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A Medical Application of Nuclear Physics: Particle Radiotherapy with Protons

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Since the discovery of radiation, applications have been made to medicine. The advent of higher energy particle accelerators in the second half of the twentieth century enabled modern tele-therapy using relatively high energy x-rays and particles. Today mega-voltage (MV) x-rays are the most common modality of delivering high doses of potentially life saving radiation to a wide variety of disease, mostly malignant cancers. However, the maximum radiation dose that can be delivered is always limited by the effects to critical surrounding biologic structures. In many cases, due to their physical properties, “heavy” particle radiotherapy with protons and light ions may provide an advantage in this respect over MV x-rays allowing either a higher dose of radiation to be delivered to the volume or, for the same dose, reducing the concomitant damage to critical structures. This motivation, together with recent advances in particle therapy systems that are making the technology more readily available, is serving to grow the field of particle therapy. In particular, treatment with fast protons is becoming more widespread with over 20 facilities operating worldwide and more under construction. This presentation will provide an introduction to heavy particle therapy and additional details specifically on proton therapy.