1. Record Nr. UNINA9910830620603321

Titolo	Magnetospheres in the solar system / / Romain Maggiolo [and three others], editors
Pubbl/distr/stampa	Hoboken, NJ : , : Wiley, , 2021
ISBN	1-119-81562-2 1-119-81564-9 1-119-82998-4
Descrizione fisica	1 online resource (803 pages)
Collana	Space physics and aeronomy collection ; ; 2 Geophysical monograph ; ; 259
Disciplina	538.766
Soggetti	Magnetosphere Planets - Magnetospheres
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Cover -- Title Page -- Copyright Page -- Contents -- List of Contributors -- Preface -- Part I The Earth Magnetosphere -- Chapter 1 A Brief History of the Magnetosphere -- 1.1 INTRODUCTION -- 1.2 BRITISH WORK IN THE NINETEENTH CENTURY -- 1.3 SCANDINAVIAN WORK IN THE NINEETEENTH CENTURY -- 1.4 SCHISM -- 1.5 CHAPMAN-FERRARO: A CAVITY IN A STREAM OF CHARGED PARTICLES FROM THE SUN -- 1.6 ALFVEN: THEORY OF STORMS AND THE ADVENT OF MAGNETOHYDRODYNAMICS -- 1.7 THE SPACE AGE BEGINS -- 1.8 DUNGEY: THE OPEN MAGNETOSPHERE -- 1.9 PARTICLE TRANSPORT IN THE OPEN MODEL -- 1.10 CONCLUDING REMARKS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 2 Large-Scale Structure and Dynamics of the Magnetosphere -- 2.1 INTRODUCTION -- 2.2 THE SOLAR WIND INPUT -- 2.3 BOW SHOCK, MAGNETOSHEATH, AND FORESHOCK -- 2.4 MAGNETOPAUSE -- 2.5 CUSPS -- 2.6 MAGNETOTAIL -- 2.7 INNER MAGNETOSPHERE: RING CURRENT, RADIATION BELTS, AND PLASMASPHERE -- 2.8 THE RESPONSE OF THE MAGNETOSPHERE TO A DYNAMIC SOLAR WIND -- 2.9 CONCLUSION -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 3 The Equations of the Magnetosphere -- 3.1 THOUGHTS ON EQUATIONS -- 3.2 BASIC

