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Laboratory Astrophysics - Cold Absorption

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The ability to create plasma sources similar in nature to astrophysical sources, but scaled to the laboratory, is extremely challenging. Specifically, photo-ionized plasmas that are common around black-hole accretion sources, nebulae and the cold interstellar medium, require powerful radiation sources that are not usually accessible in the laboratory. This leaves the photo-ionized plasma models and codes used by astrophysicists with severe uncertainties.
In the following study, we use a high-energy current generator combined with a gas-puff z-pinch load, to create a controlled X-ray source. The source is used to photo-excite and photo-ionize cold gas of astrophysical abundant elements such as oxygen and nitrogen in vacuum. We developed a spectroscopic apparatus dedicated to measure absorption spectra from which we calibrate atomic and molecular electronic transitions, coefficients, wavelengths, oscillator-strengths and cross-sections of the cold absorber. These measurements can be used to mitigate the lack of accurate atomic data in these elements, which is specifically important to better analyze many astrophysical spectra.
The experimental plasma source, the diagnostic system, and preliminary results of the X-ray source characterization will be presented.

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