Geophysical Research Abstracts
Vol. 12, EGU2010-12603, 2010
EGU General Assembly 2010

CDSM - A New Scalar Magnetometer

Andreas Pollinger (1), Roland Lammegger (2), Werner Magnes (1), Michaela Ellmeier (2), Wolfgang Baumjohann (1), and Laurentius Windholz (2)

(1) Space Research Institute, Austrian Academy of Sciences, Graz, Austria, andreas.pollinger@oeaw.ac.at, (2) Institute of Experimental Physics, Graz University of Technology, Graz, Austria

There are potential advantages of flying a magnetometer sensor suite combining a vector fluxgate with a scalar absolute sensor. Absolute sensors offer superior stability over temperature and time, lower intrinsic noise and offset-free measurements; the latter is very useful for fluxgate calibration on a 3-axis stabilized spacecraft.

A space-adapted design of a new type of scalar magnetometer, called Coupled Dark State Magnetometer (CDSM), is under development jointly by the Institute of Experimental Physics of the Graz University of Technology and the Space Research Institute of the Austrian Academy of Sciences. The CDSM is based on two-photon spectroscopy of free alkali atoms using a multi chromatic laser field. The measurement is made completely independent of the sensor temperature by a clever coupling of several coherent population trapping resonances.

The CDSM promises a less resource-demanding instrument design (500g, 1W) compared to previously flown scalar magnetometers. A significant advantage is the fact that the extended measurement range of 7 decades is covered by only one sensor cell filled with Rubidium atoms (and a buffer gas), making the sensor core small and compact. Neither a radio frequency-based excitation at the sensor unit (150g) is needed for the operation, nor is it necessary to implement motor driven moving parts or a double cell unit in order to guarantee isotropic measurements like for other scalar sensors.

A noise floor of 70pTrms/$\sqrt{\text{Hz}}$ was measured in a first configuration. It is worth to mention that there is no 1/f noise below the implemented corner frequency of 3Hz. By changing from Rubidium D2 to D1 excitation line we are able to reduce the noise by a factor of 10 to 7pT.

The technology readiness level of the CDSM is 3 at the moment and it shall reach level 5 (breadboard validation in relevant environment) by beginning of 2011.