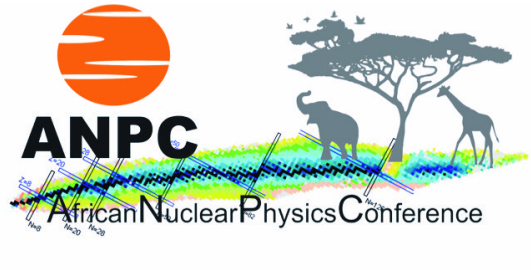

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What do cancer radiotherapy and Mars exploration have in common?

Nuclear interactions of charged particles with matter play fundamental roles in many fields of applied research. Many challenges in radiotherapy with ions and in space radioprotection are related to the investigation of the same nuclear processes and require similar approaches to be addressed.
The growing popularity of radiotherapy with protons and carbon ions as well as the interest in finding additional candidate ions (as helium or oxygen) calls for nuclear and dosimetry measurements to validate delivery techniques. Furthermore, nuclear processes could play a role in enhancing the treatment effectiveness and provide real-time verification of treatment planning versus treatment delivered.
The roadmap of space exploration predicts longer and further travels outside Earth orbit and the establishment of permanent outposts on other celestial bodies like Mars. It is now generally acknowledged that exposure to space radiation represents a major health risk for deep space missions. Currently, ad hoc radiation shielding is designed exploiting the nuclear fragmentation capability of the selected materials. Furthermore, the nuclear interactions of external radiation with the spacecraft and its contents represents the most important information for predicting the radiation risks inside a habitat.
Advancement in both radiotherapy and space radioprotection, experimental data have to be combined with calculations from theoretical and Monte Carlo codes to characterize the interactions of the primary particles with different media and, as a final step, to assess their biological effects and associated health risks.
Different experimental approaches for characterizing nuclear reactions of interest in both fields (and in particular fragmentation) will be presented. Examples of innovations in radiotherapy and space radioprotection obtained with the help of nuclear physics data will be also discussed.

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