Research End-Station for Studies of Photon-Ion Interactions on Beamline 10.0.1

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INTRODUCTION

A new collaborative research end-station has been developed at the University of Nevada, Reno for experimental studies of inner-shell photoexcitation and photoionization of ions. This collinear-beams apparatus has been designed to facilitate absolute cross-section measurements for interactions of photons with both negative and positive ions, including multiply charged positive ions. The apparatus was moved to ALS in March, 1999 and is being installed on the new High-Resolution Atomic, Molecular and Optical Physics (HIRAMO) undulator beamline 10.0.1. A schematic drawing of the end-station is presented in Figure 1. Singly charged positive ions for the initial tests and experiments will be produced by a Colutron Ion Gun Apparatus (CIGA) from the University of México in Cuernavaca. Commissioning of the end-station is scheduled for late May, 1999. Negative ions will be produced by double electron capture collisions of positive ions in an alkali vapor cell. For measurements with multiply charged ions, a permanent-magnet electron-cyclotron-resonance (ECR) ion source is being developed at the University of Nevada, Reno in collaboration with the Justus-Liebig University in Giessen, Germany.

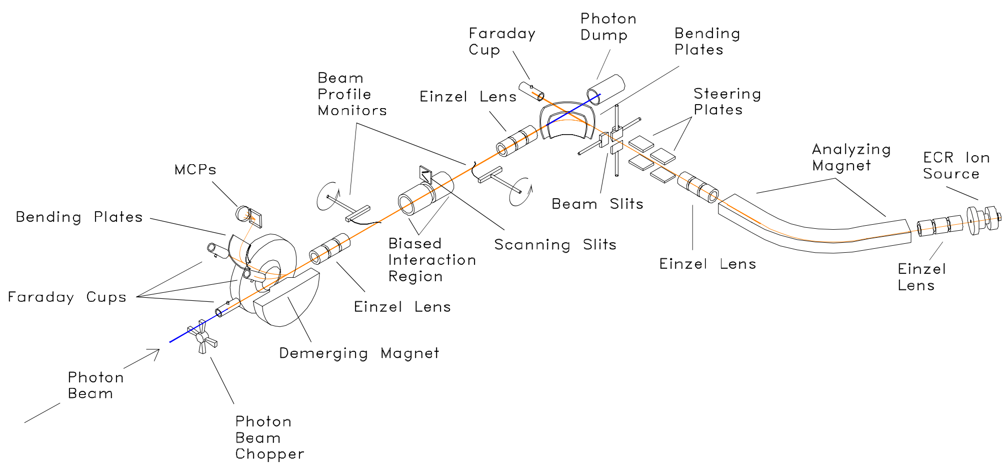

Figure 1. Schematic diagram of collinear photon-ion research end-station developed for ALS beamline 10.0.1.

The high brightness and low emittance that characterize the ALS make it an ideal facility for the study of photon-ion interactions. A common objective of the collaborative experiments to be conducted at the photon-ion end-station is a deeper understanding of the complex multi-electron interactions that govern inelastic processes occurring in ionized plasmas, which comprise more than 99.99% of the known mass in the universe. The end-station has been designed for absolute measurements, which are important for benchmarking theoretical calculations of x-ray opacities. These are critical to the modeling of astrophysical, fusion, pulsed-power and x-ray laser plasmas. Systematic studies along isoelectronic and isonuclear sequences of ions will permit a fine-tuning of their electronic structure and therefore provide a sensitive probe of the electron-electron interaction.

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