

**STUDIES IN  
TERRESTRIAL  
MAGNETISM**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649390939

Studies in terrestrial magnetism by C. Chree

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.  
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

[www.triestepublishing.com](http://www.triestepublishing.com)

**C. CHREE**

**STUDIES IN  
TERRESTRIAL  
MAGNETISM**



# STUDIES IN TERRESTRIAL MAGNETISM

BY

C. CHREE, M.A., F.R.S.

SC.D. (CAMB.), LL.D. (ABERDEEN)

*Superintendent of Kew Observatory*

*Late Fellow of King's College, Cambridge*

*Ex-President Physical Society of London*

123990  
419/12

MACMILLAN AND CO., LIMITED  
ST. MARTIN'S STREET, LONDON

1912

## PREFACE

A SHORT statement seems desirable as to the object of the present book. The volume does not aim at being a text-book of Terrestrial Magnetism, or at summarising existing knowledge in those branches of Terrestrial Magnetism with which it deals, but is intended to give a connected account of my own original work in that subject, referring to the work of others only so far as is necessary for intelligibility. It is hoped that other investigators will understand that the absence of reference to their work implies no lack of appreciation of its value.

Again, while I have worked at several of the more important branches of Terrestrial Magnetism, there are other branches which I have scarcely touched on, if at all. The subject of Terrestrial Magnetism is very large and ever-increasing; and the contributions made to it by any one individual must form but a small fraction of the whole.

The book deals almost entirely with facts, or supposed facts. The absence of a definite theory as to the origin of the several magnetic changes is due to no lack of curiosity as to the causes of things, but to a belief that at the present stage theorising is less likely to be of substantial advantage than the extension of positive knowledge. It is sometimes claimed that a theory is essential as a guide in selecting the directions in which to

prosecute research. This is a very partial truth. When a man devotes himself to a subject, allowing free ingress to his mind to all the ideas which the results obtained by investigators naturally suggest, he must be a very unimaginative person if profitable lines of enquiry do not force themselves on his intelligence. The difficulty is not in thinking of something to do, but of deciding what to do next. In making a choice, some may prefer the guidance supplied by a definite theory, but others will prefer to rely on their natural instinct for detecting a weak spot in the defence offered by Nature to the discovery of her secrets.

Those who are familiar with the additions made during recent years to our knowledge, by the discovery of ionisation and radioactive processes, and by investigations on electrical discharge in high vacua, will, I think, allow that speculations made even twenty years ago as to the origin of the phenomena of Terrestrial Magnetism laboured under great disadvantages. But to the average physicist twenty or even ten years hence, the ablest physicist of to-day may seem just as poorly equipped for theorising on Terrestrial Magnetism as the speculators of twenty years ago now seem to us.

Another consideration is that the phenomena of Terrestrial Magnetism are of a complicated nature. The so-called regular daily changes vary largely with the season of the year, and from one year to the next; the so-called irregular changes are multitudinous. We can scarcely hope that in our time any general theory will present a satisfactory explanation of all observed facts, or enable us completely to forecast the future. For, at least, a long time to come, it is to observation, not theory, that we must look for detailed knowledge, and it is in any case to observation that we must turn as the touchstone by which to try theory.

I am indebted to the President and Council of the Royal Society for permission to reproduce a variety of diagrams and curves which have appeared in the *Philosophical Transactions*, and in particular for permission to make and reproduce copies of a number of magnetic disturbances recorded in 1902-3, which were originally discussed in the volume of the *National Antarctic Expedition 1901—1904: Magnetic Observations*, published in 1909 by the Royal Society. I am also indebted to the Meteorological Committee and the Director of the Meteorological Office for permission to reproduce copies of Kew magnetic curves.

My thanks are due to Prof. R. A. Gregory, the Editor of this series, for valuable assistance in revising the proof sheets and for many useful suggestions, to the Printers for their care and the skill with which they accommodated the text to the numerous tables and illustrations, and finally to Mr. Emery Walker and his staff for the trouble which they took, especially in dealing with the curves of magnetic disturbance—many of them faint and difficult objects—and in reducing to a common time scale those forming the composite figures in Chapter XIII.

CHARLES CHREE.





# CONTENTS

	PAGE
PREFACE . . . . .	v
CHAPTER I	
MAGNETIC RECORDS . . . . .	1
CHAPTER II	
SECULAR CHANGE . . . . .	9
CHAPTER III	
NON-CYCLIC CHANGE . . . . .	23
CHAPTER IV	
DIURNAL INEQUALITY ON QUIET DAYS . . . . .	33
CHAPTER V	
DIURNAL INEQUALITY ON ORDINARY DAYS . . . . .	50
CHAPTER VI	
DIURNAL INEQUALITY ON DISTURBED DAYS . . . . .	55
CHAPTER VII	
FOURIER COEFFICIENTS . . . . .	66
CHAPTER VIII	
ANNUAL VARIATION . . . . .	80
CHAPTER IX	
ABSOLUTE DAILY RANGE . . . . .	85

## CONTENTS

	PAGE
CHAPTER X	
ANTARCTIC MAGNETIC RESULTS . . . . .	93
CHAPTER XI	
MAGNETIC STORMS . . . . .	113
CHAPTER XII	
"SUDDEN COMMENCEMENTS" . . . . .	127
CHAPTER XIII	
COMPARISON OF ARCTIC AND ANTARCTIC DISTURBANCES . . . . .	135
CHAPTER XIV	
SUNSPOTS AND TERRESTRIAL MAGNETISM . . . . .	160
CHAPTER XV	
WOLF'S' SUNSPOT FORMULA . . . . .	168
CHAPTER XVI	
NATURE OF SUNSPOT RELATIONSHIP . . . . .	177
CHAPTER XVII	
GENERAL CONCLUSIONS . . . . .	191