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### **Title**

The Chandra View of DA 530: A Subenergetic Supernova Remnant with a Pulsar Wind Nebula?

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### **Abstract**

DA 530 (G93.3+6.9) is a high Galactic latitude supernova (SN) remnant with a well-defined shell-like radio morphology and an exceptionally low X-ray-to-radio luminosity ratio. Based on a *Chandra* ACIS observation, we report the detection of an extended X-ray feature close to the center of the remnant at  $5.3 \sigma$  above the background within a circle of  $20''$  radius. The spectrum of this feature can be characterized by a power law with photon index  $\Gamma = 1.6 \pm 0.8$ . This feature, which is spatially coincident with a nonthermal radio source, most likely represents a pulsar wind nebula. We have further examined the spectrum of the diffuse X-ray emission from the remnant's interior, which has a background-subtracted count rate of  $\sim 0.06 \text{ s}^{-1}$  at 0.3-3.5 keV. The emission spectrum can be described by a thermal plasma with a temperature of  $\sim 0.3$ -0.6 keV and an Si overabundance of 7 times solar. These spectral characteristics, together with the extremely low X-ray luminosity, suggest that the remnant arose from a SN with an anomalously low mechanical energy ( $< 10^{50}$  ergs). The centrally filled thermal X-ray emission of the remnant may indicate an early thermalization of the SN ejecta by the circumstellar medium. Our results suggest that the remnant is likely the product of a core-collapse SN with a progenitor mass of 8-12  $M_{\odot}$ . Similar remnants are probably common in the Galaxy but have rarely been studied.

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## Comments

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