

# Physics and Applications of High Brightness Beams



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## Novel approaches and innovative modalities in ultrafast electron scattering applications with accelerators

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Ultrafast electron probing modalities offer unique experimental tools to access the structural dynamics of ultrafast photoinduced processes in materials and molecules, in liquid, gas, and condensed phase systems. Here we propose to capitalize on the exceptional and versatile electron beam parameters of the SEALAB Superconducting RF (SRF) photoinjector to develop a world-wide unique facility for ultrafast electron diffraction and imaging (UED and UEI), dedicated to experiments with high sensitivity in space, energy, and time. These applications highly demand not only extreme beam quality in 6-D phase space such as a few nanometer transverse emittances and femtosecond duration but also equivalent beam stability at MHz repetition rate. The talk will rationalize on beam dynamics driven design studies for different modalities and discuss first results from preparatory measurements.

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