Calculation of organ-specific radiation quality factors for the radioprotection of astronauts on the Moon: a microdosimetric approach

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Background: Many international space agencies and organizations share a common goal of extended human missions to the Moon. Therefore, the development of a Geant4 application to recreate the radiation environment on the surface of the Moon for astronaut radioprotection studies is vital.
Material and Methods: The computational human phantoms outlined in publication 145 of the International Commission on Radiation Protection (ICRP) [1] are implemented in a lunar radiation environment simulated in Geant4. The composition of the lunar soil is defined using the data of Mesick *et al.*; based on LNPE lunar borehole data retrieved during the Apollo missions [2]. The phantoms are subject to incident galactic cosmic ray (GCR) particles generated from a large hemisphere encasing the lunar surface geometry. We record the lineal energy and microdosimetric radiation quality factor Q(y) and dose equivalent within organs of interest for radioprotection studies.
Preliminary results: Here we present the daily absorbed dose and dose equivalent rates for astronauts on the surface of the moon. We provide a comparison between the dose equivalent calculated using the microdosimetric quality factor Q(y) with the more traditionally based Lineal Energy Transfer (LET) determination of the radiation quality factor.

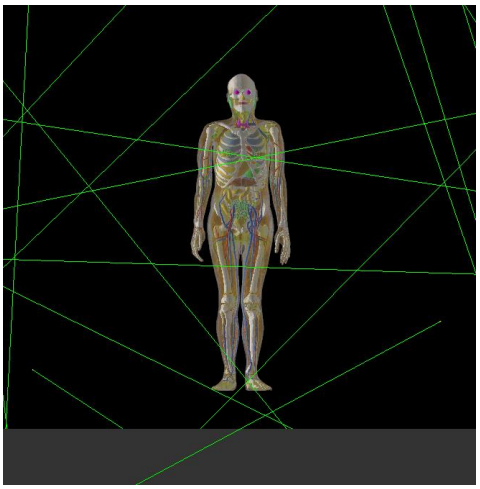

Figure 1: Male ICRP145 Human Phantom as visualized in Geant4 above the lunar surface (grey) and subject to incident GCR protons (green tracks).

[1] ICRP Publication 145 (2020), Ann. ICRP 49(3).
[2] Mesick *et al.*, *Earth and Space Sci.*, **5**, 324-338.