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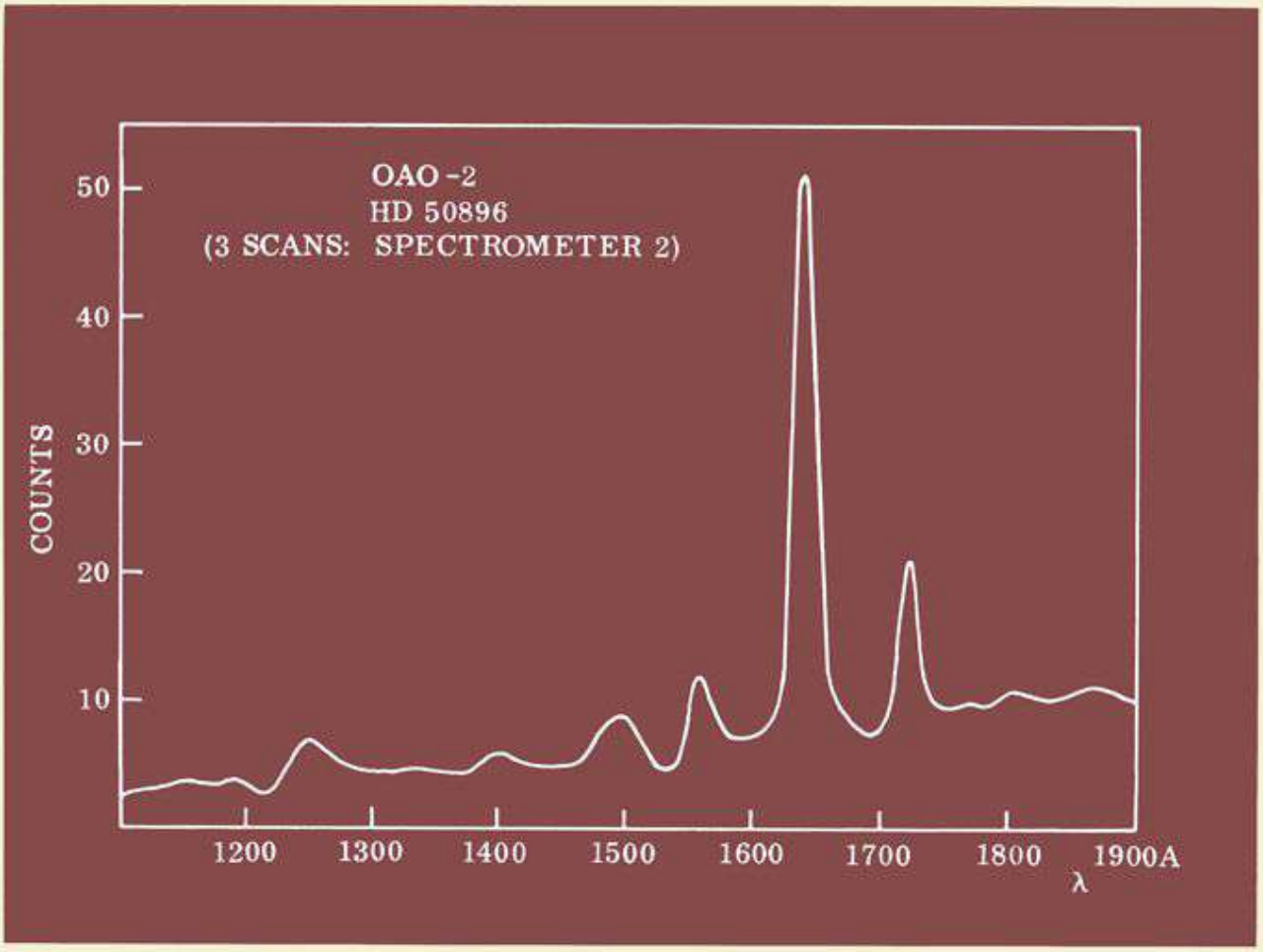
WOLF-RAYET AND HIGH-TEMPERATURE STARS

