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Radiation Fields, Effects and Risks in Human Space Missions (5)

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# FEASIBILITY OF A NOVEL TLD BASED PERSONAL MICRODOSIMETER FOR DOSIMETRY AND RISK ASSESSMENT OF ASTRONAUTS ENDURING LONG-TERM HABITAT IN SPACE STATIONS

**Abstract**

Using widely available TLD-700 (7LiF: Mg, Ti) and BeO (Thermolux) chips the authors have developed a passive microdosimeter (LiBe-14) emulating a gas filled Tissue Equivalent Proportional Counter (TEPC). The LiBe-14 is capable of assessing the average LET (Lav: 11.0 to 100 keV/m), quality factor (Qav: 1.1 to 29.8) and associated ambient dose equivalent H*(10) of complex radiation field of interest. The microdosimeter was calibrated using the mixed radiation fields produced by bombarding a 30cm x 30cm x 40cm polystyrene phantom with 81, 119, 150 177, 201 and 231 MeV protons from a Proton Therapy Medical Cyclotron (B. Mukherjee et al. 2014. Progr. Nucl. Sci. Tech. 4, 285-289) and a Rossi-Type TEPC. The principle and calibration procedures of the microdosimeter were explained in detail elsewhere (B. Mukherjee, 2015. Radiat. Meas. 72, 31-38). Presently, there are two space stations are in operation at LEO: (a) Shenzhou-VIII (Apogee-altitude: 378km, Inclination: 42.79o, 16 orbits/day) (W. Sun et al. 2013. Jour. Rad. Res. 54, 383-397), (b) International Space Station (ISS) (Apogee-altitude: 400km, Inclination: 51.64o, 15.5 orbits/day) (G. Reitz et al. 2009. Radiat. Res. 171, 225-235). Astronauts of both genders and of various age groups use to reside in those space stations for duration ranging from few weeks to several months depending on mission goals. Due to the complex nature of space radiation inside the space station, personal monitoring of the astronauts is performed by using "multi-component" dosimeters made of batches of different types of TLD and CR-39 track etch detector to assess the sparsely and densely ionizing radiation respectively (G. Reitz et al. 2006. Radiat. Prot. Dosim. 120, 442-445). The LiBe-14 microdosimeter has already been used for the assessment of out-of-field radiation dose equivalents and subsequent risk of 2nd cancer in pediatric patients undergone proton therapy (B. Mukherjee et al. 2017. Radiat. Meas. submitted). This paper highlights the feasibility of a personal microdosimeter based on TLD-700 and BeO chips for astronauts working in LEO space stations (ICRP 2013. ICRP Publication 123).