PREFACE

"If simple perfect laws uniquely rule the universe, should not pure thought be capable of uncovering this perfect set of laws without having to lean on the crutches of tediously assembled observations? True, the laws to be discovered may be perfect, but the human brain is not. Left on its own, it is prone to stray, as many past examples sadly prove. In fact, we have missed few chances to err until new data freshly gleaned from nature set us right again for the next steps. Thus pillars rather than crutches are the observations on which we base our theories; and for the theory of stellar evolution these pillars must be there before we can get far on the right track."

These words written by Martin Schwarzschild in his famous book entitled "Structure and Evolution of the Stars"(1958) remind us how necessary and fruitful is the interplay of stellar evolution theory and observations. Clearly, observations are the great censor by their possibility of confirming or contradicting theoretical constructions. In addition, they have a driving role: new and sometimes unexpected facts may give rise to progressive ideas and stimulate further theoretical developments. In turn, theory, in its major role of sifting out and placing the facts in a logical sequence based on physical laws, must also be predictive and indicate new and pertinent observations to be undertaken. The aim of this Symposium is to favour these interactions, which means comparing the numerous recent results in ground-based and space observations of stars in our Galaxy and in external galaxies with the considerable developments of evolutionary models. The period of evolution considered here covers the zero-age sequence to the pre-supernova stage, or pre-white dwarf stage, according to the initial mass considered; the cases of star formation and compact stars have already been treated in other IAU symposia.

From the middle of the sixties the appearance of the second generation of computers prompted several groups to start massive calculations of stellar evolutionary sequences. Progress in this field has been steady over the past 20 years, and it is now currently feasible (at least in principle, but often also in practice) to compute in just one "run" the whole evolutionary history of a model star, from its pre-main sequence stage, to its final fate as either a white dwarf or a supernova explosion.

These models exhibit a close "resemblance" to real stars: for example, they also become red giants, expose at some stage nuclearly processed materials, produce planetary nebulae, or end their career with

violent hydrodynamical events. In this respect the theory is highly successful. But a closer, finely quantitative comparison with the observations may often reveal subtle differences between model and real stars. A first question to raise when such a disagreement is perceived should be: are the "observations" correct? Indeed, quite often the procedure of distilling physically interesting quantities (e.g. temperatures, luminosities, abundances, etc) from the brute data (magnitudes, spectra, etc) is highly indirect, involving other theoretical tools and assumptions, which, in turn, may well be at least as imperfect as the current theory of stellar structure and evolution. Anyway, when the existence of some serious disagreement is unambiguously established, the reliability of the models is called into question, and cures and refinements have to be found.

The astrophysical interest in such a cross-check between theory and observations is at least twofold: first, we would like to fully understand every detail of how stars evolve and die, and, second, we are very interested in applying the predictions of the stellar evolution theory as a useful tool in a large variety of astrophysical fields (like age determinations and their implications for galactic dynamics and cosmology, stellar statistics, spectral and chemical evolution of galaxies, etc). This symposium on "The Observational Tests of the Stellar Evolution Theory" was conceived and organized in precisely this spirit, with its main goal being a collective assessment of the reliability of current evolutionary models. Obviously, the conclusions on this issue cannot be but very complex and/or rather problematic: they just form the matter of these proceedings!

The Symposium was organized about a series of review lectures followed by contributed talks, and about a particularly exciting and numerous poster session. Some 140 participants from 25 countries attended the meeting which was lively and successful. The local organization was undertaken by the staff of Geneva Observatory and the Astronomical Institute of the University of Lausanne who we would like to thank for their help. In particular, we express our gratitude to Mrs M.-L. Zeier for her efficiency and administrative ability during the preparation and the meeting and for her help in editing the proceedings. We are grateful to Mr. J.-F. Bopp for his valuable technical assistance in the organization. We are deeply indebted to the following organizations and institutions who gave generous financial support:

- The International Astronomical Union
- The Swiss National Science Foundation
- The Swiss Academy of Sciences
- The Faculty of Sciences of Geneva University
- The Swiss Bank Corporation

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