# Generation of photoionized plasmas in the laboratory of relevance to accretion-powered x-ray sources using keV line radiation

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In this paper we describe an experiment to generate x-ray photoionized plasmas in the laboratory, of relevance to accretion-powered x-ray sources such as neutron star binaries and quasars, which includes significant improvements over similar previous work. One of the key astrophysical plasma properties of interest is the photoionization parameter, $\xi=4\pi F/n_e$ where $F$ is the x-ray flux and $n_e$ the electron density. We demonstrate that we can achieve values of $\xi$ >100 erg-cm s$^{-1}$ using laser-plasma x-ray sources, in the regime of interest for several astrophysical scenarios.

In particular, we show that our use of a keV line source, rather than the usual quasi-blackbody radiation fields normally employed in such experiments, has allowed us to generate the same ratio of inner-shell to outer-shell photoionization as that expected from a blackbody source with ~keV spectral temperature. This is also a key factor in allowing experiments to be compared to the predictions of codes employed to model astrophysical sources.

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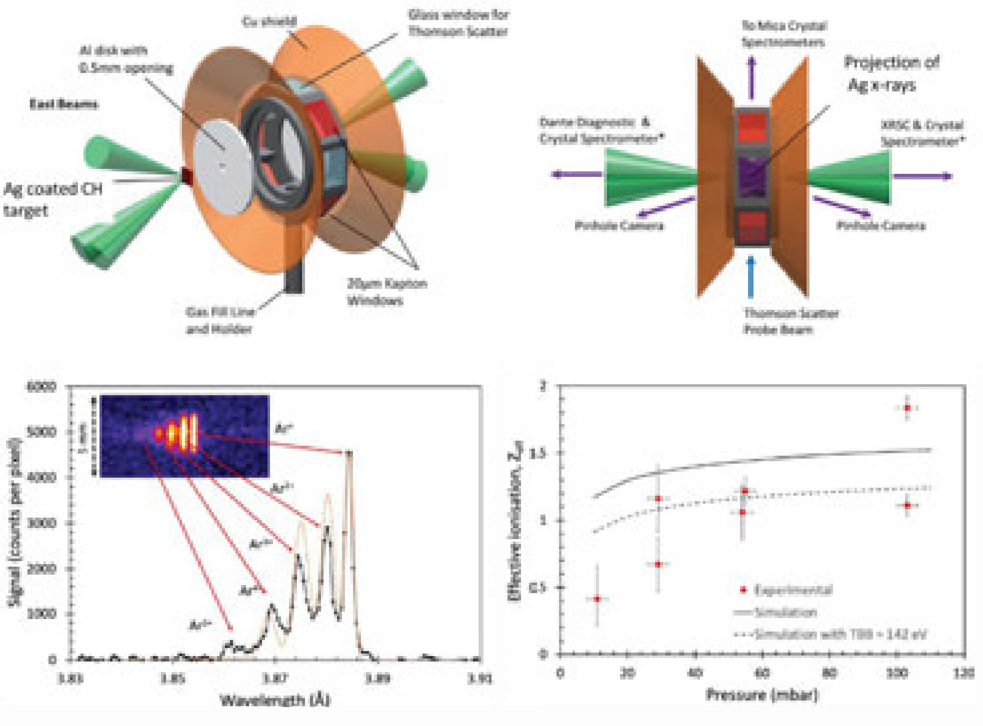


*Top: Gas cell target for photoionisation experiment. The Ar gas fill varied from 10-500 mbar. The end windows were CH coated with Ag. L-shell x-rays from the Ag photoionised and heated the Ar plasma.*

*Below Left: A spherical crystal spectrometer was used to spatially resolve the K-β fluorescence.*

*Below right: The fluorescence was used to estimate an effective ionisation state that could be compared to simulation using an in-house time dependent code.*