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X-Ray Emission in the Solar System

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Many objects in the solar system produce x-rays, including the Sun, Venus, Earth, Mars, Jupiter, and comets. A number of emission mechanisms account for this x-ray emission, including scattering and fluorescence of solar x-rays, impact excitation of atoms and molecules by energetic electrons and ions, and by charge transfer of highly charged ions with neutrals. A brief review is provided of these various solar system x-ray sources, but in this talk x-ray emission associated with the Jovian aurora will be emphasized. The first observations of Jupiter made by the Chandra X-Ray Observatory revealed a powerful x-ray aurora located in the polar caps. This x-ray aurora can probably be explained by energetic heavy ion precipitation, either on open field lines connecting to the solar wind or on closed field lines reaching to the outer magnetosphere. Associated electrical currents into the Jovian atmosphere are tens of MA, and this has significant implications for the magnetospheric dynamics and for ionosphere-magnetosphere coupling.