EQUATIONS -- 3.3 KINETIC THEORY -- 3.4 FLUID THEORY AND MAGNETOHYDRODYNAMICS -- 3.5 TEST PARTICLE MODELS -- 3.6 SUMMARY -- 3.7 CONCLUSIONS -- ACKNOWLEDGMENTS -- REFERENCES -- Part II Fundamental Processes -- Chapter 4 Magnetic Reconnection in the Near-Earth Magnetotail -- 4.1 INTRODUCTION -- 4.2 IN SITU OBSERVATIONS OF MAGNETIC RECONNECTION -- 4.3 SUBSTORM-ASSOCIATED MAGNETIC RECONNECTION -- 4.4 MICROSCOPIC VIEW OF MAGNETIC RECONNECTION IN THE MAGNETOTAIL -- 4.5 FUTURE PROSPECTS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 5 Turbulence and Complexity of Magnetospheric Plasmas -- 5.1 INTRODUCTION -- 5.2 LESSONS LEARNED FROM STUDIES OF SOLAR WIND TURBULENCE -- 5.3 TURBULENCE AND COMPLEXITY IN KEY MAGNETOSPHERIC REGIONS -- 5.4 SUMMARY AND OUTLOOK.
ACKNOWLEDGMENTS -- REFERENCES -- Chapter 6 Wave-Particle Interactions in the Earth's Magnetosphere -- 6.1 INTRODUCTION -- 6.2 THE GLOBAL DISTRIBUTION AND PROPERTIES OF MAGNETOSPHERIC WAVES -- 6.3 QUASI-LINEAR MODELING OF RADIATION BELT VARIABILITY -- 6.4 NONLINEAR MODELING OF RADIATION BELT VARIABILITY -- 6.5 UNRESOLVED ISSUES -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 7 Cross-Scale Energy Transport in Space Plasmas: Applications to the Magnetopause Boundary -- 7.1 INTRODUCTION -- 7.2 MAGNETIC RECONNECTION AND KHI -- 7.3 FROM MHD SCALES TO KINETIC SCALES -- 7.4 SUMMARY AND DISCUSSION -- ACKNOWLEDGMENTS -- REFERENCES -- Part III Solar Wind-Magnetosphere Coupling -- Chapter 8 Solar Wind Interaction with Earth´s Bow Shock -- 8.1 INTRODUCTION -- 8.2 CURRENT UNDERSTANDING OF EARTH´S BOW SHOCK -- 8.3 CLUSTER OBSERVATIONS OF EARTH´S BOW SHOCK -- 8.4 PIC SIMULATION RESULTS OF EARTH´S BOW SHOCK -- 8.5 DISCUSSION AND CONCLUSION -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 9 The Magnetosheath -- 9.1 INTRODUCTION -- 9.2 LARGE-SCALE STRUCTURE -- 9.3 WAVES AND TURBULENCE -- 9.4 TRANSIENT EVENTS -- 9.5 CONCLUSIONS AND OUTLOOK -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 10 Dayside Magnetopause Processes -- 10.1 THE MAGNETOPAUSE -- 10.2 PROCESSES THAT CREATE THE MAGNETOPAUSE -- 10.3 DAYSIDE TRANSFER PROCESSES -- 10.4 THE DOMINANT TRANSFER PROCESS: MAGNETIC RECONNECTION -- 10.5 SUMMARY AND CONCLUSIONS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 11 The Polar Cusps of the Earth´s Magnetosphere -- 11.1 INTRODUCTION -- 11.2 SPACECRAFT MISSIONS AND MODELING TOOLS -- 11.3 LARGE-SCALE STRUCTURE OF THE EARTH´S POLAR CUSPS -- 11.4 SPATIAL AND TEMPORAL NATURE OF CUSP STRUCTURES -- 11.5 CONCLUSIONS AND PERSPECTIVES -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 12 The Earth´s Low-Latitude Boundary Layer -- 12.1 INTRODUCTION -- 12.2 GENERAL FEATURES OF THE LLBL.
12.3 CANDIDATE FORMATION MECHANISMS OF THE LLBL -- 12.4 CONCLUDING REMARKS AND FUTURE RESEARCH -- ACKNOWLEDGMENTS -- REFERENCES -- Part IV Magnetosphere-Ionosphere Coupling -- Chapter 13 Field-Aligned Currents in the Magnetosphere-Ionosphere -- 13.1 INTRODUCTION -- 13.2 HISTORICAL OBSERVATIONS OF FIELD-ALIGNED CURRENTS -- 13.3 DRIVERS OF FIELD-ALIGNED CURRENTS -- 13.4 DETERMINING FIELD-ALIGNED CURRENT DENSITY -- 13.5 CLIMATOLOGICAL FEATURES OF FACS -- 13.6 SCALE SIZES DEPENDENCE OF FIELD-ALIGNED CURRENTS -- 13.7 SUMMARY AND OPEN ISSUES -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 14 Ionospheric Ion Acceleration and Transport -- 14.1 INTRODUCTION -- 14.2 IONOSPHERIC ION UPFLOWS -- 14.3

