Contribution ID: **83** Type: **Oral Presentation**

#2-83 Overview of the LUMINA experiment: a fiber optic dosimeter inside the Columbus module of the International Space Station

Thursday, June 12, 2025 9:20 AM (20 minutes)

Today, fiber optic dosimetry is booming technology. This class of detector exploits the effects of radiations, either radiation-induced attenuation (RIA) or radioluminescence (RIL), in silica-based optical fibers to monitor radiation levels. LUMINA is an active point dosimeter, exploiting RIA measurement in a phosphosilicate optical fiber to monitor the dose. This is possible because it was shown that RIA in this type of optical fiber, at certain wavelengths, are directly proportional to the dose deposited in the optical fiber by any type of particle (proton, neutron, photons···), and not dependent on dose rate or temperature (at least over the range between 0℃ and 80℃). This is particularly the case around 1550 nm, corresponding to the third telecommunications window and around 630 nm in the visible domain. Depending, on the wavelength, the fiber radiation sensitivity differs, from about 4 dB km-1 Gy-1 at 1535 nm to about 130 dB km-1 Gy-1 at 638 nm. The range of dose that can be measured by a dosimeter is then fixed at low doses by the minimal amount of loss that the detector can measure precisely and at high doses by the dynamic range of the detector. For this reason, LUMINA has two separate measurement channels, with their own performances, operating at these two wavelengths, and measuring optical losses in a 7 km (1535 nm) and a 2km -(638 nm) coils of single mode phosphosilicate optical fibers. The LUMINA dosimeter was installed in August 2021 by ESA astronaut Thomas Pesquet as part of his ALPHA mission. Since then, LUMINA has provided regularly in-flight data demonstrating its ability to measure the low dose increment within the Columbus module as the international space station passes through the South Atlantic Anomaly, an area where Earth's inner Van Allen radiation belt comes closest to Earth's surface. Thanks to the fairly intense solar activity of the past year, the obtained results also demonstrated LUMINA's ability to detect some of the most recent solar storms. During the conference, the preparation of the LUMINA mission and the main acquired results will be presented as well as the different limitations that have been observed during the mission. The advantages and limitations of fiber-optic dosimeters for future space missions will then be discussed.

Primary authors: GIRARD, Sylvain (Université Jean Monnet, Saint-Etienne, France); Mr ROCHE, Martin (Université Jean Monnet); BALCON, Nicolas (CNES); CLÉMENT, Florence (CNES); CHEINEY, Pierrick (Exail); DI FRANCESCA, Diego (CERN); MALAPERT, Jean-Christophe (CNES); KERBOUB, Nourdine (CNES); MAROT, Lourdes Oro (Telespazio); MORANA, Adriana (Université Jean Monnet); RICCI, Daniel (CERN); CHESTA, Enrico (CERN); CANTON, Rémi (CNES); MÉLIN, Gilles (Exail); ROBIN, Thierry (Exail); DE LA FUENTE, Gustavo (ESA); MARIN, Emmanuel (Université Jean Monnet); MEKKI, Julien (CNES)

Presenter: GIRARD, Sylvain (Université Jean Monnet, Saint-Etienne, France)

Session Classification: #02 - Space Sciences and Technology

Track Classification: 02 Space Sciences and Technology