwestern part of the supernova remnant RCW 86 confirmed the presence of nonthermal synchrotron emission. The observations took place on Feb 1-2, 2001 for 92 ks using 6 chips of I2, I3, and S0 to S3. At low (< 2 keV) energies emission is mostly thermal and it is concentrated in very thin filaments in a shell with a morphology similar to the optical structure. Spectra of these filaments are strongly dominated by line emission from elements such as O, Ne, Mg, Si, S, and Fe. At higher energies emission is dominated by synchrotron X-rays, and it is located mostly inside the thin thermal filaments. This high energy emission is mostly diffuse and correlates well with a bright ridge of radio emission, but faint filaments and knots are also visible, with a morphology distinctly different from optical and soft X-ray emission. Spectra of synchrotron-dominated regions show only weak line emission, clearly demonstrating veiling of thermal emission by synchrotron continuum. The presence of a relatively strong Fe Kα emission in these spectra shows that synchrotron emission originates in a very hot gas located mostly interior of the optical and soft X-ray filamentary emission. We will present a detailed comparison of the synchrotron X-ray and radio images, and we will present our determinations of the break frequency of the synchrotron spectrum, and its possible spatial variations. We will discuss these results in the framework of shock acceleration limited by radiative losses. We will also present a spatially-resolved spectral analysis of thermal emission produced by bright nonradiative shocks present in this region of the remnant.

CATEGORY: SUPERNOVAE, SUPERNOVA REMNANTS AND ISOLATED NEUTRON STARS