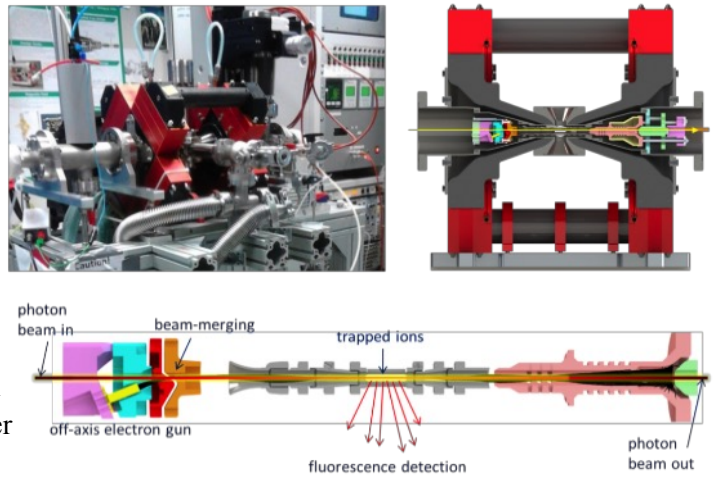
Ph. D. Program in Physics, Cycle XXXVIII, University of Trieste, Italy
PhD position in Laboratory Astrophysics@Elettra, Trieste

X-Ray absorption of highly charged ions

The goal of the experimental project is to obtain accurate laboratory data on the interaction processes between photons and different ionic targets, including multiply-charged atomic ions.
Future X-ray missions such as XRISM and Athena, will address important questions about the formation and evolution of galaxies and large-scale structure. However, we currently lack an adequate understanding of many of the atomic processes behind the spectral features. Large error bars on parameters such as critical as transition energies and atomic cross sections can lead to unacceptable uncertainties in the calculations of, e.g., elemental abundance, velocity, and temperature in the deep space.
In the framework of the EU INFRAIA project AHEAD2020[1], a collaboration among INAF, Max Planck Institute, CNR, and Elettra-ST has recently started at the GasPhase beamline of the Italian national synchrotron radiation laboratory (Elettra, Trieste, Italy). The research program aims to exploit the facilities at Elettra and FERMI, and with the use of a miniature electron beam ion trap (EBIT) of Polar-X type[2] to improve earlier works[3-6] on photoionization and X-ray resonant fluorescence spectroscopy of highly charged ions (HCI). The intensity of the FERMI FEL pulses, orders of magnitude higher than the ones produced by synchrotrons, is particular well suited to study multiply-charged atomic ions. Furthermore, the precise timing of FEL pulses enables pump-probe experiments and transition-probability determinations, an interesting possibility also in combination with coherent, seeded FEL pulses addressing long-lived, electron-density dependent metastable states.

The possibility of investigating the atomic samples with a combination of synchrotron radiation and FEL radiation constitute a unique occasion for a comprehensive study, covering both the energetics and the dynamics. The scientific program and the detailed scientific activities of the PhD program will be subject of periodic verifications, with the aim of specifying the contribution of the partners at Elettra and at INAF, taking in account the specific expertise of the successful candidate.
After a thorough training phase, in close contact with all the collaborating partners, the student will be fully involved in these experiments, and have a primary role in collecting the data and analyzing them over the PhD period of 3 years.



Electron beam ion trap (EBIT)Polar-X EBIT [2]

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References

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[4] S. Bernitt et al., Nature 492, 225 (2012)
[5] M. C. Simon et al., Phys. Rev. Lett. 105, 183001 (2010)
[6] S. W. Epp et al., Phys. Rev. A 92, 020502(R) (2015)