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The Laser-hybrid Accelerator for Radiobiological Applocations (LhARA)

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On behalf of the LhARA collaboration

The 'Laser-hybrid Accelerator for Radiobiological Applications', LhARA, is conceived as a uniquely flexible internatonal facility dedicated to the study of a completely new regime of radiobiology. The ambition of the multidisciplinary collaboration is that the technologies demonstrated in LhARA will be transformative in the delivery of ion beam therapy.

The laser-hybrid approach offers enormous potential by providing a more flexible, compact, and cost-effective high energy particle source while evading the space-charge limitations of current sources. LhARA uses a high-power laser to generate an ultrashort burst of protons or light ions from a target. These are captured using strong-focusing electron-plasma (Gabor) lenses at energies up to 15 MeV, enabling ultra-high instantaneous dose rates of up to 10^9 Gy/s in pulses as short as 10–40 ns. Further acceleration up to 127 MeV is facilitated by a fixed-field alternating-gradient accelerator designed to accommodate the source flexibility. Measuring the extremely high flux, low energy proton and ion beams at LhARA presents significant challenges. Novel techniques such as beam-gas curtain profile monitors and ion-acoustic dose-profile monitors are being developed for use in proof-of-principle systems. The status of the LhARA project in the context of the Ion Therapy Research Facility recently proposed to UKRI will be described along with the LhARA collaboration's vision for the development of a transformative proton- and ion-beam system.