ION ACCELERATION PROCESSES -- 14.4 IONOSPHERIC ION TRANSPORT IN THE MAGNETOSPHERE -- 14.5 SUMMARY AND DISCUSSION -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 15 Cold Ionospheric Ions in the Magnetosphere -- 15.1 INTRODUCTION: COLD IONS AS PART OF THE MAGNETOSPHERE -- 15.2 OBSERVATIONS: PROBLEMS AND SOLUTIONS -- 15.3 STATISTICS AND EFFECTS AT LARGE SCALES -- 15.4 EFFECTS AT SMALL SCALES -- 15.5 SPACE WEATHER EFFECTS -- 15.6 DISCUSSION AND OPEN QUESTIONS -- 15.7 SUMMARY -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 16 Magnetosphere-Ionosphere Coupling of Precipitating Electrons and Ionospheric Conductance -- 16.1 PROBLEM OVERVIEW -- 16.2 THE MAJOR SUPERTHERMAL ELECTRONS PATHWAYS IN THE MI SYSTEM -- 16.3 THE QUALITATIVE ANALYSIS -- 16.4 CONDUCTANCE DEPENDENCE ON THE SHAPE OF ELECTRON DISTRIBUTION FUNCTION -- 16.5 CONDUCTANCE DEPENDENCE ON MULTIPLE ATMOSPHERIC REFLECTIONS -- 16.6 IONOSPHERIC CONDUCTANCE IN THE PRESENCE OF THE POTENTIAL DROP -- 16.7 CONCLUSION -- ACKNOWLEDGMENTS -- REFERENCES -- Part V The Dynamic Magnetosphere -- Chapter 17 Magnetotail Processes -- 17.1 INTRODUCTION -- 17.2 QUIESCENT EVOLUTION, THIN CURRENT SHEET FORMATION -- 17.3 ONSET OF DYNAMIC MODES.
17.4 DYNAMIC CONSEQUENCES -- 17.5 SUMMARY AND DISCUSSION -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 18 The Active Magnetosphere: Substorms and Storms -- 18.1 SUBSTORMS -- 18.2 STORMS -- 18.3 SUMMARY -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 19 The Northward IMF Magnetosphere -- 19.1 INTRODUCTION -- 19.2 SOLAR WIND/MAGNETOSPHERE COUPLING -- 19.3 IONOSPHERIC AND AURORAL RESPONSE -- 19.4 INTERNAL MAGNETOSPHERIC STRUCTURE -- 19.5 REMAINING CONTROVERSIES -- 19.6 CONCLUSIONS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 20 A Brief Review of the Ring Current and Outstanding Problems -- 20.1 INTRODUCTION -- 20.2 RING CURRENT SOURCES -- 20.3 RING CURRENT LOSSES -- 20.4 OUTSTANDING PROBLEMS -- 20.5 CONCLUDING REMARKS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 21 Source, Loss, and Transport of Energetic Particles Deep Inside Earth's Magnetosphere (L&lt -- 4) -- 21.1 INTRODUCTION -- 21.2 DYNAMICAL EVOLUTION OF ENERGETIC PROTONS DEEP INSIDE THE EARTH´S MAGNETOSPHERE -- 21.3 LONG-TERM MEASUREMENTS OF ~MEV ELECTRON ENHANCEMENTS AT L&lt -- 2.6 -- 21.4 SUMMARY AND CONCLUSIONS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 22 The Plasmasphere: Its Interactions and Dynamics -- 22.1 INTRODUCTION -- 22.2 PLASMASPHERE INTERACTIONS WITH THE IONOSPHERE AND THERMOSPHERE -- 22.3 PLASMASPHERIC RESPONSE TO SOLAR WIND DRIVING AND GEOMAGNETIC ACTIVITY -- 22.4 PLASMASPHERE INTERACTIONS WITH ENERGETIC PARTICLES -- 22.5 THE STATE OF PLASMASPHERIC MODELING -- 22.6 THE FUTURE OF PLASMASPHERE RESEARCH -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 23 Impact of Ionospheric Ions on Magnetospheric Dynamics -- 23.1 INTRODUCTION -- 23.2 IMPACT ON SMALL SCALES -- 23.3 IMPACT ON LARGE SCALES -- 23.4 OPEN QUESTIONS -- 23.5 CONCLUSIONS -- ACKNOWLEDGMENTS -- REFERENCES -- Part VI Planetary Magnetic Fields -- Chapter 24 Planetary Magnetic Fields -- 24.1 INTRODUCTION AND HISTORICAL NOTES.
24.2 PLANETARY PARADE -- 24.3 DYNAMO ACTION -- 24.4 DYNAMO SCALING LAWS -- 24.5 MAGNETIC INDUCTION AND COUPLING -- 24.6 CRUSTAL MAGNETIZATION -- 24.7 MASS LOADING AND MAGNETIC PILEUP -- 24.8 MAGNETOSPHERIC AND IONOSPHERIC CURRENTS -- 24.9 MAGNETIC FIELDS OF EXOPLANETS -- 24.10 A CENTENNIAL

