MOTION OF CHARGED PARTICLES IN PERIODIC MAGNETIC FIELDS

by

SUNIL PAL SINGH RAWAT

A THESIS
SUBMITTED FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

OF THE
GUJARAT UNIVERSITY

AUGUST 1988

PHYSICAL RESEARCH LABORATORY
AHMEDABAD 380 009
INDIA

CERTIFICATE

I hereby declare that the work presented in this thesis is original and has not formed the basis of the award of any degree or diploma by any University or Institution.

Sunil Pal Singh Rawat
Author

Certified by:

R.K. Varma
(Professor-in-Charge)

Place : Ahmedabad

Date : 29-8-1988

CONTENTS

STATEMENT

The primary aim of the work described in this thesis is to study the motion of charged particles in spatially periodic magnetic fields as that of a multimirror system and to look for effects predicted by Schroedinger-like equations for the non-adiabatic behaviour of an ensemble of charged particles in inhomogenous magnetic fields.

The theory,wherein the Schroedinger-like equations have been obtained, some important predictions arising out of it along with a survey of other theoretical,numerical and experimental investigations of the motion of charged particles in a spatially periodic magnetic field are discussed in Chapter I.

The experimental device, designed and set up for verifying the occurence of Bragg-like reflections is described in Chapter II.

Details of the experiments carried out with the abovementioned objective in mind are discussed in Chapter III. Consequent observations and analysis are also presented therein.

A summary with conclusions and scope for future work is presented in Chapter IV.

ACKNOWLEDGEMENTS

The work presented in this thesis was carried out under the supervision of Prof. R.K. Varma. I am grateful to him for his guidance.

I gratefully acknowledge the help and constant encouragement extended by Dr. A.M. Punithavelu without which it would have been difficult to complete the work.

The experimental work presented in this thesis was supplemented by the efficient technical assistance of R.C. Shah, Mrs. U. Modi, A.H. Shaikh and M.G. Phadke. The help rendered by M/s. M.P.K. Kurup and K.K. Sivasankaran from the glass blowing section and H.C. Patel from the workshop is appreciated.

I owe immensely to my friends and colleagues Shishir, Debashish, Vijayasanker, K.P. Subramanian, Jitesh, Vinod, N.N. Rao, S.C. Tripathi, Debi, Nikam, Bhaskaran, Subrat and B.P. Pande for their cooperation and help during the course of the work in some way or the other.

I sincerely thank Mr. V.T. Viswanathan for neat and efficient typing of the thesis. My thanks are also due to M/s. H.S. Panchal, S.C. Bhavsar for drafting and D.R. Ranpura for photography. I also thank Mrs. R.R. Bharucha, Mrs. Ghiya, Mrs. Patil and other library staff for their cooperation.

LIST OF FIGURES