

Neutral mass and velocity spectrometer (NMS) on e-POP/CASSIOPE spacecraft

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Neutral Mass and velocity Spectrometer (NMS) is one of the e-POP (enhanced Polar Outflow Probe) payload instruments on a Canadian micro satellite CASSIOPE which will be launched in the end of 2007. NMS measures density and 2-dimensional velocity distribution function of each major neutral species such as H₂, He, O, and N₂ in the upper atmosphere using 2-D position detection.

The velocity distribution function of neutral atmospheric species has never been measured. However the information of the velocity distribution is important to understand the behavior of nonthermal components of the upper atmosphere, which are considered to be generated by various collisional processes among ambient neutral species and high-energy plasmas.

Basic design of NMS instrument has been done and its feasibility has been confirmed experimentally (Fujikawa et al., 2002). We modified the measurement method to adapt to the actual flight experiment, which has limited resources relative to the laboratory environment.

Neutral particles enter the NMS instrument with space craft ram velocity and ionized by an electron gun, then introduced to a chamber behind the electron beam. In the chamber the ions are accelerated towards the bottom in the perpendicular direction to the ram velocity by a pulsed negative voltage applied to the top plate of the chamber. A part of ions reach a slit in the bottom of the chamber and enter the ion acceleration region where ions are accelerated by a constant uniform electric field to a detector. Through this process, acceleration of incident particle occurs only in a direction perpendicular the ram and incident velocity in ram plain is maintained. The detector consists of a Micro Channel Plate (MCP) and a position sensitive anode. An accelerated ion arrives on a position according to its mass and velocity. The distribution of detected positions represents 2-D velocity distribution function of neutral particles.

Design and development of NMS will be discussed.