

# Laser-hybrid Accelerator for Radiobiological Applications (LhARA)}

Wednesday, July 29, 2020 6:15 PM (30 minutes)

The ‘Laser-hybrid Accelerator for Radiobiological Applications’, LhARA, is conceived as a novel, uniquely flexible facility dedicated to the study of radiobiology. The technologies that will be demonstrated in LhARA have the potential to allow particle-beam therapy to be delivered in a completely new regime, combining a variety of ion species in a single treatment fraction and exploiting ultra-high dose rates. LhARA will be a hybrid accelerator system in which laser interactions drive the creation of a large flux of protons or light ions that are captured using a plasma (Gabor) lens and formed into a beam. The laser-hybrid approach will allow radiobiological studies using a variety of ion species in completely new regimes.

LhARA will be developed in two stages. In the first stage, a programme of in vitro experiments will be served with proton beams with energies between 10\,MeV and 15\,MeV. In stage two, the beam will be accelerated using a fixed-field accelerator (FFA). This will allow experiments to be carried out in vitro, and particularly in vivo (e.g. using tumour-specific xenograft mouse models), with proton beam energies of up to 125\,MeV. In addition, ion beams, with energies up to  $\sim 30$ \,MeV per nucleon for carbon, will be available for in vitro and in vivo experiments. This paper presents the conceptual design for LhARA and the R\&D programme by which the LhARA consortium seeks to establish the facility.

## Secondary track (number)

11

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**Session Classification:** Technology Applications, Industrial Opportunities and Sustainability

**Track Classification:** 17. Technology Applications, Industrial Opportunities and Sustainability