

## CONTENTS

CONTRIBUTORS TO VOLUME IX . . . . .	v
PREFACE . . . . .	vii

### Aurora Borealis

By C. T. ELVEY, *Geophysical Institute, University of Alaska, College, Alaska*

I. Introduction . . . . .	1
II. General Description of Auroras . . . . .	3
III. Radio Studies of Aurora . . . . .	23
IV. Spectroscopy . . . . .	29
V. Rocket Observations . . . . .	39
References . . . . .	40

### Negative Ions

By LEWIS M. BRANSCOMB, *Atomic Physics Section, National Bureau of Standards, Washington, D. C.*

I. Introduction . . . . .	43
II. Properties of Atomic Negative Ions . . . . .	45
III. Properties of Molecular Negative Ions . . . . .	61
IV. Negative-Ion Collisions with Heavy Particles . . . . .	70
V. Negative Ions in the Upper Atmosphere . . . . .	89
References . . . . .	92

### Radio Observation of Meteors

By J. G. DAVIES, *Jodrell Bank Experimental Station, University of Manchester, Manchester, England*

I. Introduction . . . . .	95
II. Radio Techniques . . . . .	98
III. Radio Contributions to Meteor Astronomy . . . . .	111
IV. Some Geophysical Observations on Meteor Trails . . . . .	123
References . . . . .	127

### Intensity Variations in Cosmic Rays

By D. C. ROSE, *Division of Pure Physics, National Research Council, Ottawa, Canada*

I. Introduction . . . . .	129
II. Penetration of Cosmic Rays into the Atmosphere . . . . .	132
III. Meteorological Effects . . . . .	138
IV. The Geomagnetic Latitude Variation . . . . .	143
V. Periodic Variations in Intensity . . . . .	159
VI. Sudden Changes in Intensity . . . . .	173
VII. Source Theories of Cosmic Rays . . . . .	178
References . . . . .	184

**Radio-Wave Propagation: A Review**

By R. L. SMITH-ROSE, *Department of Scientific and Industrial Research, Radio Research Station, Ditton Park, Slough, Buckinghamshire, England*

I. Introduction . . . . .	187
II. The Velocity of Light and Radio Waves in a Vacuum . . . . .	193
III. Low-Frequency Ground-Wave Propagation . . . . .	196
IV. Propagation of High-Frequency Waves . . . . .	210
References . . . . .	235

**Electronics in Oceanography**

By J. B. HERSEY, *Woods Hole Oceanographic Institution, Woods Hole, Massachusetts*

I. Introduction . . . . .	239
II. Basic Measurements . . . . .	241
III. Ocean Currents . . . . .	254
IV. Ocean Wave Measurements . . . . .	255
V. Marine Seismography and Underwater Sound . . . . .	257
References . . . . .	292

**Contributions of Electronics to Seismology and Geomagnetism**

By BEN S. MELTON, *United States Air Force, Washington, D. C.*

I. Introduction . . . . .	297
II. Applications to General Seismology . . . . .	298
III. Applications to Seismic Prospecting . . . . .	311
IV. A Contribution to Geomagnetic Measurements—the Nuclear Precession Magnetometer . . . . .	327
References . . . . .	332
Author Index . . . . .	333
Subject Index . . . . .	340