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Atomic & Molecular Data for Space Astronomy: Needs & Availability

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## ATOMIC AND MOLECULAR SPECTROSCOPIC DATA FOR SPACE ASTRONOMY: NEEDS AND AVAILABILITY

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Most of our information about the Universe comes to us in the form of photons. In order to understand the messages they carry with them, we must study the origins of the photons and work out their histories as they journeyed through space. By analysis of the events in which the photons participated, we can construct pictures of the diverse physical and chemical environments and processes occurring in the Universe and we can learn about the nature of the astrophysical entities in which the photons were created.

Because many of the astronomical photons are absorbed or redirected by the Earth's atmosphere, space-based observing techniques have been developed and refined over the past several decades. The 1990's will see the launch of a number of important new space astronomy missions that will produce vast amounts of high-resolution spectral data.

Space astrophysics missions are conspicuous engineering efforts, and, as a consequence, instrument signals are sometimes equated with scientific success. In fact, however, the interpretation of the measurements will require a comprehensive base of accurate fundamental atomic and molecular spectroscopic data. Accurate atomic and molecular wavelengths, energy levels, transition probabilities, cross sections, and reaction rates, as well as information about surface and bulk properties of materials, must be employed in the transformation of electronic signals into scientific knowledge and for the quantitative comparison of models of astrophysical and astrochemical phenomena with the observational data. The accuracy with which physical and chemical conditions can be inferred for objects studied by astronomers depends directly on the breadth and accuracy of the fundamental atomic and molecular data.

The Joint Commission Meeting on *Atomic and Molecular Data for Space Astronomy: Needs and Availability* was an opportunity for the space astronomy community to present their detailed atomic and molecular spectroscopic data requirements to the producers of such data so that future laboratory work can be channelled in appropriate directions. Complementary presentations summarized the status of atomic and molecular spectroscopic

databases and introduced important new data-generation projects to the space astronomy community.

The speakers emphasized the importance of accurate atomic and molecular data in the analyses of astronomical observations, identified examples of inadequacies in the existing data, and urged renewed support for measurements of atomic and molecular spectroscopic parameters.

The abstracts that follow are supplemented by extended papers (Smith and Wiese, 1992).

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