

Chandra ACIS Observations of Jovian X-Ray Emission

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On November 25 and 26, 1999, the Chandra X-ray spacecraft conducted a set of four 19,000 sec observations of Jupiter. The ACIS-S instrument configuration was used for its good low energy efficiency and spatial resolution. An anomalous response was obtained which was subsequently attributed to strong jovian infra-red radiation penetrating the detector and piling up spurious events across the entire X-ray range. However, the preobservation establishment of an offsetting bias field has allowed the recovery of data from that portion of Jupiter's disc which remained within the elevated portion of the bias field during the observation. This ranges from fewer than 3000 sec, to the entire observing time for about 10% of the planet.

Auroral emission is seen near both poles in each observation. The northern aurora is overall more intense than the southern, consistent with prior Einstein and ROSAT Observatory results. The southern aurora shows more modulation with Jupiter's rotation than the northern. Spatial resolution has been improved by at least a factor of two over prior measurements but convincing evidence of structure has not been seen. Lower latitude emission, first observed by ROSAT, is confirmed with flux levels averaging more than a factor of five below peak auroral values. Pronounced variation in the observed emission has occurred over the observing period.

The spectral response extends from 0.24 keV, below which noise dominates, to about 1.2 keV. For all four observations the spectrum is clearly enhanced between 0.45 and 0.85 keV. This is apparently unequivocal evidence that Jupiter's X-ray emission is the result of oxygen and perhaps sulfur ions precipitating into the planet's atmosphere, where they undergo charge exchange interactions. The identification of specific transition lines in the spectrum is among the ongoing efforts. A bremsstrahlung component has not yet been identified.

Contributed (oral preferred)