

## Atmospheric Neutral Analyzer for neutral mass composition and velocity measurement in the upper atmosphere

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In order to understand the variability of the ionosphere-thermosphere system, in-situ measurements of the composition and density of the neutral atmosphere and the detailed velocity distribution of individual species are required. However, most conventional types of instruments for neutral atmosphere lack the simultaneous capability of measuring neutral atmospheric velocity and resolving neutral mass.

We are designing the Atmospheric Neutral Analyzer (ANA) instrument to measure neutral composition and velocity distribution simultaneously in the thermosphere. It is designed to measure the detailed, mass-resolved 2 dimensional velocity distribution of thermospheric neutral species, and to derive the corresponding density, mass composition, velocity and temperature from the measured distribution.

The ANA is comprised of 4 sections; Entrance Aperture (EA), Ion Accelerator (IA), Radio-Frequency Ion Mass Analyser (MA) and Imaging Particle Detector (PD). The EA consists of a planar aperture slit and deflection electrode, and functions as an incident-particle selector and collimator. A small fraction of the neutral particles is ionized by electron beam. The IA acts as a particle energy selector by accelerating the ionized particles. The RF acts as an ion velocity selector. The RF voltage is applied to grids and selectively accelerate ions of matching speed. As a result, ions with a particular mass-per-charge are selected. The PD, which is comprised of a retarding grid, micro-channel plate and charge coupled device, acts as a detector of the selected ions and a two dimensional velocity imager.

We present the concept and the detailed design of the ANA.

Keywords: wind measurement, temperature measurement, mass analysis, thermosphere-ionosphere coupling