INTRODUCTION

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The aim of IAU Symposium 145 was to use the photospheric abundances of the chemical elements to give us some hint of the past evolution and of the current structure of stars. At the invitation on the *Bulgarian Academy of Sciences*, it brought together one hundred and fifty one scientists from 21 countries to *Zlatni Pjasaci (Golden Sands), Bulgaria,* for a five day meeting.

The processes discussed included accretion, mass loss, mass exchange, convection, turbulence, meridional circulation, and diffusion in addition to nuclear reactions.

Observationally, spectroscopy was involved. New telescopes and instruments have considerably extended the scope of spectroscopy over the last few years. Space telescopes, such as IUE, have allowed the development of far UV spectroscopy. The access to the infrared has proven critical for probing cool stars. Large ground based telescopes have allowed fainter objects to be observed especially when they are equipped with more efficient detectors such as CCDs and Reticons. The co-adding of digitalized photographic plates has extended their usefulness. It has become possible to make high resolution, high signal to noise observations of objects that could only be observed at low resolution in former days. Weak lines can now be measured with accuracy, allowing the precise determination of the abundances of elements as rare as lithium and the determination of precise limits to isotopic ratios. For more abundant elements, such as iron, the possibility to measure weak lines means that the analysis is less hampered by NLTE effects and by such poorly known parameters as microturbulence. Synthetic spectra have enhanced our analytical capabilities. Larger telescopes are currently being built and they promise major new developments.

The objects discussed included main sequence stars, giants, supergiants, planetary nebulae, horizontal branch stars and white dwarfs. Both Population I and II were discussed. Chemical abundance anomalies appear throughout the main sequence. On the cooler main sequence stars, except for galactic evolutionary effects, abundance variations are the exception, but the D, Li and Be underabundances and ^{3}He excesses offer a test of our understanding of turbulence and convection zones. Among upper main sequence stars, the contrast is stark. Metal to iron variations are the rule rather than the exception and the anomalies are by more than one order of magnitude. They are seen up to T_{eff} = 25000 K in the *He rich stars*.

Next, the effect of nuclear reactions appears on giant stars as well as on asymptotic giant branch stars. Numerous effects lead to a wealth of objects such as carbon, S, s-process element giants as well as OBN, OBC and MS stars.

G. Michaud and A. Tutukov (eds.), Evolution of Stars: The Photospheric Abundance Connection, 1–2.

The abundance anomalies found in upper main sequence stars are in some respect similar to those found in evolved, cool giant stars. Nuclear processing plays a key role in the latter, while in the former, chemical separation dominates. In both cases, the abundances change during the star's lifetimes, and the degree of anomalies is determined by unseen and poorly understood hydrodynamical processes within the interiors. A wealth of information, contained by abundance anomalies, fixes otherwise free parameters of models.

Then some stars go through the planetary nebula phase to become white dwarfs as well as through the horizontal branch and may become sdO, sdOB and sdB stars. In each of these phases, the surface abundances are determined by the past evolution and present structure, involving numerous physical processes. For example, in the planetary nebulae, sdB, sdOB and white dwarf phases, diffusion plays a role in addition to nuclear evolution.

While the surface abundances of chemical elements had been discussed before in a number of objects in many separate colloquia and symposia, rarely had they been discussed simultaneously in a large number of objects with the intention to determine the effect of the various processes in different environments. The emphasis was usually put on the evolution of the abundances as caused by nuclear reactions. Usually this was done in one specific type of object such as white dwarfs or giant stars. The relation between the abundances observed on many different objects had not been sufficiently studied. The effect of the various processes, in particular non nuclear, on surface abundances had not been studied concurrently. In meetings on Ap stars, the effects of diffusion had been studied, and so had they been studied on meetings on white dwarfs, but never had they been studied together in the same meeting. Particle transport clearly is important to bring the results of nuclear reactions to the surface of giant stars, but never had this been discussed at the same time as the effect of particle transport processes that create other anomalies.

This meeting brought together experts on different topics of modern stellar abundance and evolution. They discussed their results for the first time on so wild a field. The following pages clearly show that the forthcoming possibility to do high resolution, high signal to noise observations of faint stars will challenge our understanding of the interaction between hydrodynamical processes, particle transport and nuclear reactions taking place in the interior of stars.