A superconducting shield for astronauts

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Credit: K. Anthony/CERN

The CERN Superconductors team in the Technology department is involved in the European Space Radiation Superconducting Shield (SR2S) project, which aims to demonstrate the feasibility of using superconducting magnetic shielding technology to protect astronauts from cosmic radiation in the space environment. The material that will be used in the superconductor coils on which the project is working is magnesium diboride (MgB_2), the same type of conductor developed in the form of wire for CERN for the LHC High Luminosity Cold Powering project.

Back in April 2014, the CERN Superconductors team announced a world-record current in an electrical transmission line using cables made of the MgB_2 superconductor. This result proved that the technology could be used in the form of wire and could be a viable solution for both electrical transmission for accelerator technology and long-distance power transportation. Now, the MgB_2 superconductor has found another application: it will soon be tested in a prototype coil that could provide the solution to ensure safe trips for astronauts during deep-space missions. The idea is to create an active magnetic field to shield the spacecraft from high-energy cosmic particles. "In the framework of this project, CERN is testing MgB_2 tape in a configuration that has specifically been developed for the SR2S project by Columbus Superconductors," explains Amalia Ballarino, Superconductors and Superconducting Devices section leader.

"In the framework of the project, we will test, in the coming months, a racetrack coil wound with an MgB_2 superconducting tape," says Bernardo Bordini, coordinator of CERN activity in the framework of the SR2S project. "The prototype coil is designed to quantify the effectiveness of the superconducting magnetic shielding technology."

During long-duration trips in space and in the absence of the magnetosphere that protects people living on Earth, astronauts are

bombarded with high-energy cosmic rays that might cause a significant increase in the probability of various types of cancers. Because of this, exploration missions to Mars or other distant destinations will only become realistically possible if an effective solution for adequately shielding astronauts is found. "If the prototype coil we will be testing produces successful results, we will have contributed important information to the feasibility of the superconducting magnetic shield," says Ballarino.

There are many more challenges to overcome before a spacecraft shield can be built: various possible magnetic configurations need to be tested and compared and other key enabling technologies need to be developed. But the MgB_2 superconductor seems to be very well-placed to take part in this challenging adventure as, among its many advantages, there is also its ability to operate at higher temperatures (up to about 25 K) thus allowing the spacecraft to have a simplified cryogenic system.

Provided by CERN