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## The French contribution for the NASA HelioSwarm mission

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The HelioSwarm mission was selected as a MDEX mission by NASA in February 2022 for launch in 2029 with a nominal duration of 15 months. Its main objectives are to reveal the 3D spatial structure and dynamics of turbulence in a weakly collisional plasma and to investigate the mutual impact of turbulence near boundaries (e. g., Earth's bow shock and magnetopause) and large-scale structures evolving in the solar wind (e. g., coronal mass ejection, corotating interaction region). The HelioSwarm mission will also contribute to the space weather science and to a better understanding of the Sun-Earth relationship. It consists of a platform (Hub) and eight smaller satellites (nodes) evolving along an elliptical orbit with an apogee ~ 60 and a perigee ~15 Earth radii. These 9 satellites, three-axis stabilised, will provide 36 pair combinations and 126 tetrahedral configurations covering the scales from 50~km (subion scale) to 3000 km (MHD scale). It will be the first mission able to investigate the physical processes related to cross-scale couplings between ion and MHD scales by measuring, simultaneously at these two scales, the magnetic field, ion density and velocity variations. Thus each satellite is equipped with the same instrument suite. A fluxgate magnetometer (MAG from Imperial College, UK) and a search-coil magnetometer (SCM) provide the 3D measurements of the magnetic field fluctuations whereas a Faraday cup (FC, SAO, USA) performs the ion density and velocity measurements. In addition, the ion distribution function is measured at a single point onboard the Hub by the iESA instrument, allowing to investigate the ion heating in particular. The SCM for HelioSwarm provided by LPP and LPC2E is strongly inherited of the SCM designed for the ESA JUICE mission. It will be mounted at the tip of a 3m boom and will cover the frequency range associated with the ion and subion scales in the near-Earth environment [0.1-16Hz] with the following sensitivities [15pT/√Hz at 1 Hz and 1.5 pT/√Hz at 10 Hz]. The iESA, developed by IRAP and LAB, is inherited from the PAS instrument operating on

the ESA Solar Orbiter mission. It will provide the ion distribution function at high time and angular resolutions, respectively 0.150 s and 3°. Furthermore the energy range will be ~200 eV to 20 keV with 8% energy resolution. Status of the development of SCM and iESA prototypes will be presented.

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