Edited by M. K. V. BAPPU and J. SAHADE



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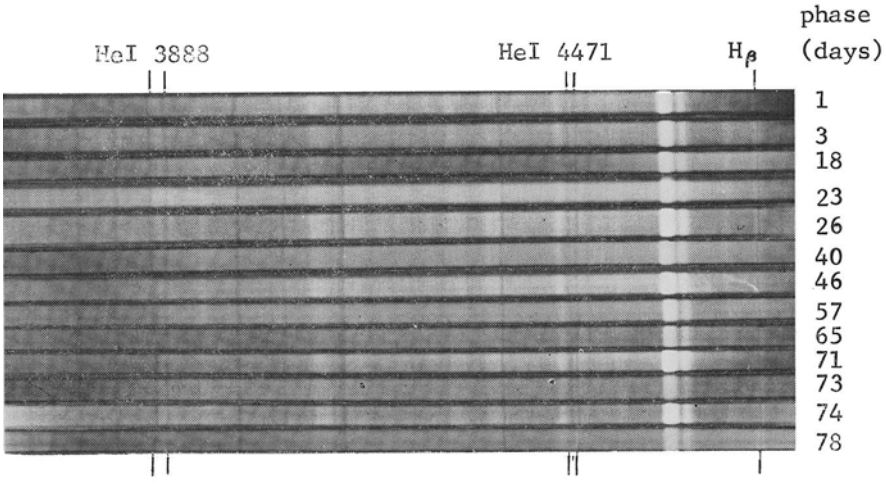

γ_2 Velorum 1919

Some spectra of γ_2 Velorum taken by Perrine in 1919, showing the violet-shifted, variable absorption edge of the He I 3888 line.

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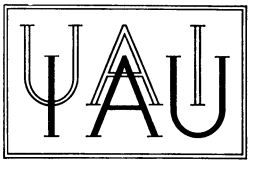

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This volume is dedicated to

C. S. BEALS

B. EDLEN

CECILIA PAYNE-GAPOSCHKIN

P. SWINGS

For their contributions to our present degree of comprehension of Wolf-Rayet Spectra

PREFACE

We have in this volume, compiled a connected account of the proceedings of the Symposium on Wolf-Rayet and High-Temperature Stars held at Buenos Aires. The Organizing Committee had assigned broad areas of topical interest to be reviewed by invited speakers. Each of these presentations was followed by lengthy discussions that were tape recorded and transcribed later. These discussions have been edited only to a limited extent. We have shortened them and rearranged them to bring about a greater coherence. We have, however, attempted to retain the tenor of the discussions, the flavour of impromptu remarks and the continuity of an argument. Much of the success of such a venture depends on the contributors to the discussions. To be able to make these thoughts available to a larger audience has been the task of those responsible for the elaborate tape recording of the proceedings. We thank those at the Instituto de Astronomía y Física del Espacio for the efficient way in which this responsibility has been discharged. Many at Buenos Aires and Kodaikanal have contributed efficient assistance to the preparation of this volume and we are deeply indebted for their help. In particular, two amongst these, Nora Martinez and A. M. Batcha have contributed overwhelmingly both to the organization of the symposium and the final preparation of the symposium volume.

Financial support for this symposium came from the International Astronomical Union and the Argentine National Research Council. The Faculty of Exact and Natural Sciences of the University of Buenos Aires also sponsored the Symposium. We are grateful to all these for the support they have provided us.

