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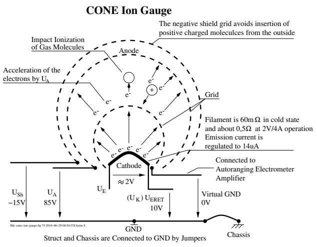
vonHOERNER&SULGER

SPACE • RESEARCH • INDUSTRY

Rocket Instruments for Middle Atmosphere Research

CONE

Combined Sensor for Neutrals and Electrons



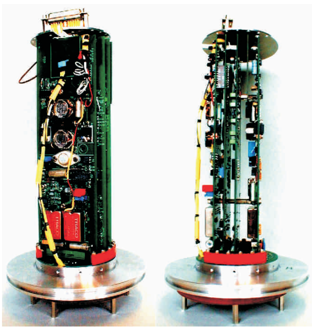
The figure at the left shows the principal design of the CONE ion gauge. An additional shield surrounding the gauge is not shown here. It has a potential of +6 V to collect electrons. The next inner negative shield with Ush is used to shield against ionospheric plasma.

Inside the ion gauge electrons are emitted by the hot cathode and accelerated towards the anode.

Gas molecules inbetween the anode and catcher electrode are ionized and collected by the electrode.

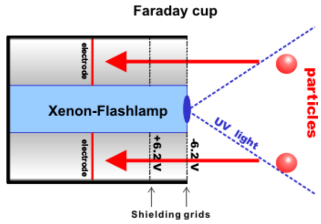
The current is digitized by an autoranging 16 bit ADC.

The hot cathode emission current is also measured by a housekeeping ADC. All data is transmitted via a telemetry interface in real-time to ground.



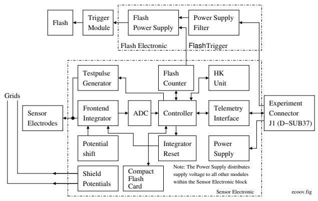
ECOMA

Existence and Charge State of Meteoric dust grains in the Middle Atmosphere



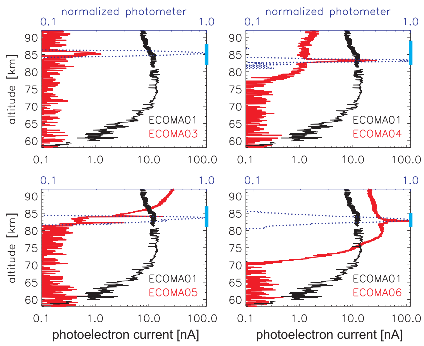
The Xenon flash lamp is flashing with 20 Hz in flight direction. The dust particles in front of the rocket are photoionized by the UV light of the flash lamp. The charged particles are collected by the electrode inside the Faraday cup. Electrons and postive ions are shielded by two grids in front of the electrode.

The Frontend integrator collects the charge induced by the electrode. The output voltage of the frontend integrator is A/D converted with a 16 bit ADC at a sample rate of 100 kHz. The integrator is reset before every flash event. Shield potentials and currents are also digitized by a 16 bit housekeeping A/D converter with a sample frequency of 300 Hz. All acquired data are written to an onboard CompactFlash memory card.



Major parts of the data are also transmitted in real-time via external telemtry to the ground. The flash is detected by a optocoupler and counted inside the controller.

Scientific Results from IAP



The graphs above are showing an overview of all photoelectron measurements during the summer flights ECOMA03 to ECOMA06 (red lines) compared to the results of flight ECOMA01 (black line) in September 2006, i.e. outside the polar summer period.

The blue bars on the right ordinate indicate the altitude ranges in which the Faraday cup measurements with the ECOMA instrument indicate the presence of charged ice particles.

The blue dotted profiles show photometer measurements of optically detectable ice particles, i.e. noctilucent clouds, on the same sounding rockets (upper abscissa).

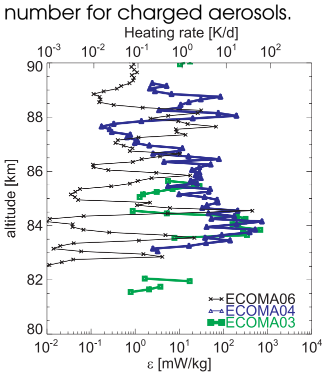
The graphs below are showing on the left panel: turbulence energy dissipation rates derived from in-situ measurements by CONE.

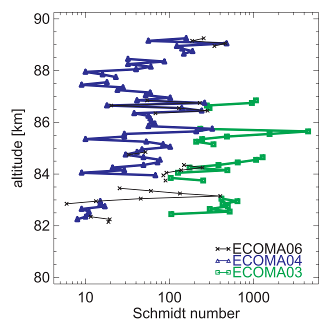
At the right panel below: Schmidt numbers derived for charged aerosols from relative density fluctuations measured in situ by ECOMA-PD.

Conclusions: Simultaneous measurements of the densities of neutral air and charged aerosols make it possible to derive Schmidt numbers with a high spatial resolution.

Our measurements show that the charged aerosols inside and between the PMSE layers are highly structured down to spatial scales of a few meters. The Schmidt numbers derived for the charged aerosols fall within the range from 6 to 4500, which implies particle radii from 1 to 26 nm.

The ECOMA gave the first ever in-situ measurements of the Schmidt number for charged aerosols.





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Poster by Guido Krein (vH&S) for the 20th ESA Symposium on European Rocket & Balloon Programmes and related research, 22–26 May 2011, Hyères – France