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A simple X-ray camera for rocket based imaging of energetic auroral electron precipitation.

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When energetic electrons enter the upper atmosphere, they are retarded due to interactions with the particles present. In this process, bremsstrahlung is emitted. These X-rays can be detected by an X-ray camera flown on a rocket or a satellite. We intend to conduct measurements with a simple pinhole X-ray camera on the ESPRIT student rocket. This rocket will be launched from Andøya Rocket Range located in the auroral zone in Northern Norway. The scientific objective of ESPRIT is to conduct in situ measurements in the mesosphere and lower thermosphere. The X-ray camera has a one-dimensional array of four spectroscopy grade CadmiumZincTelluride detectors, and this array exploits the rocket spin in order to create a two dimensional image of the X-ray emissions in the upper atmosphere. CdZnTe detectors enable operation without detector cooling, and they also have high detector efficiency from a few keV, to more than 100 keV. We will also fly two silicon solid state detectors for direct detection of the energetic electrons at the rocket's instantaneous location. This makes it possible to compare the flux of energetic electrons deduced from the X-ray measurements with the directly measured electron flux at the rocket location. In addition to generating bremsstrahlung, the electrons will also ionize the atmosphere and thus influence the electron density. The absorption of cosmic radio noise in the atmosphere is dependent upon the electron density. This absorption is observed by a riometer; an instrument that measures the cosmic radio noise that reaches ground level. For this study, an imaging riometer being established on Andøya, Norway, will be used. If available, measurements of electron density from EISCAT during the rocket flight will also be utilized.