ROADMAP -- ACKNOWLEDGMENTS -- REFERENCES -- Part VII Induced Magnetospheres -- Chapter 25 Induced Magnetospheres -- 25.1 INTRODUCTION -- 25.2 THE MARS SPACE ENVIRONMENT -- 25.3 THE MARS-SOLAR WIND INTERACTION -- 25.4 FLOWS, FIELDS, AND FORCES -- 25.5 ASYMMETRIES -- 25.6 CRUSTAL MAGNETIC FIELDS -- 25.7 WAVES AND INSTABILITIES -- 25.8 FUTURE DIRECTIONS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 26 Induced Magnetospheres: Titan -- 26.1 INTRODUCTION -- 26.2 OVERVIEW OF TITAN´S PLASMA INTERACTION -- 26.3 THE INDUCED MAGNETOSPHERE OF TITAN AS SEEN BY CASSINI -- 26.4 ENERGY AND MOMENTUM TRANSFER PROCESSES AND PLASMA ESCAPE -- 26.5 CONCLUSIONS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 27 Birth of a Magnetosphere -- 27.1 INTRODUCTION -- 27.2 OVERVIEW OF ROSETTA PLASMA OBSERVATIONS -- 27.3 ELECTRIC FIELDS IN A COMET MAGNETOSPHERE -- 27.4 BEFORE THE BOUNDARIES FORM -- 27.5 EMERGENCE OF BOUNDARIES -- 27.6 FUTURE DIRECTIONS -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 28 Induced Magnetospheres: Atmospheric Escape -- 28.1 INTRODUCTION -- 28.2 MEASUREMENTS AND MODELS -- 28.3 ESCAPE PROCESSES AND RATES -- 28.4 PLANETARY-SCALE IMPLICATIONS -- REFERENCES -- Part VIII Giant Planet Magnetospheres -- Chapter 29 The Magnetodisk Regions of Jupiter and Saturn -- 29.1 INTRODUCTION -- 29.2 MAGNETODISK STRUCTURE AND DYNAMICS -- 29.3 MAGNETOSPHERIC COMPRESSIBILITY -- 29.4 PARTICLE DYNAMICS -- 29.5 SUMMARY -- ACKNOWLEDGMENTS -- REFERENCES -- Chapter 30 Fast Rotating Magnetospheres: Jupiter and Saturn Plasma Sources, Loss and Transport -- 30.1 FROM MOONS TO MAGNETOSPHERIC PLASMA. NEUTRAL VERSUS CHARGED PARTICLE DYNAMICS.

Sommario/riassunto

"This book provides an overview of the magnetospheres in the solar system, from the small induced magnetospheres that form around unmagnetized bodies to the large magnetospheres of the giant planets. Magnetospheres are highly complex, structured and time-dependent systems constantly interacting with the solar wind and the components of the planetary systems like their ionosphere, atmosphere, surface, rings and moons. Each magnetosphere is unique and contains various intertwining sub-regions, particle populations and plasma processes. This explains the scientific interest of magnetospheric physics: magnetospheres are accessible natural laboratories for studying fundamental physical processes of universal application. Moreover, the Earth's magnetosphere is a key component of our near-space environment on which our modern societies are increasingly dependent. The book is divided in eleven sections that cover the current state of our understanding as well as future directions for scientists. Section I starts with a brief history of magnetospheres and presents the basic principles and equations. Section II addresses the fundamental processes that govern magnetospheric physics. The three following sections are dedicated to the Earth's magnetosphere, the most studied and best known of the solar system magnetospheres. They respectively focus on its coupling with the Earth's ionosphere (section III), its coupling with the solar wind (section IV) and its dynamics (section V). The next sections are oriented toward other solar system bodies. After a discussion about planetary magnetic fields in section VI, we focus on the induced magnetospheres in section VII, on the magnetospheres of giant planets in section VIII and, in section IX, on "mini-magnetospheres" like those of Mercury and magnetized moons. Section X considers the tools that are used to investigate magnetospheric processes. Finally, section XI discusses the key questions and challenges to be addressed in the coming years,

providing some insights on the future developments of magnetospheric research. The chapters contained herein include contributions from experimentalists, theoreticians and numerical-modelers."--