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Charged radiation in the International Space Station: the ALTEA measurements

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Radiation is a fundamental issue in preparing the near future human space exploration missions.
The knowledge of the cosmic radiation field characteristics in the environments where astronauts are going to live during their interplanetary voyages is a mandatory step towards the minimization of the radiation risks below acceptable thresholds. Most recent results from radiation biology ask for a detailed knowledge of this radiation flux, discriminating charge (Z), input energy, rates (often referred to as the parameters describing the radiation quality). Measurements should therefore be able to determine the radiation environment with this detail, also to provide elements for a throughout validation of radiation models.
ALTEA is a facility developed with ASI grants which includes a system of advanced active silicon detectors operating in the International Space Station (ISS) since 2006. ALTEA is the only detector in operation in the ISS, able to provide information on the radiation quality.
In this talk we will show recent results achieved with ALTEA, during a 3D survey of the USLab, and the most recent tests on possible shielding materials performed in Columbus (ALTEA-shield, ESA sponsored experiment).
A quite significant asymmetry of the high LET (Linear Energy Transfer) radiation due to the shielding provided by the different racks and experiments in the ISS has been demonstrated in these measurements, as well as a negligible variation of the High-Z elements during a solar particle event (December 2006 SPE). Also a significant overestimation of iron in CREME96 based models is shown. Iron is a very important ion in the radiation risk assessment, accounting for a significant percentage of the space radiation induced cancer risk, and this discrepancy must therefore be properly addressed.
Previous results obtained with ALTEA and aimed at the understanding of the anomalous Light Flashes phenomenon (perception of light without light) reported by astronauts since Apollo 11, will be also briefly showed. In these experiments the particles impinging in the brain of the astronauts were measured together with their brain electrophysiological dynamics, to study the modification of the electrophysiological activity due to particle passages.

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