1. INTRODUCTION

https://doi.org/10.1017/S0074180900116420 Published online by Cambridge University Press

INTRODUCTORY OVERVIEW

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Abstract. The subject of this meeting is the confrontation between precise observational and theoretical determinations of fundamental stellar properties. Its goal is to better define the limits of our present understanding of the structure and evolution of stars, and of our own and other galaxies. That goal is not approached by keeping to the "safe" side of the border: The areas where significant *dis*agreement is found between the best observations and the best theories also show the directions where progress is to be made.

1. Introduction

It is a privilege to introduce this IAU Symposium in honour of Professor Hanbury Brown's 80th birthday, on a subject also close to my own heart. His own work with the Narrabri Intensity Interferometer is, of course, an established classic in the field, and the many references to it throughout this meeting show it to be still very much alive today. Moreover, his group – our hosts – has remained in the forefront of stellar interferometry ever since, and results presented at this meeting show the field to be poised for another breakthrough in the next few years. No doubt, fascinating results from optical interferometers – some of them fed by 8-10 m telescopes – will feature prominently on the programme when we meet here again in 2007 in honour of Professor Hanbury Brown's 90th birthday!

The subtitle of the meeting reminds us that the observational determination of fundamental stellar properties is not a goal in itself: The results only become really interesting when placed in a larger astrophysical context. Keeping in mind what today's burning questions are helps us to focus

T.R. Bedding et al. (eds.),
Fundamental Stellar Properties: The Interaction between Observation and Theory, 3–6.

our efforts on obtaining the data that will be needed to answer them: *Which* fundamental stellar parameters are needed to answer this question? *How accurate* must the results be to be useful? *Which other types of data* will be needed to apply the results in the most meaningful way? *How are they analysed* to produce the most interesting astrophysical results?

While in the heat of the battle, it is natural to focus on how to best carry out the work – how to find "the right answer" to the initial question. But in lucky cases, when the observations are sufficiently accurate, what one finds is that, in fact, the *question* was wrong, based on an inadequate theoretical framework. And one is reminded that the most interesting progress is made by looking for the right questions rather than for the right answers.

2. A Few Examples ...

A few examples, immodestly drawn from my own experience, will serve to illustrate the point. As is natural for a meeting on fundamental stellar properties, they will pertain directly to such aspects of stellar astrophysics as stellar atmospheres, compositions, structure, end evolution. Yet, as the interaction between observations and theory has advanced our understanding of these subjects, the ramifications to the larger picture of the formation and evolution of galaxies and the synthesis of the chemical elements has become ever clearer and more important.

The first review at the very first IAU meeting I ever attended (Popper, 1970) discussed new fundamental results on stellar masses and radii in the context of the then vigorously developing theory for the evolution of single and binary stars. An immediate result from these accurate data was the demise of the long-cherished notion that mass and radius are strict functions of spectral type or colour for main-sequence stars, a lesson that took another 20 years to be fully appreciated (Nordström, 1989). More significantly, the general feeling at the time, that the "Algol paradox" had been solved by the theory of mass exchange in close binaries, was shattered shortly after when Refsdal et al. (1974) found no models which could account for the first precise fundamental data for an actual Algol system (Popper, 1973), highlighting the shortcomings of the theory at the time.

The chemical evolution of our own Milky Way galaxy provides another set of examples. The key fundamental stellar properties in this context are ages, detailed element abundances, and galactic orbital parameters derived from observed positions and space motions. These were determined for a number of disk F dwarfs by Edvardsson et al. (1993) with sufficient accuracy that "the" age-metallicity and other key relations predicted by chemical evolution models for the local disk could be defined with superior precision. The results, however, showed that the basic concept of a well-

defined age-metallicity relation for the solar neighbourhood, and with it the basic paradigm for standard models of its chemical evolution, is inadequate in the real galaxy. Yet, individual element ratios were found to be surprisingly tight functions of overall metallicity and galactocentric distance, in ways that will strongly constrain more realistic physical models of nucleosynthesis in the galactic disk. This result was found later to apply also to nearby stars of metallicities down to those of the most metal-poor globular clusters. Yet, through very careful spectroscopy, Nissen & Schuster (1997) have recently uncovered subtle abundance anomalies in one group of halo stars, characterised by outlying orbits, which may hold important clues to the processes by which the halo was assembled. Similarly, the highly unusual abundance patterns recently found in the most metal-poor halo stars (Sneden et al. 1996, Barbuy et al. 1997) tell us that nucleosynthesis in our galaxy proceeded very differently before and after the stage when globular clusters were formed.

Finally, noting that the precise sequence in which the major components of the Milky Way galaxy were assembled – and how – remains uncertain even today, the value of precise stellar data in establishing a reliable age scale for galactic stars is worth recalling. That precise knowledge on such fundamental stellar properties as cluster membership, duplicity, and mass is important when testing stellar models for this purpose is, in retrospect, not really surprising. However, the example presented at this meeting (Nordström et al., 1997) shows not only how imprecise broad-band photometry, neglect of interstellar reddening, and subjective membership assignments may conspire to make the age of a supposedly "classical" open cluster uncertain by a factor of four, but also provides a striking reminder that the stellar content of a present-day cluster may be but a faint shadow of the original population.

3. ... and Let's Get Started!

Over the next few days we will hear many new and interesting results, and some long-standing discrepancies between observations and theory will no doubt be shown to have been reduced or eliminated. However, let us not get swept away with contentment, but keep the border to the unknown within sight, not only within the field of stellar astrophysics *per se*, but also in those other major fields of contemporary astrophysics where our results are perhaps less directly visible, but nonetheless crucial. I look forward to five days of pleasant, constructive, and harmonious disagreement!

Acknowledgements I am delighted that Dan Popper can be with us at this meeting: My own presence here is a direct consequence of his own review

28 years ago. Financial support from the Danish Natural Science Research Council and the Carlsberg Foundation for the research discussed here is gratefully acknowledged.

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