A Tribute to Bob Kurucz

This meeting honors Bob Kurucz. We have all visited Bob's web site which is a portal to marvelous stellar related data, models, programs, and information. Bob has an AB from Harvard College in 1966 and a Ph.D. from Harvard University in 1973. Except for some time at Kitt Peak National Observatory in Tucson and in San Diego where he obtained the computer time to calculate his odf's and grids of line blanketed model atmospheres, his professional career has been spent at Harvard and at the Smithsonian Astrophysical Observatory in Cambridge, MA. Most of that time he has been a Physicist at the Smithsonian Astrophysical Observatory. Bob lists some 160 papers. He has consistently done excellent science on soft money support. In 1992, he was presented with the George van Bieasbroeck Prize of the American Astronomical Society that honors a living individual for a long-term extraordinary or unselfish service to astronomy.

Beginning about 1972 Bob regularly distributed his codes and models on 7 track, 800 bpi tapes and later on 9 track, 1600 bpi tapes. Twenty years later beginning in 1994 came his famous set of CDs. With the advances of the internet now we can get most of his programs, models, and atomic data via ftp. This extraordinary generosity has produced a community of extremely grateful astronomers. If Bob had asked each to include his name as a coauthor on the first paper with one of his codes, the number of papers attributed to him would be very much larger than 160. His number of literature citations to his work is about 18,000 on the ADS.

Bob has always been willing and has tried to answer intelligent questions about his programs.. He has served and continues to serve as a role model for others who have distributed their codes, models, and data as freely as he. Let all of us resolve to follow his example in this regard to the greatest extent possible.

When historians of astronomy study stellar astronomy in the last 35 years, I am certain that they will unanimously conclude that Bob Kurucz has been the most important investigator in this and related fields. His contributions to our field of astronomy have been so immense that it is somewhat difficult to appreciate their enormity. Chuck Cowley told me of an incident in the 1970's. When he mentioned Bob's name, the colleague responded "Oh, yes, the fellow who produced 265-thousand f-values". Instead of this being said with genuine awe, the colleague suggested by tone and by manner that this effort was somehow a misuse of time. Chuck later realized that this particular colleague and some others simply lacked a grasp of the problem of the analysis of stellar spectra, of the significance of Bob's accomplishments, and/or of the virtuosity involved in bringing it about. Bob has usually been far ahead of our field in anticipating problems that would likely arise.

Bob has made contributions to several interrelated areas that I categorize for convenience as model atmosphere and synthesis codes, stellar spectra, atomic spectra, and molecular spectra. His accomplishments in any of these fields alone represent a commendable career achievement for a single individual. That Bob has made significant progress in all of the areas is remarkable.

His ATLAS and its auxiliary codes have been used for a very large number of studies. These programs have been ported to many different platforms since 1970 and now to LINUX. Bob's subroutines have been borrowed for many other codes. His model atmospheres have been used as input for additional codes including for example, those that then add on additional physical considerations. His line lists have been the basis of many other line lists. Unfortunately some of them have been distributed with different names and formats without substantial changes.

In 1970 when Bob published his ATLAS Smithsonian Astrophysical Special Report 309, there were many plane parallel atmospheres codes. ATLAS included hydrogen-line blanketing in its models, which was a considerable improvement. Soon after a copy reached Caltech along with a copy of WIDTH, stellar investigators, especially those who were calculating abundances and trying to fit spectrophotometric observations tried it. A. R. "Harry" Hyland, then a Post-Doctoral Investigator, told me that these codes were the best available and I should use them for my thesis research. He also had a small grid of models that I could use. I looked at the computer code, parts were straightforward to follow, but then there were the space saving features that illustrated how good a programmer Bob was. I saw more than one programming guru marvel at them and scratch his/her head trying to figure their logic.

I used these codes for my own thesis and then reanalyzed two stars that I done using older codes. About the time Bob received his Ph.D. in 1973, my first abundance determination papers were accepted by the Astrophysical Journal. I was not alone. The availability of a fast model atmospheres code that included hydrogen-line blanketing with a grid of models and useful auxiliary programs converted many adherents of other codes to Bob's.

Another important aspect of Bob's research has been the extremely extensive calculations of semi-empirical gf values and line broadening parameters using the Cowan code. The experimental determination of gf values of lines of particular interest has always lagged behind the desires of astrophysical spectroscopists in number and in accuracy. Theoretical calculations have been a major means to close the gap. Bob has encouraged those atomic physics colleagues who determine energy levels to find more levels and classify them correctly. The effect on his successive calculations has been for his values to become successively closer to the best experimental values and to reduce systematic errors. This work has affect investigations of all kinds of stars.

In the 1970's a major line of investigation was how to include the effects of metal lines in stellar atmospheres. Part of the problem concerned including all of the lines not just those that had been discovered or predicted by atomic physicists. Bob's massive calculations for those elements that were most likely to contribute provided vital information as to the size of the effect. A number of approaches were tried. Bob's use of opacity distribution functions provided a workable method in the ATLAS9 code published in 1979. As we well know an alternative approach, the opacity sampling technique is used in ATLAS12. But the computers had to grow in power so that more than just those with access to the largest computers could use this method.

I spent four years at Boston University in the mid 1970's and on occasion visited the Smithsonian Astrophysical Observatory. I remember coming into Bob's office for the first time. In one little corner was Bob and his terminal. The rest of the place was overfilled with paper, plots, and punch cards up to the ceiling. The mass per square meter of office space was well into that what one found for well stocked libraries. In those days when Bob went to a meeting a subset of his work consisting mostly of plots to be shown and discussed accompanied him. He drove if at all possible to astronomical meetings as he did not want to par down below the level necessary to answer 99+% of the questions he might encounter on a wide range of problems.

With the increase in computer power, more of the stellar analysis community can afford to calculate their own model atmospheres and to synthesize spectral regions rather than just derive abundances via equivalent widths. SYNTHE (Kurucz & Avrett 1981) has become an extremely useful and vital tool. For example, I regularly use it to calculate regions centered on Balmer lines so that I can include the effects of metal line blanketing when I compare predictions with observations.

Much of Bob's research has concerned the solar spectrum. His work has illuminated the role of line blanketing in solar-type stars. His calculations and his inclusion of the work of molecular spectroscopists has kept ATLAS models useful particularly when the molecular spectra do not dominate the atomic spectra.

Bob has followed carefully the changing determinations of the solar abundances. Successive grids of model atmospheres have reflected these changes.

As we should have known, Bob still has major projects that he would like to complete, for example, the line calculations and the solar irradiance spectra. I suspect that there are many others. Let us wish Bob, continued health, lots of computer time and the support to bring these to completion.

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