The Atomic and Ionic Data for Astrophysics (AIDA) Project at Georgia State University

Steven T. Manson*

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Abstract

Data on atoms and ions that are present in astrophysical objects are crucial to interpreting astronomical data and, thereby, crucial to the understanding of these objects and the ultimate success of NASA missions. Among the most important data are photoionization rates (cross sections) of atoms and ions and the relaxation of the photoionized ion to the ejection of one or more photoelectrons. This relaxation is of critical importance for inner-shell ionization after which the photoion decays *via* either radiation (typically in the far UV or x-ray range), or radiationless Auger decay accompanied by the emission of an Auger electron (usually a quite energetic electron.

At Georgia State University, there is a long history of calculations of atomic and ionic photoionization cross sections, along with the resulting relaxation processes, spanning five decades. Many of these calculations have been performed with an eye towards astrophysical applications. In the course of this work, an array of state-of-the-art methodologies have been developed to perform the photoionization calculations, e.g., R-Matrix (in a number of different forms including the Breit-Pauli and Eigenchannel versions), Relativistic Random Phase Approximation (RRPA) and the associated Relativistic Multichannel Quntum Defect Theory (RMQDT), Randon Phase Approximation with Exchange (RPAE), and Augmented Many-Body Perturbation Theory (AMBPT). This arsenal of methodologies has allowed us to fit the methodology to the problem, not the other way around. In addition, the variety of methodologies allows us to provide "quality control" for our results. Furthermore, we work in close collaboration with experimenters for the ultimate "quality control".

This work has morphed into the AIDA project at present. Here we are concerned with providing accurate photoionization data to the astrophysical community on both inner shells and outer shells of ground and metastable states of atoms and ions of astrophysical interest, eventually posting the data on an AIDA web site. Some examples of our recent results will be presented along with a prospectus of future calculations.

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*Georgia State University