Chandra CCD imagery of the NW and NE limbs of SN1006

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Abstract

At radio wavelengths, the historical SN of AD 1006 exhibits a limb-brightened bi-polar morphology. Approximately 30 arcmin across, it is brightest in the NE and SW. At optical wavelengths, the SNR is quite faint and the most prominent features are a series of thin filaments, seen only in the Balmer lines, along the NW limb of the SNR. Filaments of this type are known to delineate the primary shock of a SNR as it propagates into (at least) partially neutral interstellar material. Although early X-ray spectra of SN1006 showed very little evidence of line emission, unlike other, limb-brightened historical SNRs, ASCA revealed two distinct spectral components, a synchroton-dominated power law prominent in spectra of the NE and SW limbs, and thermal emission in the interior. This is consistent with the hypothesis that X-ray emission in the NE is synchrotron-dominated and the general idea that magnetic field amplification and electron acceleration are more effective when the shock velocity is perpendicular to the shock front.

To further elucidate the physics of the shock front in SN1006, we have used ACIS to obtain spectacular deep 70 and 90 ksec images of the synchrotron-dominated NE and the thermally-dominated NW limbs of SN1006, respectively, as well as a substantial portion of the interior of the SNR. There is a close correspondence between the brightest features in the X-ray images with radio features in the NE and with Balmer-dominated filaments in the NW. The spectra of the brighter filaments in the NE are harder with less prominent line emission than those in the NW. In addition to highly-elongated filaments, both images show enhanced "splotches" of emission well inside of the shock front that appear to be dominated by emission from oxygen. These presumably arise from shock heated ejecta. In this paper, we describe our on-going analysis of these images, including a search for the X-ray halo predicted by the diffuse Fermi acceleration picture in synchrotron-dominated regions and the development of thermal X-rays in the NW.

CATEGORY: SUPERNOVAE, SUPERNOVA REMNANTS AND ISOLATED NEUTRON STARS