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M1Or3E-02: [Invited] Space experiments using superconducting magnet technology

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We report on bulk superconductor space experiments with the Earth's magnetic field which has been recognized as a major task for a better understanding of our planet. In the co-operational Magvector/MFX project on the International Space Station (ISS) in 2014-2018 we studied the interaction of the fast moving Earth magnetic field with materials of variable and perfect conductivity. For this, a 10 cm YBCO superconductor was prepared, installed, and cooled in vacuum cryostat onboard the ISS. MFX consisted of a lightweight vacuum cryostat, operated at 10E-5 mbar with a 4 W modified Stirling cryo-cooler up to 45 K. An external 3D-Helmholtz coil nullifies the surrounding unwanted electromagnetic fields. High-sensitive flux gate sensors monitored the magnetic configuration when the HTS plate was cooled down to cryogenic temperatures. Screening and field concentration effects of the Earth's magnetic field were observed and will be discussed. In parallel, the magnetic performance of two single crystal 30 mm YBCO bulks was scanned before and after the German "blue dot"ISS mission to observe any changes. Mechanical and thermally induced low-cost magnetic flux compression for future far-distance space missions has been successfully tested. A one-step trapped flux enhancement of up to 30% was obtained which allows future spacecraft shielding and braking functions.

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