SEMINAIRE ISMO

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Multiscale physics of radiation damage and ion beam cancer therapy

The multiscale approach to the molecular level assessment of radiation damage in biological targets consequent to irradiation by ions was designed in order to qualitatively and quantitatively describe the effects that take place when energetic ions interact with living tissues, e.g. the Relative Biological Effectiveness (RBE) of radiation. A road towards the understanding physical aspects of ion-beam cancer therapy on the molecular level revealed that this problem has many temporal, spatial, and energy scales, while the main events leading to the cell death happen on a nanometer scale.

The multiscale approach is interdisciplinary, phenomenon-based and, having started some years ago, passed several milestones making discoveries on different scales. Thus, in addition to the traditional pathways of biodamage often related to secondary electrons and free radicals production in cells after irradiation, the multiscale approach also considers a new efficient pathway of DNA damage caused by the nanoscopic shock waves created by the strong local heating in the vicinity of the ion tracks due to the energy deposited by ions. It allows also to evaluate radio-sensitisation effects caused by metal nanoparticles and other radio-sensitising molecular species. This work is especially active now within the currently running European project ITN-ARGENT.

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