

Abstract for an Invited Paper  
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**Contemporary theoretical methods to treat atomic processes in gaseous and plasma environments: Heavy particle collisions studied using supercomputers**  
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Interactions among photons, electrons, ions, atoms, molecules, and surfaces are ubiquitous within gaseous and plasma environments and their detailed description is fundamental to understanding and controlling these scientifically and technologically important states of matter. Reaching a more accurate and comprehensive knowledge of such atomic processes has been greatly aided by use of contemporary computational resources and through a close interplay with advancing experimental techniques. Following an introduction to atomic processes in gaseous and plasma environments and of methods used to solve the heavy particle collision problem, recent studies will be described which have been enabled by massively parallel computer solutions.