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Development of an energy analyser for the characterization of the neutral and ionized upper atmosphere.

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Measurements in the thermosphere are essential for understanding the solar forcing induced by the solar UV/EUV radiation, the particle precipitation and all sources of heating of this region of our atmosphere controlled by our Sun. Despite its significance, the Thermosphere Ionosphere (TI) stands as the least measured and understood of all atmospheric regions. Altitudes between ~100 to 200 km, where the magnetospheric current systems close and where Joule heating maximizes, are too high for balloon experiments and too low for existing LEO satellites. Moreover, characterizing this heating implies to be able to perform accurate measurements of the velocity, composition and density of the main species in this region.

Here we propose an instrument called INEA (Ions and Neutral Energy Analyser) that will be able to measure the density, temperature and drift velocity along the axis of sight of the instrument of neutral and ionized atmospheric particles with an accuracy compatible with DAEDALUS project (Sarris et al., Geosci. Instrum. Method. Data Syst., 2020). In order to analyse the energetic structure of particles within the TI, INEA's performance must achieve resolutions lower than 20 K and 20 m/s over a wide range of densities.

In this presentation, I will present the concept of the instrument, the expected performances based on a complete numerical model of the instrument and the results of first experiments on parts of the instrument. With such accuracy, such an instrument could be used for other issues related to other planetary objects such as Mars where the direct measurement of atmospheric exhaust remains a challenge due to the inability of current mass spectrometers to measure the energy of neutral particles with enough accuracy.