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Atomic Astrophysics in 3-D: Discovery, Data and Diagnostics

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For the foreseeable future, new ground- and space-based instruments, with higher spectroscopic resolution and greater sensitivities, will discover new astronomical phenomena, creating a continuing demand for rigorous atomic and molecular studies to provide understanding of the underlying astrophysics. In order to deduce the physical conditions of astronomical objects, astronomers use diagnostics such as spectral line ratios for key atomic or ionic species, together with increasingly complex models, involving millions of spectral lines. Atomic physics data of unprecedented accuracy is critical to this enterprise. Several recent examples of atomic collision processes important to understanding astronomical observations will be given.