Contribution ID: **228** Type: **Invited Lecture**

In vitro radiobiological effects of low energy accelerated protons

Wednesday 9 July 2025 11:30 (30 minutes)

The unique physical characteristics of hadron therapy—most notably the Bragg peak phenomenon—facilitate highly precise dose deposition that effectively targets tumors while minimizing radiation exposure to adjacent healthy tissues. The advancement of hadron therapy requires thorough research in radiobiology to better understand the complex effects that high doses of charged particles exert on cellular processes. Current studies suggest that the biological effectiveness of hadron therapy exhibits significant variability based on the type of particle utilized and the specific microenvironment of the tumor. Furthermore, the integration of FLASH irradiation regimens, which apply ultra-high dose rates (≥40 Gy/s), with hadron therapy is anticipated to markedly reduce patient exposure while enhancing therapeutic efficacy. This approach aims to minimize damage to normal tissues while maintaining effective tumor control. Understanding key mechanisms such as DNA damage responses, alterations in gene expression, and the effects of tumor oxygenation is crucial for refining treatment protocols in hadron therapy. In this framework, the ion accelerators at IFIN-HH, including two tandem accelerators (9 MV and 3 MV) and one cyclotron (19 MeV for protons), have been adapted to deliver doses ranging from 0 to 10 Gy to biological samples, encompassing both 2D and 3D cell cultures. Notably, a setup for ultra-high dose rate irradiation with protons has been implemented at the 3 MV tandem accelerator, enabling innovative experimental protocols. The results regarding the responses of tumor and normal tissues to accelerated proton irradiation are elucidated and discussed in the context of the prevailing literature, highlighting the potential of proton therapy to improve therapeutic outcomes through tailored approaches.

Primary author: RADU, Mihai (1Horia Hulubei National Institute for Physics and Nuclear Engineering, Reactorului 30, Măgurele, Romania)

Presenter: RADU, Mihai (1Horia Hulubei National Institute for Physics and Nuclear Engineering, Reactorului 30, Măgurele, Romania)

Session Classification: Biophysics, Life Sciences, Medical Physics

Track Classification: S02 –Biophysics, Life Sciences, Medical Physics