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Exploring the Earth's X-ray aurorae with a Cubesat

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Abstract

In recent years XMM-Newton and Chandra have revealed the diagnostic potential of X-ray observations in exploring the physical processes occurring in the environs of the planets in the solar system, and particularly in their auroral regions. For example, X-ray spectral studies of Jupiter's aurorae have provided unexpected insights into the charged particle populations of the Jovian magnetosphere, their dynamics and energetics.

X-ray observations of the Earth's aurorae have been mainly carried out at high energies, above $\sim$3 keV, where electron bremsstrahlung is the dominant emission process. Particles (mainly electrons) precipitating in the Earth's upper atmosphere are also likely to give rise to characteristic K-shell soft X-ray lines of nitrogen and oxygen, the main atmospheric constituents. Recent Chandra imaging observations support this view, and have shown the Earth's soft X-ray aurora to be highly variable, with intense patches and arcs of emission. The extent to which ionic charge exchange also contributes to the Earth's soft X-ray aurora is still unknown.

As a Master Degree project, we have been investigating the possibility of carrying out soft X-ray observations of the Earth's aurora using an X-ray camera on a Cubesat in polar orbit. This presentation will describe the scientific requirements, sensitivity estimates, necessary trade offs, and the accommodation study carried out to determine the feasibility of such an instrument.