

X-Ray Emission from the Saturnian System

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Early attempts to detect X-ray emission from Saturn with Einstein (in December 1979) and ROSAT (in April 1992) were negative and marginal, respectively. Saturnian X-rays were unambiguously detected by XMM-Newton in September 2002 and by the Chandra X-ray Observatory in April 2003. These earlier X-ray observations of Saturn revealed emissions only from its non-auroral disk. In January 2004, Saturn was observed by the Advanced CCD Imaging Spectrometer of the Chandra observatory in two exposures on 20 and 26-27 January; each continuous observation lasted for about one full Saturn rotation. These new observations detected an X-ray flare at Saturn, and show that the Saturnian X-ray emission is highly variable – a factor of 4 variability in brightness over one week. These observations also discovered X-rays from Saturn's rings. The X-ray spectrum of the rings is dominated by emission in the 0.49–0.63 keV band with peak flux near the atomic oxygen K α fluorescence line at 525 eV. In addition, there is a hint of auroral emission from Saturn's south pole. But unlike Jupiter, X-rays from Saturn's polar region have characteristics similar to those from its disk and that they vary in brightness inversely to the FUV aurora observed by the Hubble Space Telescope. These exciting results obtained from Chandra observations will be presented and discussed.

XMM-Newton will be observing X-rays from Saturn in two epochs, each two Saturn rotation long (~21 hr), during 2005 in mid-April and early-November. These observations are planned to take advantage of in-situ observations being conducted by Cassini spacecraft. Preliminary results from the April XMM-Newton observations will also be presented.