X-RAY IMAGING AS A DIAGNOSTIC TOOL FOR STUDYING MAGNETOSPHERES

T. E. Cravens[1], M. Collier and D. Sibeck[2], and N. Ozak[3]

[1] *Univ. of Kansas,* [2] *NASA GSFC,* [3] *Weizmann Institute*

X-ray imaging has traditionally been used to provide information on hot solar coronal plasma, but it can also provide information on plasma structures and processes elsewhere in the solar system, including at Earth, Jupiter, and comets. The main emphasis in this talk will be on x-rays produced by charge exchange (CX) collisions between highly-charged ions and neutral atoms and molecules. The product ions are excited to high principal quantum numbers and emit x-ray photons. Such ions are formed in the hot solar corona and are carried out into interplanetary space where they can produce x-rays when they encounter neutral gas. X-rays from this solar wind charge exchange mechanism (SWCX) have been observed from comets and interstellar gas. This mechanism is also known to be operating in the terrestrial magnetosheath and cusp due to solar wind ion collisions with geocoronal atomic hydrogen. This emission should allow one to image the solar wind plasma surrounding the terrestrial magnetopause and to study how this important region evolves during the course of a magnetic storm. Plans are underway to build an x-ray imager to measure these emissions and to use them to help understand how the solar wind interacts with the Earths magnetosphere Intense auroral emission has been observed from Jupiter across the electromagnetic spectrum (visible, ultraviolet, infrared, and x-ray). The emission from the main auroral oval is in the ultraviolet, but x-rays are observed from the polar caps with a luminosity of about 1 GW. X-ray spectra measured by the Chandra X-Ray Observatory and by the XMM-Newton observatory indicate that precipitating MeV energy oxygen and sulfur ions are responsible and are due to CX collisions. X-ray images provide information on magnetosphere-ionosphere coupling processes at Jupiter.