MAT Science Week
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Enabling in situ diffraction and imaging studies during heavy relativistic ion irradiation and studies of photon-ion interactions: A „Compact Light Source @ SIS 100 @ FAIR

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It is now possible to acquire a "compact light source", CLS, which delivers hard x-rays with a brilliance similar to 3rd generation synchrotrons. The CLS is based on a miniature electron storage ring, in combination with a picosecond laser, where the laser pulse stored in a high-finesse optical cavity acts as an "undulator" to produce x-rays. Such a CLS can be built to have a brightness of 4 x 10^{12} [photons/s/mrad^2/mm^2/4% BW] and, in a next development stage, 10^{14} [photons/s/mrad^2/mm^2/4% BW]. Photon energies are tunable between 8 – 35 keV initially, and up to 100 keV for the next development stage. X-ray pulses are 65 ps long, with a repetition rate of 65 MHz. As the machine is extremely compact it would be possible to place it close to FAIR experimental stations. It would then be possible to either use the intense high energy photon beam for studies of the interaction between ion-beams and photons, or to use diffraction, spectroscopic and imaging approaches to study materials during irradiation with relativistic ions in real time with millisecond time resolution. In times when no ion beams are available, the machine could be used for diffraction, spectroscopic and imaging studies.

The combination of a high energy, brilliant x-ray source with the FIAR facilities would provide unique experimental opportunities not available anywhere else and hence it would now be timely to consider integrating such a machine into the FAIR facilities.

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