

INTERNATIONAL ASTRONOMICAL UNION
AND
INTERNATIONAL UNION OF THEORETICAL AND APPLIED MECHANICS

PROCEEDINGS OF THE FOURTH SYMPOSIUM
ON COSMICAL GAS DYNAMICS

AERODYNAMIC PHENOMENA IN STELLAR ATMOSPHERES

I.A.U. SYMPOSIUM N. 12

*Held at the International School of Physics « E. Fermi »
Villa Monastero, Varenna (Lake of Como) under the auspices
of the SOCIETA ITALIANA DI FISICA and with the financial
assistance of the « CONSIGLIO NAZIONALE DELLE RICERCHE*

August 18-30, 1960

Edited by R. N. THOMAS, National Bureau of Standards

Co-Editors: G. COLCHAGOFF, Air Force Office of Scientific Research
H. LIEPMANN, California Institute of Technology
G. RIGHINI, Osservatorio Astrofisico di Arcetri

(Reprinted, with financial assistance from UNESCO, from
the *Suppl mento del Nuovo Cimento*, Vol. XXII, n. 1, 1961)

NICOLA ZANICHELLI - EDITORE
B O L O G N A
MDCCCCCLX

SUPPLEMENTO
AL VOLUME XXII, SERIE X, DEL
NUOVO CIMENTO
A CURA DELLA SOCIETÀ ITALIANA DI FISICA

1961

4^o Trimestre

N. 1

I N D I C E

R. N. THOMAS - Preface	pag.	VII
G. POLVANI - Opening address	»	XII
K. O. KIEPENHEUER - Schematic structure of the quiet sun	»	XIV
C. DE JAGER - Model of an active region of the sun	»	XIV
K. O. KIEPENHEUER and E. N. PARKER - Velocities and energies of active sun	»	XV
Photographic group of the participants	» plate	
PART I. - Questions of general background and methodology relating to aerodynamic phenomena in stellar atmospheres.		
J.-C. PECKER and R. N. THOMAS - Summary-introduction	»	1
Discussion	»	44
PART II. - General summary of results on « astronomical turbulence » in stellar atmospheres.		
A. B. UNDERHILL - Summary-introduction	»	69
Discussion	»	100
PART III. - Spherically-symmetric motions in stellar atmospheres.		
A. Pulsating variable stars.		
P. LEDOUX and C. A. WHITNEY - Summary-introduction: Velocity fields and associated thermodynamic variations in the external layers of intrinsic variable stars	»	131
Discussion	»	194
B. The propagation of a shock-wave in an atmosphere of varying density.		
E. SCHATZMAN - Summary-introduction	»	209
Discussion	»	227

C. Non-catastrophic mass-loss from stars.	
A. DEUTSCH – Summary-introduction	» 238
Discussion	» 260
Re-discussion, from the viewpoint of aerodynamics.	
P. GERMAIN – Remarks on steady perfect fluid with spherical symmetry	» 296
Discussion	» 301
PART IV. – Considerations on localized velocity fields in stellar atmospheres : Prototype - the solar atmosphere.	
A. Convection and granulation: Preview on granulation - Observational studies.	
J. RÖSCH – Observations from the Pic du Midi	pag. 313
E. SPIEGEL – The Princeton balloon observations	» 319
R. B. LEIGHTON	» 321
Discussion	» 325
A. B. SEVERNÝ – The motions and magnetic fields in the undisturbed solar atmosphere (outside active regions) .	» 327
E. BÖHM-VITENSE – Summary-introduction.	
A) Observations	» 330
B) Theory of the hydrogen convection zone	» 338
Discussion	» 346
B. Considerations of convective instability from the viewpoint of physics.	
W. V. R. MALKUS – Summary-introduction: Similarity arguments for fully developed turbulence	» 376
Discussion	» 385
C. Transient velocity fields in the lower solar atmosphere.	
A. B. SEVERNÝ – Summary-introduction	» 403
Discussion	» 416
D. Collision-free shock-waves.	
H. E. PETSCHEK – Summary-introduction: Collision-free plasmas	» 448
A. A. BLANK and H. GRAD – Second summary-introduction: Steady one-dimensional fluid-magnetic collisionless shock theory	» 459
Discussion	» 468
PART V. – Summaries.	
H. LIEPMANN	» 487
R. N. THOMAS	» 494
R. LÜST	» 500
Discussion	» 505
M. MINNAERT – Closing remarks to the meeting	» 512