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INTRODUCTION

Accurate calculations of stellar envelope opacities are vital if realistic structure, evolution and pulsation models are to be computed for stars of all spectral types. Opacities from the Los Alamos Astrophysical Opacity Library (LAAOL) by Huebner *et al.* (1977, *Los Alamos Scientific Laboratory Report* LA-6760-M) have been almost universally applied although the atomic data used as a basic ingredient have themselves been computed, in many cases, with the crude methods in use (necessarily) before the advent of modern supercomputers. Carson & Hollingsworth (1968, *Mon. Not. R. astr. Soc.* **141**, 77), for example, critically examined the validity of the hydrogenic approximation in the evaluation of atomic energy levels and radiative absorption cross sections used in such opacity calculations.

Nonetheless, with a few notable exceptions, LAAOL opacities resulted in models that appeared to give a satisfactory agreement with observation. The long-standing difference between cepheid masses inferred from pulsation models and evolution tracks—both computed with LAAOL opacities—is one such exception. The suggestion by Simon (1982, *Astrophys. J.* **260**, L87), that increasing the metal contribution to the total opacity by a factor of 2–3 would remove this discrepancy, therefore attracted immediate attention. It was clearly important to check Simon's conjecture as there were implications for stellar evolution and the distance scale.

The origin and magnitude of any increased metal contribution to the total opacity had to be identified through accurate atomic physics calculations and detailed consideration of the equation of state. Seaton (1987, *J. Phys. B* **20**, 6363) proposed the calculation of the required atomic data by *ab initio* methods, and launched an international collaboration that became known as the Opacity Project (OP). An independent project was started by Iglesias *et al.* (1987, *Astrophys. J.* **322**, L45), often referred to as OPAL, where the atomic data are computed using parametric potentials. Moreover, different formalisms of the equation of state are used in the two calculations. The "chemical picture", in which bound systems are interpreted as autonomous species with reactions between them, has been adopted by the OP following Mihalas *et al.* (1990, *Astrophys. J.* **350**, 300). OPAL opacities are based on the "physical picture", where an activity expansion is used and only fundamental species (electrons and nuclei) are explicitly treated as described by Rogers (1986, *Astrophys. J.* **310**, 723).

Line blanketing by molecular lines is known to dominate the opacity in the outer layers of cool stars. Eriksson *et al.* (1984, *Astron. Astrophys.* **132**, 37) have shown that, in the case of carbon stars, polyatomic molecular line blanketing is sufficient to radically alter the structure of the atmosphere. The computation of molecular data for opacity calculations presents an even greater challenge than the computation of atomic data required for the OP and OPAL work.

Preliminary results by both OPAL and OP indicate that Simon's (1982) prediction is broadly correct. Because of the consequent requirement for a careful comparison of the approximations and results of the two projects, together with a need for more comprehensive reviews of the astrophysical implications and of new molecular work, research groups actively involved in the calculation of astrophysical opacities and related problems agreed that a meeting would be timely.

The resulting Workshop on Astrophysical Opacities (WAO) took place at the IBM Venezuela Scientific Center in Caracas during the week (15–19 July 1991) immediately before the 21st General Assembly of the International Astronomical Union held in Buenos Aires, Argentina. The proceedings of the WAO are published in this special issue of the *Revista Mexicana de Astronomía y Astrofísica*. The WAO was held with the financial assistance of IBM Venezuela, Fundación Polar and the Venezuelan CONICIT; the latter through bilateral agreements with the Centre National de la Recherche Scientifique (CNRS) of France and the Royal Society of London. Part of the editorial work for this proceedings was carried out at, and funded by, the Observatoire de Paris, Meudon, France. The Editors, on behalf of all participants, would like to gratefully acknowledge this generous support. Thanks are extended to Joy Seaton, Rolando Peña, Nelson Garrido and Alejandro Otero's succession for donating artist's impressions and a group photograph to these proceedings and to Maricel Nunes for assistance in the organization of the meeting.

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