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Subtraction of Correlated Low-Frequency Noise Induced by a Magnetic Field Simulator for In-Orbit Experiments of Magnetic Measurements

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In this work, we present a Low Earth Orbit (LEO) magnetic field simulator for technology demonstrators of future space-born gravitational wave detectors. The scientific unit used during the tests is a magnetic experiment system conceived to demonstrate the in-orbit performance of Anisotropic Magnetoresistance (AMR) sensors onboard nanosatellites. As part of the H2020 and Horizon Europe Programmes, and with the participation of the European Space Agency (ESA), this experiment will undergo functional characterization in orbit. A key difficulty, however, lies in disentangling the instrument's intrinsic noise from the low-frequency magnetic disturbances caused by the Earth's field along the orbit. To address this, the present work seeks to reproduce the expected magnetic environment in LEO and develop subtraction strategies to remove spurious contributions from the scientific data. Long-term magnetic variations are simulated on ground using a three-axis Helmholtz coil system, while a Fluxgate Magnetometer (FGM) provides reference measurements of the applied fields. Correlating these references with the payload's output enables effective subtraction of environmental effects. Validating this approach is an essential step towards a reliable in-orbit characterization of magnetic measurement systems in space for future missions requiring low magnetic noise levels and long integration times.

Author: MARÍA-MORENO, Cristian (University of Cadiz)

Co-authors: Dr MATEOS, Ignacio (University of Cadiz); PACHECO-RAMOS, Guillermo (Universidad de Sevilla); RIVAS, Francisco (Universidad Loyola); CIFREDO-CHACÓN, María-Ángeles (University of Cadiz); QUIRÓS-OLOZÁBAL, Ángel (University of Cadiz); GUERRERO-RODRÍGUEZ, José-María (University of Cadiz); CÁRDENAS-FERNÁNDEZ, Pablo (University of Cadiz); MORILLAS-ALCARAZO, Julen (University of Cadiz); KARNESIS, Nikolaos (University of Thessaloniki)

Presenter: MARÍA-MORENO, Cristian (University of Cadiz)

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