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The status of research on the FLASH effect using laser-driven protons

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The recent observation of a normal tissue protecting effect of ultra-high dose rate (UHDR) radiation at unchanged tumor treatment efficacy, the FLASH effect, promises great benefits for radiotherapy patients. Since the first description of the FLASH effect, preclinical studies have confirmed the effect for electrons, photons, protons, and carbon ions in various tumor and normal tissue models. Yet, two fundamental questions remain to be answered: Firstly, what are the mechanisms causing the FLASH effect, and secondly, what are the dose application parameters, e.g. peak and mean dose rate, required for triggering FLASH?
In this context, laser-driven plasma accelerators (LPAs) for protons offer unique research capabilities by providing proton pulses with multi-10 MeV energies at unprecedented dose rates of 10^9 Gy/s. Yet, to make these beam parameters available for the FLASH research community, a research environment supporting radiobiological experiments at LPAs needs to be established, including beam transport and radiation field formation to provide pre-defined dose distributions at an in-air irradiation site, beam monitoring, as well as dosimetry and infrastructure to handle biological samples.
In this talk, the current status of FLASH research at LPA sources as well as the challenges for a wider implementation of radiobiological studies will be discussed.

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