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DOTTORATO DI RICERCA IN FISICA

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Heavy ions in therapy and space

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Abstract: Heavy charged particles produce biological damage which is different from that normally produced by sparsely ionizing radiation, such as X- or gamma-rays which are a large component of the natural radiation background. In fact, as a result of the different spatial distribution of the energy deposited along the core and penumbra of the track, DNA lesions are exquisitely complex, and difficult to repair. Relative Biological Effectiveness (RBE) factors are normally used to scale from X-rays to heavy ion damage, but it should be kept in mind that RBE depends on several factors (dose, dose rate, endpoint, particle energy and charge, etc.) and sometimes heavy ions produce special damages that just cannot be scaled by X-ray damage alone. The special characteristics of heavy ions can be used to treat tumors efficiently, but they represent a threat for human space exploration.