

Contents

Declaration	i
Certificate from the supervisors	ii
Dedicatory	iv
Acknowledgements	v
Abstract	vi
Preface	x
Contents	xi
List of Tables	xiv
List of Figures	xv
1 Introduction and Review	1
1.1 Introduction	1
1.2 General Relativity:	2
1.3 Dark Energy	4
1.4 Dark matter	10
1.5 Candidates to explain Dark Energy:	12
1.6 Candidates to explain Dark Matter:	14
1.6.1 Matter representation of dark matter:	14
1.6.2 Alternative models to explain dark matter effects	15
1.7 Objectives of the present work	17
1.8 Current status of studies on local gravitational influences of dark sector	18

1.8.1	Influences of Dark sectors on perihelion shift of planets	20
1.8.2	Influences of dark sectors on gravitational deflection of light:	24
1.8.2.1	Approaches to deduce gravitational deflection angle on several dark sector models:	24
1.8.3	The influences of dark sector on gravitational time delay:	32
1.8.3.1	Approaches to deduce gravitational time delay on several dark sector models:	33
1.8.4	The influences of dark sector on gravitational frequency-shift:	37
1.8.4.1	Approaches to deduce gravitational frequency-shift on several dark sector models:	38
1.8.5	Gravitational wave and a wider aspect to detect the influences of dark sector:	39
2	Influences of dark energy and dark matter on gravitational time advancement	41
2.1	Introduction	41
2.2	Gravitational Time Advancement	43
2.3	Influence of Dark energy/matter on Gravitational Time Advancement	45
2.3.1	General trajectory	46
2.3.2	Small distance travel	49
2.4	Discussion and Conclusion	51
3	Probing dark matter and dark energy through gravitational time advancement	54
3.1	Introduction:	54
3.2	Methodology	55
3.3	GTA of a particle with non-zero mass in Schw-arzschild geometry .	58
3.4	Effect of Dark sector on GTA of a relativistic particle	61
3.5	Discussion and conclusion:	65
4	Gravitational lensing by global monopole	69
4.1	Introduction:	69
4.2	The space-time metric due to global monopole	72
4.3	Methodology for estimation of bending angle	73
4.4	Gravitational deflection of light due to global monopole	76
4.5	Bending of light due to a Schwarzschild black hole that swallowed a global monopole	79
4.6	Image position and magnification in weak lensing by global monopole space time	80
4.7	Discussion & Conclusion	82
5	Space-time geometry of spiral galaxy halo	86
5.1	Introduction:	86
5.2	Galactic potential in presence of cold dark matter invoking observed flat rotation curve feature:	88

5.2.1	Space time geometry of halo for cold dark matter	90
5.2.2	Matching with the exterior Schwarzschild space time	92
5.2.3	The space time geometry of galactic halo	92
5.3	Gravitational lensing due to gravitational field of galactic halo	94
5.4	Discussion and Conclusion	97
6	Baryonic Tully-Fisher test of Grumiller's modified gravity model	101
6.1	Introduction	101
6.2	Rotation velocity as a function of baryonic matter in Grumiller theory	103
6.3	Estimation of Rindler acceleration parameter from observed rotation velocity vs Mass data	104
6.4	Discussion and conclusion	107
7	Conclusion	109
7.1	Conclusion:	109
	Bibliography	112
	Index	126