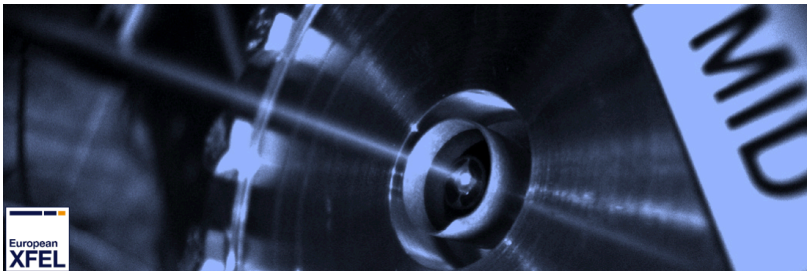

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Study of heavy elements collisional-radiative behavior using hard XFEL radiation

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Heavy elements (Z > 40) are of major importance for many fields of physics related to High-Energy Density Physics. For example, we commonly find them in all inertial confinement fusion related studies, in which the X-rays they generate are used to heat and compress DT capsules. On a broader scope, they are also extensively used are back lighters and tracers in many types of laser-matter interaction studies.

However, due to their very high K-edge thresholds (and also L-edge for very heavy elements as Au), making a detailed study of the hard X-ray emission and the plasma kinetics from these atoms is a very difficult challenge. Collisional-radiative description for such atoms is extremely hard to measure / verify due to the very complex emission of these elements at standard laser generated plasma temperatures (~1-5 keV).
Using a hard XFEL radiation, though, studying the very complex collisional-radiative behavior of heavy elements can be make much easier through the resonant photo-pumping phenomenon. Tuned at very specific frequencies the XFEL can drive photo-excitation of electrons inside the plasma. The result of this excitation is a strong reemission around the pumping frequency. This shows a snapshot of the plasma charge state and excited state populations when the XFEL hits the plasma. Thus, this technique allows to isolate specific parts of the plasma emission depending on the delay between a laser pump and the XFEL (which behaves here as a pump and a probe at the same time).

In this talk, we discuss this technique, its application, and why hard XFELs are the best tools for such studies that can strongly help to stress collisional-radiative, line shape and opacity theoretical models for heavy elements.

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