

Conference Highlights

Spectroscopic Challenges of Photoionized Plasmas¹

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The conference “Photoionized Plasmas 2000: The Challenge of High Resolution X-Ray through IR Spectroscopy of Photoionized Plasmas” was held on 2000 November 13–17 at the Lexington campus of the University of Kentucky. Sponsorship for the conference was provided by the NASA Applied Information Systems Research Program and by the University of Kentucky. Conference participants came from Australia, Brazil, Canada, Denmark, France, Germany, India, Ireland, Israel, Kazakhstan, Mexico, the Netherlands, Northern Ireland, the United Kingdom, and the United States. There were a total of 83 participants.

This conference was the third in a series which begin in 1985 with a meeting on modeling ionized nebulae in Meudon, France. The second meeting was held in 1994 at the Lexington campus of the University of Kentucky and was in conjunction with the 70th birthdays of Professors Donald Osterbrock and Michael Seaton. The timing of this third conference was motivated by recent advances in observational astrophysics.

With the recent launches of *Chandra* and *XMM-Newton*, high-resolution spectroscopy of photoionized plasmas at X-ray energies has become routine. *HST* and *FUSE* make the vacuum ultraviolet readily accessible. Ground-based optical telescopes can now obtain spectra of faint galaxies at the very edge of the visible universe. And within a few years *SOFIA* and *SIRTF* will routinely provide high-resolution spectra in the mid- and far-infrared regions. Understanding the astrophysical messages contained in these spectra makes unprecedented demands on our understanding of atomic processes and our ability to simulate conditions in these nonequilibrium plasmas.

This meeting brought together developers of plasma emission codes, experts in atomic physics and radiation transport, and the observers who are working to unravel the message in the spectrum. A broad range of physical processes determine the observed spectrum, and a complete simulation of the plasma is an intricate computational problem. The

physical state of the gas is often determined by processes at the frontiers of theoretical and experimental atomic physics. Both the simulations and the atomic physics are driven by the need to understand new observations.

The main goals of the meeting were to identify current uncertainties and future needs and to promote research in quantitative spectroscopy. A number of questions received considerable attention. Here we list some of these questions:

Atomic physics.—How is our understanding of fundamental issues in astrophysics limited by existing uncertainties in our understanding of atomic physics? How do these uncertainties affect the ability to interpret the spectrum? What are the greatest needs for future work? What is the current status of the atomic database?

Radiative transfer.—Many plasmas are optically thick. Most plasma codes either neglect radiation transport (RT) or use escape probabilities. As machines grow ever faster, it will soon be possible to do exact RT. How do the current treatments compromise the simulation, and what exact RT methods should be employed? Time dependence and hydrodynamics are all important in sources and must be considered.

Plasma emission codes.—What is the current status of plasma emission codes? What are the sources of disagreement? We will establish a new set of benchmarks in the spirit of the 1994 Lexington meeting.

Observations.—What spectroscopic observations will be possible with current and upcoming instrumentation? What is needed from the atomic physics and plasma simulation communities to understand the messages in these spectra?

Extensive review talks of 40 minutes each were given by the 16 invited speakers. There were six atomic physics talks, six talks relating to the plasma emission codes and radiative transfer, and four observational talks. In addition, there were a total of 40 poster presentations.

The conference proceedings contains contributions from all 16 of the invited speakers and many of the poster presenters. The proceedings are intended as both a reference for where we are today and an outline for future progress.

¹ Conference was held in Lexington, Kentucky, on 2000 November 13–17. Proceedings will be edited by Gary Ferland and Daniel Wolf Savin and published in the ASP Conference Series.