

Table of contents

<i>a. Abstract</i>	<i>i-iii</i>
<i>b. Declaration</i>	<i>iv</i>
<i>c. Certificate</i>	<i>v</i>
<i>d. Acknowledgements</i>	<i>vi-vii</i>
<i>e. Table of contents</i>	<i>viii-xi</i>
<i>f. List of tables</i>	<i>xii</i>
<i>g. List of figures</i>	<i>xiii-xv</i>
<i>h. List of abbreviations</i>	<i>xvi</i>
<i>i. List of symbols and significances</i>	<i>xvii-xviii</i>
<i>j. Academic programs participated</i>	<i>xix</i>
<i>k. List of research publications</i>	<i>xx</i>

Chapter-1 [1-16]

A brief overview of plasmas: laboratory to astrophysical scales

<i>Abstract</i>	1
1.1 Introduction	1-2
1.2 Laboratory plasma	2
1.2.1 Plasma sheath formation mechanism	3
1.2.2 Bohm criterion	3
1.2.3 Sheaths in astrophysical domain	3-4
1.3 Astrophysical plasma	4
1.3.1 Dust molecular cloud	5
1.3.2 Types of molecular clouds	5-7
1.3.3 Jeans instability	7-8
1.3.4 Solar (stellar) plasma	8-9
1.3.5 Solar structure	10
1.3.6 GES model of solar wind	10-11
1.3.7 Polytropic model of solar wind	11-13

<i>References</i>	13-16
-------------------	-------

Chapter-2 [17-32]

Sheath structure with electron-inertia in magnetized plasmas

<i>Abstract</i>	17
2.1 Introduction	17-18
2.2 Plasma model and formalism	18-24
2.3 Results and discussions	24
2.3.1 Analytical results	24-25
2.3.2 Numerical results	25-28
2.3.3 Comparative results	28-29
2.4 Conclusions	29-30
<i>References</i>	30-32

Chapter-3 [33-43]

A perturbative correction on electron-inertia in magnetized plasma sheaths

<i>Abstract</i>	33
3.1 Introduction	33-34
3.2 Plasma model and formalism	34-39
3.3 Results	39-41
3.4 Conclusions	41-42
<i>References</i>	42-43

Chapter-4 [44-59]

Nonlinear fluctuations in gravitating polytropic charged dust clouds

<i>Abstract</i>	44
4.1 Introduction	44-45
4.2 Physical model	46
4.3 Mathematical formulation	46-48
4.4 Coupled m -KdV equations	48-52
4.5 Results and discussions	53

4.5.1 Electrostatic fluctuations	53-55
4.5.2 Self-gravitational fluctuations	55-56
4.6 Conclusions	57
<i>References</i>	58-59

Chapter-5 [60-71]

A theoretical model formalism of the nonextensive GES structure

<i>Abstract</i>	60
5.1 Introduction	60-61
5.2 Physical model	61
5.3 Mathematical formulation	61-62
5.3.1 SIP calculation scheme	62-64
5.3.2 SWP calculation scheme	64
5.4 Results and discussions	64-68
5.4.1 Comparative results	68-69
5.5 Conclusions	69-70
<i>References</i>	70-71

Chapter-6 [72-82]

Stability of the polytropic solar wind

<i>Abstract</i>	72
6.1 Introduction	72-73
6.2 Physical model	73-74
6.3 Mathematical formulation	74-77
6.4 Results and discussions	77-80
6.5 Conclusions	80-81
<i>References</i>	81-82

Chapter-7 [83-86]
Conclusions and future directions

APPENDIX-A [87-88]
A generalized bi-fluidic model formalism of plasma sheath evolution

APPENDIX-B [89-90]
Pulsational mode behaviour in complex nonextensive viscous astrocloud

APPENDIX-C [91-92]
Wave damping behaviors in solar prominence plasmas