M. K. V. BAPPU

J. SAHADE

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INTRODUCTION

It is with a feeling of very great pleasure that I, on behalf of the Organizing Committee, welcome all of you to the Symposium on Wolf-Rayet stars and high temperature stars. Sponsored jointly by the International Astronomical Union and our local hosts the National Research Council of Argentina, this occasion is the forty-ninth in the series of an effort by the IAU in accordance with its role of fostering progress in astronomical research. These symposia have aided active workers in a field to critically assess on such occasions, the current status of achievement in order to best orient future efforts towards a maximum return. The measure of success has been varied in degree, as one would naturally expect in the diversity of topics covered to date. But if success as a parameter is measured by the yardstick of stimulus to many an individual, with no regard to national boundaries whatsoever, truly these occasions have justified the faith placed in them by those who have conceived them.

We thank our hosts for their very gracious invitation to have this Symposium here in Buenos Aires. It is never an easy task to examine the myriad of details that have to be ensured for the practice of hospitality to have a successful impact on guests of such diverse origins, tastes and requirements. In the few hours that we have been here we have already begun to feel the results of their efforts in this direction. We are confident that indeed our stay here will be memorable, invigorating and informative. We are particularly grateful to Prof. Sahade and his team of collaborators who have spent so much time and energy in looking into the various requirements that undoubtedly will ensure a successful symposium.

It would not be out of place for me to remark on the aptness of holding such a meeting at such a southern location. The brightest objects of the species which forms the principal theme of our discussions are in the Southern Hemisphere. Astronomy and astronomical research activity in South America, by a series of fortunate circumstances, is experiencing an expansion at a rate and magnitude that has never been witnessed anywhere before. Undoubtedly, many of the future developments in our area of interest will be the result of efforts on these southern objects. Where, obviously, should one generate that spark of enthusiasm, except where such a result is most likely to originate?

In planning the details of this Symposium the Organizing Committee considered the time opportune for taking a comprehensive stock of these objects and the limitations under which we operate currently. The Wolf-Rayet object is essentially one that displays a phenomenon, when at a particular stage a distinct atmospheric condition prevails that comes about for different objects with varying chemical compositions from different causes along the diverse evolutionary paths. In talking of the Wolf-Rayet stars our speakers will introduce the points of similarity as well as minor

discordances between objects as the WR stars and planetary nuclei, the Of stars and others that display characteristics that have a common factor. The dichotomy of spectral behaviour is one wherein we have as yet no clue as to the nature of the cause. The obvious non-equilibrium configuration of the atmosphere necessitates consideration of the mechanisms of excitation of the various levels and possible stratification effects that prevail. And unless we are clear in our minds about the details of the physical conditions prevalent in the atmosphere, we can hardly speculate on the causes which may be the origin of such behaviour.

To my mind, therefore, the target for this week of deliberation is to examine firstly our achievements in observation and inference in detail, with its limitations in precision and capability of evaluation, followed by detailed consideration of how we can fill in the lacunae in our information and ability to build up a picture of what constitutes a Wolf-Rayet star.

A little over a hundred years ago, Wolf and Rayet detected the spectacular appearance of the spectra of these objects located in Cygnus. A short interval later, at total eclipses of the Sun, spectroscopic detection of the solar prominences, solar chromosphere and the solar corona followed in rapid sequence. Four decades ago Meg Nad Saha speculated on the nature of the ultraviolet spectrum we would see if only we could by a new technology open a window of research in the electromagnetic spectrum, hitherto inaccessible. Less than a decade ago, we detected in the far ultraviolet spectra of early type supergiants violet-displaced absorption edges to emission features, of a magnitude that we had been accustomed to believe from the visual spectrum to exist only in a Wolf-Rayet star. These are the unifying factors, a common characteristic in extended atmospheres that we pick out in the Sun and the stars, massive, young and old. The problem of the Wolf-Rayet phenomenon is the problem of an extended atmosphere with its diverse sources of radiative and mechanical energy and kinematical and thermal characteristics. Treated thus with the magnitudes of the different features as variants, we have more than a ray of hope towards a successful solution. With this in mind I shall now request Dr. Thomas to commence our deliberations with some general comments on the problems of extended atmospheres.

M. K. V. BAPPU

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