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The Swarm Absolute Scalar Magnetometer : new features, capabilities and performances

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Abstract :

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The Swarm mission, conducted by the European Space Agency (ESA), will provide the best ever survey of the earth's magnetic field and its temporal evolution. This will be achieved by a constellation of three satellites to be launched in 2012. The Absolute Scalar Magnetometer (ASM) proposed by CEA-LETI and CNES was selected by ESA in 2005 as the Swarm magnetic reference. This paper presents the new features, capabilities and performances of this magnetometer in comparison with the NMR instruments that equipped the Ørsted and CHAMP satellites launched respectively in 1999 and 2000.

The ASM operating principle is based on the atomic spectroscopy of the helium 4 metastable state. It makes use of the Zeeman's effect to transduce the magnetic field into a frequency, the signal being amplified by optical pumping. Thanks to a dedicated design, it will offer the best precision and accuracy ever attained in space, with similar performances all along the orbit. The results obtained on the flight models already delivered to ESA are reported.

In addition, the ASM implements on an experimental basis a capacity for providing simultaneously synchronous absolute vector measurements. This innovative concept is presented as well as the achievements. Swarm will offer a unique opportunity to validate these new vector data in orbit by comparing them with the ones provided by the Swarm Vector Field Magnetometer, thus opening the way for a potential in-space cross calibration.