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STUDIES IN WAVE-PARTICLE INTERACTIONS

BY
VAMAN H. KULKARNI

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PHYSICAL RESEARCH LABORATORY
AHMEDABAD 380 009
INDIA

DEDICATION

TO
MY PARENTS

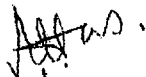
CERTIFICATE

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



V.H. KULKARNI
(Author)

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ANATH CHANDRA DAS

May 22, 1975

S T A T E M E N T

The author has made a theoretical study on wave particle interactions in the whistler mode with a view to explain some of the features of Very Low Frequency (VLF) emissions observed in the magnetosphere. These VLF emissions occur in the range from 300 to 30,000 Hz, and are observed in mid and high latitude stations in close association with naturally occurring whistlers. These have a variety of frequency time structures e.g. risers, falling tones, hooks, inverted hooks and long enduring oscillations. These emissions can also be triggered by man made signals like morse pulses. It is important to note that the dashes (150 m.s) produce emissions while the dots (50 m.s) very rarely do. Furthermore, the triggering is found to be more frequent for the pulses of the frequency which is equal to half the minimum gyro-frequency. The generation mechanism of these emissions and the formation of their frequency time structure seem to be quite complex and the author has made a modest attempt to invoke a mechanism which could

~~could~~ generate these emissions as well as their frequency time structure.

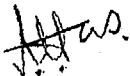
Gyro-resonance interaction between the whistler mode waves and the energetic electrons is believed to be the mechanism underlying the triggering of VLF emissions. The linear theory does not give a satisfactory explanation of the various frequency time structure of these emissions and so the nonlinear theory has to be developed. Furthermore these emissions occur in the magnetosphere and therefore the nonlinear theory should include the effect of nonuniformity of the magnetic field, which produces the second order resonance when the change in doppler shifted frequency seen by the electron is equal to that of its own gyro-frequency.

The first chapter reviews the experimental observations and theories of VLF emissions. The merits and demerits of the available theories have been pointed out. Chapter II deals with interaction of a whistler mode wave with a particle distribution, which is modified due to a large amplitude electromagnetic wave background. In chapter III, we have

studied the interaction of a particle with two whistler mode waves and also the existence of whistler side bands. The nonlinear interaction of particle with a whistler mode wave packet in presence of nonuniform magnetic field has been studied and the resulting frequency time structures are presented in chapter IV. Chapter V summarises the results of present work and also the scope for the further studies is outlined.



V.H. KULKARNI



A.C. DAS

A C K N O W L E D G M E N T S

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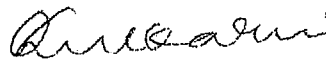
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V.H. KULKARNI
(Author)

C O N T E N T S

Certificate

Statement

Acknowledgment

CHAPTER I INTRODUCTION

1.1	Objective	1
1.2	Notations used	3
1.3.1	Whistlers	6
1.3.2	Classifications of whistlers	8
1.3.3	Objective whistler studies	10
1.3.4	Whistler studies as applied to the dynamics of magnetosphere	14
1.3.5	Whistler studies in India	16
1.4.1	VLF Emissions	17
1.4.2	Types of VLF emissions	21
1.5.1	Triggered emissions: Whistler triggered emissions	27
1.5.2	Triggered emissions: Artificially stimulated emissions (ASE)	28
1.6	Controlled VLF stimulation experiments	30
1.7.1	Reviews of the theories	33
1.7.2	Cerenkov emissions	35

1.7.3	Cyclotron radiation	37
1.7.4	Plasma kinetic theory	42
1.7.5	Effect of Inhomogeneity of the medium	47
1.7.6	Effect of trapped particles on the nonlinear evolution of wave packet	49
1.8	Contribution of the present work	52

CHAPTER II EFFECT OF TRAPPED PARTICLES IN AN ELECTROSTATIC WAVE ON THE WHISTLER MODE

2.1	Introduction	54
2.2	Motion of an electron in presence of an electrostatic wave	57
2.3	Dispersion relation for whistlers	60
2.4	Growth of whistlers	66
2.5	Side bands and their growth	67
2.6	Numerical values	68
2.7	Discussion of results	
2.7.1	Triggered Emissions	69
2.7.2	Oblique propagation of the whistler	69
2.7.3	Frequency fine structures in Type IIIb solar radio bursts	70

CHAPTERIII NONLINEAR WAVE-PARTICLE INTER-
ACTIONS AND SIDE BAND GROWTHS
IN THE WHISTLER MODE

3.1	Introduction	77
	Electron trajectories in presence of a whistler mode wave and a uniform magnetic field	
3.1.2	Equation of motion	78
3.1.3	Plane wave solutions	82
3.1.4	Effect of particle trapping	84
3.1.5	The numerical procedure	86
3.1.6	Redistribution of trapped particles	90
3.2	Importance of studies of particle interaction in presence of a wave packet	96
3.3	Particle trajectories in presence of two waves	99
3.4	Redistribution of particles due to two waves	102
3.5	Discussions	108

CHAPTER IV SECOND ORDER RESONANCE AND
FREQUENCY TIME STRUCTURE OF
VLF EMISSIONS

4.7	Introduction	111
4.1.2	Linear approximations	112
4.2	Equation of motion of the particle	117
4.3	Dimensional analysis	120
4.4	Numerical estimates for dimensional analysis	122
4.5	Domain of second order resonance	124
4.6	Time development of wave fields and the frequency change	127
4.7	Resonant particle currents	134
4.8	Numerical procedure	137
4.9	Amplitude structure in VLF emissions	141
4.10	Frequency time structure	143
4.11	Frequency time structure as seen on the ground and by satellite	145
4.12	Discussions	147

CHAPTER	V	<u>SUMMARY AND CONCLUDING</u> <u>REMARKS</u>	150
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B	Plasma instability for whistlers in presence of an electrostatic wave background	151
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C	Particle motion in presence of two whistler mode waves	154
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D	Wave packet modulation	157
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REFERENCES