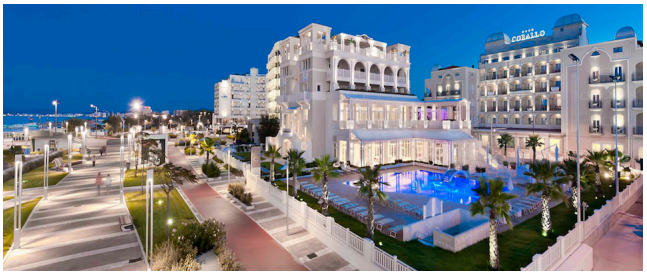

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Horizon Europe EIC-Pathfinder Project TECHNO-CLS: ”Emerging technologies for crystal-based gamma-ray light sources”

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TECHNO-CLS project aims at the breakthrough in technologies needed for designing and practical realisation of novel gamma-ray Light Sources (LS) operating at photon energies from ~100 keV up to GeV range that can be constructed through exposure of oriented crystals (linear, bent and periodically bent) to the beams of ultra-relativistic charged particles [1]. The TECHNO-CLS high-risk/high-gain science-towards-technology breakthrough research programme will address the physics of the processes accompanying the oriented crystal exposure to irradiation by the high-energy electron and positron beams at the atomistic level of detail needed for the realisation of the TECHNO-CLS goals [2-4].

A broad interdisciplinary, international collaboration has been created previously in the frame of FP7 and H2020 projects, which performed initial experimental tests to demonstrate the crystalline undulator (CU) idea, production and characterisation of periodically bent crystals and the related theory (see [2-4] and references therein). TECHNO-CLS aims to build the high-risk/high-gain science-towards-technology breakthrough research programme on these successful studies aiming at a practical realisation of the novel gamma-ray LSs such as crystalline channeling radiation emitters, crystalline synchrotron radiation emitters, crystalline undulators and others. Additionally, by means of a pre-bunched beam a CU LS has a potential to generate coherent superrradiant radiation with wavelengths orders of magnitudes less than 1 Angstrom, i.e. within the range that cannot be reached in existing LSs based on magnetic undulators. Such LSs will have many applications in the basic sciences including nuclear and solid-state physics and the life sciences. Theoretical, computational, experimental and technological results obtained in the course of this project will pave a way for key technological developments of the LSs and their wide exploitation. The TECHNO-CLS international collaboration possesses all the necessary expertise to conduct successfully the outlined programme.

There will be presented the main goals and the current developments within the TECHNO-CLS project. Particular emphasis will be made on the recent theoretical advances in atomistic simulations of channeling and radiation processes in oriented crystals [2-6] which was achieved by means of the advanced software packages MBN Explorer [7] and MBN Studio [8] during the last years.

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