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A Langmuir Probe – fluxgate magnetometer combination for Comet Interceptor

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ESA's Comet Interceptor mission is a low budget, fast track mission to a dynamically new comet (DNC). As a DNC enters the inner solar system for the first time, it is expected to feature strong activity and to display a fluid-scale plasma environment, rather than the kinetic-scale environment encountered at weakly active objects such as 67P. In situ characterization of this plasma environment is therefore one of the main mission objectives and is the object of the Dust-Fields-Plasma instrument, a suite of sensors for the measurement of the dust, the plasma populations, and the magnetic and electric fields and waves, with the field sensors being mounted on booms, all within strict mass, power, and budget constraints. In this context a sensor has been developed that harbors a fluxgate magnetometer at the center of a hollow spherical Langmuir probe. Precautions have been taken to minimize the possible interference between both, while at the same time being very lightweight. An engineering model has been built, tested and characterized in detail. Together with a companion Langmuir probe and an additional magnetometer in gradiometer configuration, the probe-magnetometer combination (COMPLIMENT + FGM) provides data regarding magnetic and electric fields and waves, total ion and electron densities and electron temperature, as well as the ambient nanodust population. It also offers reference data for the other sensors, such as magnetic field direction, spacecraft potential and total plasma density at high cadence, and integrated EUV flux.