

# Photoionization of Neutron-Capture Atomic Ions for the Determination of Elemental Abundances in Planetary Nebulae

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Photoionization of atomic ions is a highly selective probe of atomic structure. A powerful tool for exploring these interactions in the laboratory is *photo-ion spectroscopy*, where a beam of ions is merged with a beam of monochromatized synchrotron radiation. In the present proposal, a systematic study of absolute photoionization cross-section measurements of select neutron-capture elements will take place at the Advanced Light Source (ALS) at Lawrence Berkeley National Laboratory in Berkeley, California. The precision photoionization spectra that result are vital to the development of theories of stellar evolution, which in-turn are essential to the understanding of the chemical evolution of the Universe. Precision photoionization spectra are also the accepted benchmarks against which the most advanced numerical atomic codes are tested, codes which are used to accurately model the behavior of heavy and highly complex elements. The ability to model such elements is instrumental in the ongoing development of both theoretical and observational astrophysics. Of particular importance to both astronomers and computational theorists is the energy-resolution of the photoionization spectra they rely on. In that regard, the milli-electron-volt energy resolution of the Ion-Photon-Beam Endstation at Beamline 10.0.1 of the ALS is unparalleled in the fields of UV and soft X-ray spectroscopy. The proposed project therefore represents a unique opportunity for one of Montana's leading universities to make significant contributions to some of the most fundamental goals of NASA's ongoing scientific mission, while exposing University of Montana students to a world-renowned research facility at one of our country's leading laboratories.

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