The future of heavy ion therapy

Marco Durante

GSI Helmholtzzentrum für Schwerionenforschung and Technische Universität Darmstadt. Darmstadt, Germany

Biological optimization of the treatment planning is a necessary step toward a full exploitation of energetic charged particles in oncology. Most of the efforts in particle radiobiology for radiotherapy have concentrated on measurements of RBE. A large and comprehensive database of RBE measurements is available for different ions. However, *qualitative* differences between densely ionizing ions and photons have been observed and are not taken into account in the scaling factor RBE. Most cancer patients are subject to multi-modal strategies that involve, in addition to radiotherapy, drug treatments: chemotherapy, targeted therapy, or immunotherapy. The interaction radiation-drug can be substantially different when densely and sparsely ionizing radiation are compared. Considering the radiobiological differences, charged particles and X-rays should be regarded as two separate drugs in oncology.