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The flyby of a dynamically new comet by ESA-F1 Comet Interceptor spacecraft offers unique multi-point opportunities for studying the comet's dusty and ionised cometary environment in ways that were not possible with previous missions, including Rosetta. As Comet Interceptor is an F-class mission, the payload is limited in terms of mass, power, and heritage. Most in situ science sensors therefore have been tightly integrated into a single Dust-Field-Plasma (DFP) instrument on the main spacecraft A and on the ESA sub-spacecraft B2, while there is a Plasma Package suite on the JAXA second sub-spacecraft B1. The advantage of tight integration is an important reduction of mass, power, and especially complexity, by keeping the electrical and data interfaces of the sensors internal to the DFP instrument.

The full diagnostics located on the board of the 3 spacecrafts will allow to modeling the comet environment and described the complex physical processes around the comet and on their surface including also the description of wave particle interaction in dusty cometary plasma.

The full set of DFP instrument on board the Comet Interceptor spacecraft will allow to model the comet plasma environment and its interaction with the solar wind. It will also allow to describe the complex physical processes taking place including wave particle interaction in dusty cometary plasma .

On spacecraft A, DFP consists of a magnetometer, a Langmuir and multi impedance probe/electric

field instrument, an ion and an electron analyzer, a dust sensor, and a central data processing unit and electronics box. On spacecraft B2, the instrumentation is limited to a magnetometer and a dust sensor. The choice of sensors and their capabilities are such that it maximizes synergies and complementarities.

To give one example: While the dust instrument aims at establishing the dust spectrum for millimeter to micrometer sized particles, the Langmuir probes aided by the data processing unit will analyze the signatures of micrometer to nanometer sized particles.

Moreover, unique multi-point measurements will be obtained from magnetometers on the three spacecraft, from dust sensors on A and B2, and from ion measurements on A and B1.

The tight integration of dust-field-plasma sensor hardware and science targets embodied by DFP promises an optimized science return for the available resources.